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II) Agricultural Technology

(Agricultural mechanization through farm management, natural resources management techniques, post-harvest management techniques).

III) Agricultural Finance

(Credit systems etc.)

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Preface

In the general body meeting of Maharashtra Society of Agricultural Economics held on 2nd February 2014 at Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, it has been unanimously decided to published full length and abstract of Scientific Papers of Souvenier, Silver Jubilee Convention of Maharashtra Society of Agricultural Economics at Dr. PDKV, Akola during 1st and 2nd February, 2014. The subject selected for the publication based on three components i.e. "Agriculture Development, Agriculture Technology and Agriculture Finance.

Agribusinesses have a great importance for developed as well as developing countries. Agribusiness professionals play a crucial role in development of agriculture sector. Orientation of agriculture towards business plays a significant role in generating income and employment throughout the development process. Agribusiness provides a assured market for raw materials and value added products, thus helps the farming community.

The Agribusiness system includes all the firms involved in manufacturing and supplying inputs and / or services to agriculture produce or that handles or process farm output until they reach the final consumer.

The basic aim of agricultural price policy is the intervention in the agricultural produce markets to influence the price levels and their fluctuations, particularly from farm gate to retail level. Price policy is directed to bring about growth and equity in the country; therefore it is occupying a prime place in economic and political debate.

Prices are largely determined by supply and demand. The prices of agriculture goods fluctuate significantly, even during one single day. Pricing of agriculture commodities are important from farmer's point of view. To control the supply in the market, it needs to regularize the production, availability of storage facility are one side problems and another to increase the productivity. Market Intelligence has become vital for taking production and marketing decisions. Unequal access to this type market related intelligence inputs lead to unequal playing grounds for farmers and traders. In the past the farmer's ignorance was the traders gain.

It gives me a great pleasure to acknowledge all the research contributors and President of Maharashtra Society of Agriculture Economics giving opportunity of publishing the journal.

R.G. Deshmukh
Secretary

CONTENT

The following Awards and Cash Prizes were given in the Silver Jubilee Convention held at Dr. PDKV, Akola of MSAE-2014

Sr. No.	Name of awards/prizes	Name of awarded	Purposes
1	Prof Ulemale memorial life time achievement award with trophy and manpatra	Dr. Prakash W. Mahindre	For renowned Agricultural Economist
2	Late Wamanrao Mahindre sir memorial award (Trophy)	Shri.D.N.Ingole and others, Dr. PDKV.,Akola	For best paper
3	Late smt.Parvatibai mahindre memorial silver medal	Ku.Dharti Bihade, NMKV,Parbhani	For best paper presentation by female Agril. Economist
4	Cash prize of Rs.1000/- and certificate in the memory of late Dr. V.D.Galgalikar	Shri. V.O.Bondhre Ph.D. Student	For Best paper presentation by male Agril. Economist
5	Cash prize of Rs.1000/- and certificate in the memory of late Dr. D.K.Sohani	Dr. S.W. Jahgirdar, Associate professor(Stat), Dr. PDKV.,Akola	For the best research guide and co-guide in Agriculture economics and allied science
6	Special prestigious award	1)Dr. S. S. Marawar (Ex Head, Akola) 2) Dr.M.K.Shingare(1st Head. Akola) 3) Dr T.G.Satpute, Ex Head Parbhani 4) Dr. B.G. Sapate, Dr.PDKV.,Akola	For Senior faculty as highly significant contribution in the field of Agriculture economics
7	Special appreciation award with certificate	Dr. R. B. Changule, Parbhani Dr. B.V.Pagire,Dapoli Dr. S.S.Thakre, Amravati	For best three papers in each theme
8	Special appreciation award with certificate	Dr. A.S. Tingre. Akola Dr.A.C. Deorukhakar, Dapoli Dr. R.V. Chavan, Parbhani	For best three papers presentation in each theme
9	Special appreciation award with certificate	M.M. Kadam , Ph.D. student, Akola Ku.S.K. Jadhav, Ph.D. student Parbhani	Two Best poster presentation in male and female
		Dr. P. W. Mahindre, President MSAE, Dr. D. L. Sale, Secretary, MSAE	For over all associated to organizing the convention and ISSN No.
		Dr. D. B. Yedav, Dr. B. R. Pawar, Dr. N. D. Pawar,	For over all associated to organizing the convention and participation of staff and students
		Shri. Dipak Ulemale, Amravati Dr. J. K. Katkede, Parbhani Dr.Washnik, New Delhi	For overall associated to organizing this convention and efforts for getting ISSN No to Journal.
		Dr. S.W. Jahgirdar, Dr. S.J. Kakde, Dr. S.C. Nagpure, Dr. A.S. Tingre, Shri.R.K. Kolhe Dr. Amar Bhopale Shri.Shashikant Bhoyer	For over all associated to organizing the convention
10	Special appreciation award with certificate and Silver medal	Dr. R.G. Deshmukh, Head, Deptt. of Agril. Econ. & Stat. Dr. PDKV Akola and Organizing Secretary, MSAE 2014	For best event organization of convention of MSAE.

THEME I - AGRICULTURE DEVELOPMENT

Inter Regional Variability in Agricultural Performance

M.S. Mohod, R.G. Deshmukh, S.W. Jahagirdar, M.M. Kadam and M.S. Pisal

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ABSTRACT

Agriculture is the backbone of Indian economy contributing about 13.7 per cent of gross domestic product and engaging 55 per cent of the country's human force. The food grain production in the country was 57.47 million tonnes in 1950-51, which increased up to the level of 255.36 million tonnes in 2012-2013. In order to study the area, production, productivity of major crops i.e., tur, gram, kharif jowar, soybean and cotton grown in Marathwada and Vidarbha region, The present study was under taken with following objectives i.e; To examine the performance of agriculture in Marathwada and Vidharbha region and to measure the instability in area, production and productivity of different crops. The study was based on the secondary data collected from the publications of Government / Non-Governmental Organizations such as Epitome, District Statistical abstract. The data were cited for the period from 1980-81 to 2009-10. The study concluded that; The overall compound growth rate in area, production and productivity of tur, gram, Kharif jowar, cotton and Soybean crops were found positive at 1 per cent in Marathwada and Vidarbha region. The overall compound growth rate of area was founded highest in Soybean Crop (32.86 per cent) and (10.71 per cent) in Marathwada and Vidarbha region.The overall compound growth rate of production was found highest in Soybean Crop (28.92 per cent) and gram (9.54 per cent) in Marathwada and Vidarbha region respectively. The overall compound growth rate of productivity was founded highest in Soybean Crop (19.39 per cent) and (16.75 per cent) in Marathwada and Vidarbha region respectively.

Introduction

Agriculture is the backbone of Indian economy contributing about 22 per cent of gross domestic product and engaging 55 per cent of the country's human force. Agriculture being the predominant sector of economy, the pace of economic development of the country has been continues to be significantly influenced by the pace of its agricultural development. Agricultural growth is being contended in many quarters that although the seventies and eighties witnessed higher growth rate in agricultural production, these high rates of growth are alleged to be accompanied by considerable year to year fluctuation giving rise to increasing instability in agricultural production.

The food grain production in the country was 57.47 million tonnes in 1950-51, which increased up to the level of 255.36 million tonnes in 2012-2013. The high yielding and input responsive varieties of Rice and Wheat and supportive government policies led to cereal

based green revolution. This brought considerable unevenness in food production progress in different commodities. Rice and Wheat yield increased over time, but the production of most other crops grown is less endowed. The production of Pulses and Oilseeds raised from 22.05 and 23.46 million tonnes in 1993-94 to 24.13 and 50.17 million tonnes in 2012-13, but the growth in the production of Jowar, Gram and Tur is negligible in Maharashtra. The estimated per capita per month consumption of cereals and pulses based on 66th round of National Sample Survey(2009- 10) are 9.43 kg and 0.85 kg resulting in annual requirement of cereals and pulses at 132.47 lac MT and 11.94 lac MT respectively.

The present study under taken in Marathwada and Vidharbha region to study performance of major crop with the following objective.

1) To examine the performance of agriculture in Marathwada and Vidharbha region,
2) To measure the instability in area, production and productivity of different crops,

METHODOLOGY

The districts selected for the present study were namely Aurangabad, Jalna, Beed, Parbhani, Latur, Nanded & Osmanabad of Marathwada region and Amravati, Akola, Buldhana, Yavatmal, Nagpur, Wardha, Bhandara, Chadrapur, Gadchiroli of Vidarbha region. The study is based on the secondary data collected from the official publications of Government / Non-Governmental Organizations such as Epitome, District Statistical abstract. The present study takes into consideration area, production and productivity of five major food grain crops i.e., tur, gram, kharif jowar, soybean and cotton. The data were cited for the period from 1980-81 to 2009-10The entire study period split to in two sub period as

Period I: 1980 - 1981 to 1989 –1990
Period II: 1990- 1991 to 1999 –2000
Period III : 2000-2001 to 2009-2010.

The growth rate was estimated using exponentional trend model.

$$Y = a.b^{t}$$

Where,

Y = Area / production / productivity
a = Intercept
b = Regression Coefficient
t = Time variable.

The above equation can also be written as,

Log Y = Log a × Log b

From the estimated function the compound growth rate was worked out by

CGR (r) = [Antilog (log b) – 1] X 100

Where,

r = compound growth rate.

The regional study growth rate for area, production and productivity for selection crop in the crop performance of was measure with the measure of coefficient variation percentage of the crop in be classified as in consistent and highly inconsistent crop.

Results and Discussion

TABLE NO.1 : COMPOUND GROWTH RATE OF AREA , PRODUCTION , PRODUCTIVITY IN MARATHWADA AND VIDARBHA FOR TUR

COMPOUND GROWTH RATE OF AREA , PRODUCTION , PRODUCTIVITY IN MARATHWADA AND VIDARBHA FOR TUR									
	MARATHWADA					VIDARBHA			
	P -1	P -2	P -3	OVERALL		P -1	P -2	P -3	OVERALL
AREA	1.92465	-0.27144	0.879897	1.4117**		7.593292**	1.172608**	0.006881	2.9855**
PRODUCTION	1.92465	7.296663	8.0353**	3.2645**		10.40565**	6.45569	-0.73871	3.3505**
PRODUCTIVITY	3.7591	8.219647	12.8359	13.361**		2.70022**	4.311718	17.70377	8.7767**

** denotes significance at 1 per cent

The growth in area, production, productivity of tur in Marathwada and Vidarbha in Maharashtra is found to be positive which is given in Table 1. The compound growth rate of area was higher in period I (1.92 per cent) than period III(0.87 per cent) in tur crop of Marathwadaregion.The compound growth rate of production is higher in period III (8.03 per cent) than period II(7.29 per cent) in tur crop of Marathwada region.The compound growth rate of productivity is higher in period III (12.83 per cent) than period II(8.21 per cent) in tur crop of Marathwada region.

The growth in area, production, productivity of tur in Marathwada and Vidarbha in Maharashtra is found to be positive which is given in Table 1. The compound growth rate of area was higher in period I (7.59 per cent) than period II (1.17 per cent) in tur crop of Vidarbharegion. The compound growth rate of production is higher in period I (10.40 per cent) than period II (6.45 per cent) in tur crop of Vidarbha region. The compound growth rate of productivity is higher in period III (17.70 per cent) than period II (4.31 per cent) in tur crop of Vidarbha region.

TABLE NO.2 COMPOUND GROWTH RATE OF AREA, PRODUCTION , PRODUCTIVITY IN MARATHWADA AND VIDARBHA FOR GRAM

COMPOUND GROWTH RATE OF AREA , PRODUCTION , PRODUCTIVITY IN MARATHWADA AND VIDARBHA FOR GRAM									
	MARATHWADA					VIDARBHA			
	P -1	P -2	P -3	OVERALL		P -1	P -2	P -3	OVERALL
AREA	-0.57767	5.556983**	6.649272**	2.778**		9.949807**	8.478588**	12.33255**	6.4631**
PRODUCTION	2.76769	6.198515	12.88569**	5.4805**		14.22083**	9.303661	18.92439**	9.5405**
PRODUCTIVITY	2.55268	0.920117	28.88836**	12.193**		4.108394	-0.01588	24.92352**	11.01**

** denotes significance at 1 per cent

The growth in area, production, productivity of gram in Marathwada and Vidarbha in Maharashtra is found to be positive which is given in Table 2. The compound growth rate of area was higher in period III (6.64 per cent) than period II(5.59 per cent) in gram crop of Marathwadaregion.The compound growth rate of production is higher in period III (12.88 per cent) than period II(5.59 per cent) in gram crop of Marathwada region. The compound

growth rate of productivity is higher in period III (28.88 per cent) than period II(0.92 per cent) in gram crop of Marathwada region.

The growth in area, production, productivity of gram in Marathwada and Vidarbha in Maharashtrais found to be positive which is given in Table 2. The compound growth rate of area was higher in period III (12.33 per cent) than period I (9.94 per cent) in gram crop of Vidarbha region.The compound growth rate of production is higher in period III (18.92 per cent) than period I (14.22 per cent) in gram crop of Vidarbha region.The compound growth rate of productivity is higher in period III (24.92 per cent) than period I (4.01 per cent) in gram crop of Vidarbha region.

TABLE NO.3 COMPOUND GROWTH RATE OF AREA, PRODUCTION, PRODUCTIVITY IN MARATHWADA AND VIDARBHA FOR K. JOWAR

COMPOUND GROWTH RATE OF AREA , PRODUCTION , PRODUCTIVITY IN MARATHWADA AND VIDARBHA FOR K. JOWAR									
	MARATHWADA					VIDARBHA			
	P -1	P -2	P -3	OVERALL		P -1	P -2	P -3	OVERALL
AREA	2.48633**	3.09012**	5.79399**	2.815**		5.79399**	6.12072**	10.089**	4.899**
PRODUCTION	-4.53431	-0.74784	4.0331**	1.881**		1.677992	5.86454**	8.17353**	4.063**
PRODUCTIVITY	-1.59351	2.471847	19.91334	10.158**		3.345534	0.216069	16.76282	8.828**

** denotes significance at 1 per cent

The growth in area, production, productivity of jowar in Marathwada and Vidarbha in Maharashtrais found to be positive which is given in Table 3. The compound growth rate of area was higher in period III (5.79 per cent) than period II(3.09 per cent) in gram crop of Marathwada region. The compound growth rate of production is higher in period III (4.53 per cent) than period II(4.03 per cent) in jowar crop of Marathwadaregion.The compound growth rate of productivity is higher in period III (19.91 per cent) than period II(2.47 per cent) in gram crop of Marathwada region.

The growth in area, production, productivity of jowar in Marathwada and VidarbhainMaharashtrais found to be positive which is given in Table 3. The compound growth rate of area was higher in period III (10.08 per cent) than period II (6.12 per cent) in jowar crop of Vidarbha region.The compound growth rate of production is higher in period III (8.17 per cent) than period II (5.86 per cent) in jowar crop of Vidarbha region. The compound growth rate of productivity is higher in period III (16.76 per cent) than period I (3.34 per cent) in jowar crop of Vidarbha region.

TABLE NO.4 COMPOUND GROWTH RATE OF AREA, PRODUCTION, PRODUCTIVITY IN MARATHWADA AND VIDARBHA FOR COTTON

COMPOUND GROWTH RATE OF AREA , PRODUCTION , PRODUCTIVITY IN MARATHWADA AND VIDARBHA FOR COTTON									
	MARATHWADA					VIDARBHA			
	P -1	P -2	P -3	OVERALL		P -1	P -2	P -3	OVERALL
AREA	-2.2.53	4.648829**	5.078487**	6.980946**		0.460175	0.318522	2.83504**	1.004**
PRODUCTION	-11111111.20286	8.925451**	17.4443**	5.8394**		5.029292	2.618815	8.334761**	3.3749**
PRODUCTIVITY	2.90138	5.063443	15.80378**	5.5783**		6.131448	3.026184	14.52372**	6.1934**

** denotes significance at 1 per cent

The growth in area, production, productivity of cotton in Marathwada and Vidarbha in Maharashtrais found to be positive which is given in Table 4. The compound growth rate of area was higher in period III (5.07 per cent) than period II (4.68 per cent) in cotton crop of Marathwada region.The compound growth rate of production is higher in period III (17.44 per cent) than period II(8.92 per cent) in cotton crop of Marathwada region. The compound growth rate of productivity is higher in period III (15.80 per cent) than period II (5.06 per cent) in cotton crop of Marathwada region.

The growth in area, production, productivity of jowar in Marathwada and Vidarbha in Maharashtra is found to be positive which is given in Table 4. The compound growth rate of area was higher in period III (2.83 per cent) than period I (0.46 per cent) in cotton crop of Vidarbha region. The compound growth rate of production is higher in period III (8.33 per cent) than period I (5.02 per cent) in cotton crop of Vidarbha region.The compound growth rate of productivity is higher in period III (14.52 per cent) than period I (6.13 per cent) in cotton crop of Vidarbha region

TABLE NO.5 COMPOUND GROWTH RATE OF AREA, PRODUCTION, PRODUCTIVITY IN MARATHWADA AND VIDARBHA FOR SOYBEAN

COMPOUND GROWTH RATE OF AREA , PRODUCTION , PRODUCTIVITY IN MARATHWADA AND VIDARBHA FOR SOYBEAN									
	MARATHWADA					VIDARBHA			
	P -1	P -2	P -3	OVERALL		P -1	P -2	P -3	OVERALL
AREA		29.34316**	35.94765**	32.86615**			21.13093**	14.25557**	10.71738**
PRODUCTION		32.12785**	30.82681	28.92958**			28.53135**	7.225296**	8.595101**
PRODUCTIVITY		0.901359**	22.29349	19.39028**			6.098513**	11.81888	16.75719**

** denotes significance at 1 per cent

The growth in area, production, productivity of soybean in Marathwada and Vidarbha in Maharashtra is found to be positive which is given in Table 5. The compound growth rate of area was higher in period III (35.94 per cent) than period II (29.34 per cent) in soybean crop of Marathwada region. The compound growth rate of production is higher in period II (32.12 per cent) than period III (30.82 per cent) in soybean crop of Marathwada region. The compound growth rate of productivity is higher in period III (22.29 per cent) than period II (0.90 per cent) in soybean crop of Marathwada region.

The growth in area, production, productivity of soybean in Marathwada and Vidarbha in Maharashtrais found to be positive which is given in Table 5. The compound growth rate of area was higher in period III (14.25 per cent) than period II (21.13 per cent) in soybean crop of Vidarbharegion.The compound growth rate of production is higher in period II (28.53 per cent) than period III (7.22 per cent) in soybean crop of Vidarbha region.The compound growth rate of productivity is higher in period III (11.81 per cent) than period II (6.09 per cent) in soybean crop of Vidarbha region

Conclusions

- The overall compound growth rate in area, production and productivity of tur, gram, Kharif jowar, cotton and Soybean crops were found positive at 1 per cent in Marathwada and Vidarbha region.
- The overall compound growth rate of area was founded highest in Soybean Crop (32.86 per cent) and (10.71 per cent) in Marathwada and Vidarbha region.
- The overall compound growth rate of production was founded highest in Soybean Crop (28.92 per cent) and gram (8.59 per cent) in Marathwada and Vidarbha region respectively.
- The overall compound growth rate of productivity was founded highest in Soybean Crop (19.39 per cent) and (16.75 per cent) in Marathwada and Vidarbha region.

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Economic analysis of milk production in Western Maharashtra

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Abstract

The result of the study revealed that, at the overall level, total cost of milk production of cow and buffaloe were comprised of 85 per cent working cost and 15 per cent fixed cost of the total cost. Per household feeding cost shared 71 per cent of the total cost for dairy animals. The feed and fodders accounted for a major portion of the total cost followed by human labour. Per litre cost of milk production was worked out to Rs. 9.61 and Rs. 19.47 for cow and buffaloe milk, respectively. The average net income per cow and buffaloe per annum worked out to Rs. 12490 and Rs. 9496. The benefit cost ratio was higher for cow as compared to buffaloe. The input-output ratio of cow and buffaloe for milk production was 1.33 and 1.22 for different categories of sample households. The estimated milk production function indicated that, the average productivity of cross-bred cows and buffaloes could be increased well above the present level by way of feeding the animals with higher quantities of green fodder, dry fodder and concentrates to maximize the milk production. The marginal value productivity of significant variables which indicated that there is great scope for increasing milk production. Non availability of pure breed in local market, difficulties in obtaining loans, malpractices followed by agents in market, low prices, high wage rate of labour, high cost of feed and fodder etc

Introduction

Dairying is one of the important subsidiary occupation next to agriculturein rural area of India. Dairy development has assumed a paramount importance in the rural economy of India because of its immense potential for supplementing the income to small farmers, marginal farmers and landless agricultural labours for augmenting the employment to the rural masses. Dairy development in India has taken place under a well knownprogramme known as Operation Flood. Co-operative and private dairy being an integral part of the Operation Flood Programme, have played a major role in the production and marketing of milk. India ranks first in the World and MaharashtraState ranks sixth in India in milk production. During 2010-11, the production of milk at the State level was 8.04 million M.T. and the per capita daily availability was 196gms, while the production of milk at all-India level was 122 million MT and the per capita daily availability was 253 gms.

In MaharashtraState the share of animal husbandry in Gross State Domestic Products of agriculture and allied activity during the year 2010-11 was 24 per cent. The total livestock in the State was 3.72 crores in the year 2007. State has made a remarkable progress in milk production through the maintenance of crossbred cows and establishment of co-operative and private dairy units aimed of selling milk and milk products at remunerative prices. The dairy industry has witnessed the increase in livestock population and milk

production particularly in Western Maharashtra. The milk production in MaharashtraState and Western Maharashtra was 80.44 lakh tones and 50.48 lakh tons during the year 2010-11 respectively. The share of Western Maharashtra in the State was 62.75 per cent. Keeping this view in mind, present study attempts to analyze "Economic analysis of milk production in Western Maharashtra".

Objectives

The present study was confined to the following specific objectives

1. To examine feeding pattern of milch animals in Western Maharashtra.
2. To estimate the costs and returns from dairy enterprise at producer's level in Western Maharashtra
3. To study the problems of milk producers.

Materials and Methods

The micro-level data at milk producers level were obtained by conducting personal interview of selected 270 sample milk producers for the year 2007-08. The Ahmednagar, Pune and Kolhapur districts of Western Maharashtra were purposively selected for present study. Milk producer sample household selling milk to co-operative dairy unit and private dairy unit and sample household selling milk to consumer were selected purposively. Milk producers of each selected dairy units were classified into three herd size categories viz; small (1 to 2 milch animals), medium (3 to 4 milch animals) and large (above 5 milch animals) using random sampling method. Thus, total sample were 270 milk producers consisting of 90 milk producers selling milk to co-operative dairy units, 90 milk producers selling milk to private dairy units and 90 milk producers selling milk to consumers, which were selected purposively.

Results and Discussion

Cow and buffaloe milk production:

The total cost of milk production composed of working cost (86 per cent) and fixed cost (14 per cent) of the total cost at the overall level. Feeding cost shared 72 per cent of the total cost for dairy animals. The total labour cost per lactation was Rs.4633 having a share of 12.17 per cent in total cost. The veterinary aid cost comprised a negligible amount in total cost and its share was 1.27 per cent and the share of value of accessories required for management of herds was negligible.Herd replacement cost was estimated Rs.2343.

Interest on value of animals and fixed assets were measured as 10 per cent interest on the average value of dairy animal. The interest on value of animal and fixed assets was estimated to Rs. 1307 at the overall level.

Depreciation of fixed investments and accessories was another cost in raising dairy animals. Considering depreciation, the housing cost worked out about 4 per cent per lactation of milch animals.The per cow cost of milk production was Rs.38078 and the per litre cost of milk production was Rs.9.61. Per litre price received for sample households was Rs. 12.14at overall level. The cow milk production was also found to be profitable because of better management practices and rational allocation of resources might have helped in augmenting the profitability from the milk production.

Table 1 Perlitre cost of milk production of cow and buffaloe

(Rs./animal)

Sr. No.	Particulars	Cow	Buffaloe
A	Working cost	32728 (85.95)	36855 (84.22)
1	Feeding cost	27290 (71.66)	29687 (68.24)
2	Labour cost	4633 (12.17)	5930 (13.63)
3	Veterinary and Misc. charges	485 (1.27)	740 (1.70)
4	Value of accessories	320 (0.84)	498 (1.14)
B	Fixed cost	5350 (14.05)	6647 (15.28)
5	Herd replacement cost	2343 (6.15)	3747 (8.61)
6	Interest on value of animals and fixed assets	1307 (3.43)	1336 (3.07)
7	Depreciation on fixed investment and accessories	1700 (4.46)	1564 (3.59)
	Total cost (A+B)	38078 (100)	43502 (100)
8	Per liter cost	9.61	19.47

(Figures in parentheses are the percentages to the total cost)

The structural composition of total cost,cow and buffaloeof milk production revealed that the feed item shared 71 and 68 per cent expenditure and labour shared about 12 and 14 per cent of the total cost at the overall level.

It is observed from the Table 1.that, the per buffaloe cost of milk production was Rs. 42,502 and the per litre cost of milk production was Rs.19.47.

The productivity performance of the dairy animals has been assessed and it depends on breed, present age, age at first heat, number of services per conception, age at first calving, number of lactations, lactation period, inter-calving period, peak yield and breed used for insemination and stages of lactation, etc.

Costs and returns from milk production:

In dairy enterprise, cost of inputs plays a vital role in the net return from the dairy animals. Dairy farmers generally manage concentrate and dry fodder from market and they grow green fodder on their own farms. The cost of inputs depends on the various factors

Table 2 Costs and returns from milk production
(Rs.**/animal)**

Sr. No.	Particulars	**Cow**	**Buffaloe**
1	WorkingCost	32728 (85.95)	36855 (84.72)
2	Fixedcost	5350 (14.05)	6647 (15.28)
3	Totalcost	38078 (100)	43502 (100)
	Grossreturns	50568	52998
	Net returns over working cost	17840	16143
	Net returnsover totalcost	12490	9496
	Input-outputratio	1.33	1.22

(Figures in parentheses are the percentages to the total cost)

and resources available with the dairy farmer. Table 2 depicts the information relating to per family annual costs, gross returns and net returns from milk production.

The data relating to annual costs and returns from milk production forcow and buffaloe milk production activity yielded the net returns of Rs.12490 and Rs.9496 over the total cost in cow and buffaloeherd sized households respectively, at the overall level. The net returns over working cost were maximum (Rs.17840) in cow herd size household, while it was minimum (Rs.16143) in buffaloesize households. It can be concluded from above discussion that, net returns over total cost, input-output ratio were relatively more in the case of cow households as compared to the buffaloe households.

It is clear from this study that cross-bred cows are more profitable than buffaloes due to benefit cost ratio for cross-bred cow was 1:33 is higher than buffaloe (1:22).

Resource use efficiency in milk production:

In order to establish the functional relationship between milk output and important input variables, a Cobb-Douglas type of production functions were estimated separately for cow and buffaloe milk production activities with total annual milk production in litres (Y) as the dependent variable and number of milk animals in No. (X_1), quantity of green fodder in kg (X_2), quantity of dry fodder in kg (X_3), quantity of concentrate in kg (X_4) and human labour in man equivalent days (X_5) as independent variables. It is evident from the table that all the co-efficient have positive signs which indicates that all the explanatory variables contributed positively to the milk production with varied magnitudes.

Cow milk production function:

The results of the estimated Cobb-Douglas type production function at the overall level for cow and buffaloe milk production are presented in Table 3.

The five independent variables viz; number of milch animals, green fodder, dry fodder, concentrate and human labour have jointly explained 96 per cent variation in the milk production in case of cowmilk production function. At the overall level, the regression co-

efficient of number of milch animals, green fodder, dry fodder and concentrates were have turned out to be highly significant for cowmilk production function. The regression co-efficient (0.10) of green fodder variable indicates that milk production would increase by 0.10 per cent with an increase of green fodder by 1 per cent. The regression co-efficient of concentrates was found significant and positive in cow milk production function. This indicated that by one per cent increase in the feeding of concentrate, the milk production would increase by 3.83 per cent in cow milk production function. This indicated that the cow milk production and these variables are associated positively and have influenced milk production significantly. The significances were examined with the help of student's 't' test. Thus, it further indicated that there is the scope for feeding cows with green fodder and concentrates in order to increase the milk production.

Table 3 Results of the estimated Cobb-Duglas production function for cow and buffaloe milk production

(%)

Sr. No.	**Particulars**	**Cow**	**Buffaloe**
1	Intercept (a)	1.7104	1.8857
2	No. of milch animals (X_1)	0.3135*** (0.0415)	0.5428*** (0.0299)
3	Green fodder in kg. (X_2)	0.1081*** (0.0334)	0.2251*** (0.0396)
4	Dry fodder in kg. (X_3)	0.0799***(0.0204)	0.0051^{NS} (0.0118)
5	Concentrates in Kg. (X_4)	0.3831*** (0.0416)	0.1470 *** (0.0302)
6	Family labour in man days (X_5)	0.0295^{NS} (0.0295)	0.0598*** (0.0196)
7	R^2	0.96	0.98
8	F Value	701.67	273.63

(Figures in the parentheses are the standard errors of regression coefficients)
'*', '**'** and **'*'** =Significant at 1, 5 and 10 per cent level, respectively
'NS' = Non- significant

Buffaloe milk production function:

The co-efficient of multiple determination (R^2) was observed to be 0.96 in buffaloemilk production function. The buffaloe milk production function indicated that about 96 per cent variation in the milk production and have been influenced by the included variables in the regression model. The 'F' value 273.63 was found significant at one per cent level, indicating goodness of fit of the variables. The regression co-efficient of number of milch animals, green fodder, concentrate and human labours were observed positive and significant for buffaloemilk production function. The regression co-efficient (0.22) of green fodder indicates that milk production can be increased by 0.22 per cent with an increase of

1 per cent of green fodder. However, dry fodder variable was observed non-significant in all categories of sample size households. The regression co-efficient of human labour variable was found positive and statistically significant in buffaloemilk production function. This indicated that increased use of human labour variable will exert influence on increase of milk production. This indicated that the buffaloe milk production and number of milch animals, green fodder, concentrates and human labour variables are associated positively and have influenced the milk production significantly. Thus, it further indicates that there is scope for feeding buffaloes with green fodder and concentrate in order to increase the milk production.

Marginal value productivities of the resources:

The production elasticities of different inputs were used for computing their MVPs. Table 4 presents the MVPs of various inputs in the cow and buffaloe milk production activity alongwith their per unit acquisition costs.

The allocative efficiencies of various inputs in the cow and buffaloe milk production were examined by comparing the marginal value products (MVPs) of the inputs (viz; green, dry fodder and concentrates) with their respective per unit price. The input is treated as over utilized/ under utilized, if its marginal value product is less/greater than its unit cost.

Table 4 Marginal value productivities and per unit acquisition cost of resources used in milk production

Sr. No.	Particulars	MVP/MC	Cow	Buffaloe
1	No. of milch Animals	MVP	15178.99	24874
		Marginal cost	14000	14000
2	Green fodder (kg.)	MVP	1.17	1.94
		Marginal cost	0.90	0.90
3	Dry fodder (kg.)	MVP	2.43	0.12
		Marginal cost	1.80	1.80
4	Concentrates (Kg.)	MVP	13.85	8.12
		Marginal cost	8.00	8.00
5	Family labour (man days)	MVP	21.32	111.15
		Marginal cost	70.00	70.00

The marginal value products of number of milch animals, green fodder and concentrates were observed greater than their respective unit cost, at the overall level.

The results indicated that the green fodder and concentrates, all the sample households should increase the use level of these inputs in order to maximize the returns from cow and buffaloe milk production activities.

Problems faced by milk producers:

Non availability of pure breed in local market, difficulties in obtaining loans, malpractice followed by agents in market, low prices, high wage rate of labour, high cost of feed and fodder etc. were the major problems faced by the milk producers.

Conclusions:

The total cost of milk production of cow and buffaloe were composed of 85 per cent working cost and 15 per cent fixed cost of the total cost at the overall level. Per household feeding cost shared 71 per cent of the total cost for dairy animals. The feed and fodders accounted for a major portion of the total cost followed by human labour. The per litre cost of cow was low as compared to buffaloe due to higher milk yield of cross-bred cows. The cross-bred cows were more economical compared to buffaloes. Feeding of green fodder and concentrates to cows and buffaloes contributed significantly.The milk production and gross returns showed positive relationship with the number of milch animals. The activity of maintaining cross-bred cows of milk production was profitable than that of maintaining buffaloes.

Feeding of green fodder and concentrates to cows and buffaloes contributed significantly indicating that milk productivity could be increased through feeding of green fodder and concentrates economically. The resource use efficiency estimated for cow and buffaloe milk production indicated the under utilization of resources (green fodder and concentrates) used in milk production. There is great scope for increasing milk production of the cow and buffaloe through better management practices.

The average productivity of cross-bred cow and buffaloe could be increased well above the present level by way of feeding the animal with higher quantities of green fodder, dry fodder and concentrates and by decreasing use levels of human labour and miscellaneous expenditure.

Policy Implication:

1. The expenditure on feed, fodder and concentrates could be reduced by adopting high yielding varieties of grasses, legumes and fodder crops on farmers fields, replacing the local milch animals with improved breeds at faster rate. The Government should provide the necessary input supplies at subsidized rates to the dairy farmers so that these breeds can be reared cheaply and commercially.
2. There is scope to improve the milk production of crossbred cows, indigenous cows and buffaloes across dairy farm using the existing resources. The milk producers should be trained for dairy management practices viz; feeding practices, maintaining optimal herd size, balanced feeding, artificial insemination and new technologies in dairying in order to achive the maximum milk production thereby realizing more profit and would generate employment and income.

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Performance of Sugarcane and Sugar Production In India

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India is the second largest producer of sugar in the world after Brazil and is indulged in the production of cane sugar and not beet sugar. It produces approximately 22 million tonnes of sugar annually. The data were obtained for the period of 22 years beginning with 1985-86 to 2006-07. The data were divided into two sub periods i.e. Pre-WTO period (1985-86 to 1994-95), Post-WTO period (1995-96 to 2006-07) and overall period (1985-86 to 2006-07).The data obtained from secondary sources were analyzed to obtain estimates of annual compound growth rates of area, production and productivity of sugarcane and sugar production in India during different time periods . The area under sugarcane in India has increased during the entire period of study. However, it declined during Post-WTO period. The production of sugarcane in India has increased during Pre-WTO period. However, it remained stagnant during Post-WTO period. The productivity of sugarcane has declined during Post-WTO period. The production of sugar in India has increased at the rate of 4.69 per cent during the entire period. The increase in production of sugar in India during Pre-WTO period was relatively more as compared to Post-WTO period. This might be due to shift in acreages under sugarcane to other high value cash crops and due to decline in productivity of sugarcane.The study suggests that the efforts should be made to improve the productivity of sugarcane in order to increase sugar production in India.

Introduction

Sugarcane, the main source of sugar, is said to have originated in New Guinea. The process of sugar production, i.e. by evaporating the cane juice, came from India in around 500 BC. In Alexander's region, the people from West formed this process as "honey produced without bees"

For a long time, the rest of the world did not know the process of cane sugar production because it was kept as secret as it earned them a good amount of profit finally Arabs broke this secret and started growing sugarcane in Spain and other parts of Europe and Africa around 7^{th} century AD. It started gaining popularity in European continent and it was considered a luxurious product at that time. A large amount of sugar was imported from East as it started giving competition to honey as a sweetening agent. In Europe and within European countries sugarcane was especially cultivated to extract sugar from it.

India is the second largest producer of sugar in the world after Brazil and is indulged in the production of cane sugar and not beet sugar. It produces approximately 22 million tonnes of sugar annually. The major sugarcane growing states in India are Uttar Pradesh, Maharashtra, Tamil Nadu, Andhra Pradesh, Karnataka and Gujarat. These states contribute around 85 per cent sugarcane production of the country. The other important producers of sugarcane in the country are Assam, Bihar, Haryana, Kerala, Madhya Pradesh, Orissa, Punjab, Rajasthan and West Bengal. The production of sugar in the country highly

depends upon the availability of sugarcane. The leading producer of sugar is Maharashtra producing about 6 million tonnes of sugar followed by Uttar Pradesh and Karnataka and these states constitute the maximum area under sugarcane in the country. Two grades of sugar namely S-30 and M-30 are produced in India; grade S-30 dominating the share in total production. The production of sugarcane in India has increased during the last ten years and is still on an increasing trend. The productivity of sugarcane in the northern areas of the country was lower than the productivity in southern areas. In India, sugarcane is grown over 4 million hectares of land.

The sugar production in India largely depends on the acreages under sugarcane and policies of Government with regards to export and import of sugar. These two factors affects the sugar production and the country like India in some years there was surplus production and during next year of surplus production, the production of sugar was deficit than requirement. Thus the sugar production in India is widely fluctuating. The sugar production in India during the last decade was surplus therefore the subsidies were provided for its export. The sugar production during 2008-09 was declined by 28 per cent from previous year and it was 190 lakh tonnes (Indian Sugar, 2010) taking into account to carryover stock of 100 lakh tonnes from previous year. The total availability of sugar was 290 lakh tonnes against requirement of 230 lakh tonnes. The fall in sugar production was mainly due to lower sugarcane production because of fall in sugarcane area from 53 lakh hectares in 2006-07 to 44.1 lakh hectares in 2007-08. Thus, from 2007-08 onwards there was reduction in the sugar production or due to increase in domestic demand India had emerged as net sugar importer in 2008-09 and import of sugar was 2.5 million tonnes. In this view the study is undertaken to analyze changes in area, production and productivity of sugarcane in India. The specific objective was

- To estimate the growth rates in area, production and productivity of sugarcane and sugar production in India.

Data and methodology : In order to analyze the changes in area, production and productivity of sugarcane in India during Pre-WTO and Post-WTO periods as well as overall period, annual compound growth rates were estimated. For this purpose, the data were obtained on the aspects such as area, production and productivity of sugarcane in India as well as state wise area, production and productivity of sugarcane. The year wise data were drawn from various volumes of Indian Sugar and Co-operative Sugar for the period from 1985-86 to 2006-07. To understand production performance of sugar over the period especially before India came into WTO agreements and after globalization and liberalization of sugar trade in India. To assess the changes in sugar production, the compound growth rates in sugar production were estimated. For this purpose, the data were obtained on year wise production of sugar in India as well as state wise production of sugar. The year wise data were drawn from various volumes of Indian Sugar for the period from 1985-86 to 2006-07.

Specification of time periods : To facilitate proper understanding of impact of WTO agreements on Indian sugar trade with regard to percentage increase in area, production and productivity of sugarcane and sugar production, the entire period of 22

years from 1985-86 to 2006-07 was divided into two sub periods and one entire period as indicated below.

Period- I (Pre-WTO period) : 1985-86 to 1994-95
Period- II (Post-WTO period) : 1995-96 to 2006-07
Period- III (Entire period) : 1985-86 to 2006-07

Analysis of data

In order to analyze the changes in area, production and productivity of sugarcane and sugar production in India during Pre-WTO and Post-WTO periods as well as overall period, annual compound growth rates were estimated. In the present study, the compound growth rates in area, production and productivity of sugarcane and sugar production in India were estimated by fitting exponential type of equation

$$Y = ab^t$$

Where,

Y = Area/production/productivity of sugarcane and sugar production
a = Intercept
b = Regression co-efficient or trend value
t = Time variable

Results and discussions

Growth rates in area under sugarcane in India

The annual compound growth rates in area under sugarcane in major six sugarcane growing states and country as a whole during Pre-WTO and Post-WTO periods as well as entire period are estimated and presented in Table1.

Table1. Compound growth rates in area under sugarcane in major sugarcane growing states

Sr. No.	States	Pre-WTO period	Post-WTO period	Overall period
1.	Uttar Pradesh	1.74***	0.66	1.24***
2.	Maharashtra	6.72***	1.65	3.75***
3.	Tamil Nadu	4.74***	0.65	2.01***
4.	Karnataka	7.17***	-3.27	2.00**
5.	Andhra Pradesh	4.79***	1.78**	2.61***
6.	Gujarat	7.72***	1.7**	4.86***
	India	**2.92*** **	**1.34**	**1.86*** **

***,**and*= Significant at 1,5 and10 Per cent level of probability, respectively
Source : Indian Sugar, 1995, 2007

The area under sugarcane in India has been increased at the rate of 1.86 per cent per annum during the entire period of 22 years. The annual compound growth rate in area under sugarcane in India during Pre-WTO period was 2.92 per cent and it was significant at 1 per cent level of significance. However, it declined and became 1.34 per cent per annum

during Post-WTO period but it was found non-significant. This might be due to shift in acreages under sugarcane to other high value cash crops.

The state wise picture of changes in area under sugarcane revealed that at the overall level, growth rates in area under sugarcane in Uttar Pradesh, Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh and Gujarat were 1.24, 3.75, 2.01, 2.00, 2.61 and 4.86 per cent per annum, respectively and were found significant. During Pre-WTO period, the growth rates were significant and during Post-WTO period the growth rates of area under sugarcane in the states like Uttar Pradesh (0.66), Maharashtra (1.65), Tamil Nadu (0.65) and Karnataka (-3.27) were non-significant. Also, the growth rates of area under sugarcane in Andhra Pradesh (1.78) and Gujarat states (1.7) were found significant at 5 per cent level and the per annum increase was 1.78 and 1.70 per cent, respectively. Thus, the area under sugarcane in India and especially in six major sugarcane growing states has been increased during Pre-WTO period and it has declined in Post-WTO period. The drastic decline in sugarcane acreages was noticed in Karnataka state during Post-WTO period.

Table 2 Growth rates in production of sugarcane in India

The annual compound growth rates in production of sugarcane in major six sugarcane growing states and country as a whole during Pre-WTO and Post-WTO periods as well as overall period are estimated and depicted in Table 2.

Table 2 Growth rates in production of sugarcane in major sugarcane producing states

Sr. No.	States	Pre-WTO period	Post-WTO period	Overall period
1.	Uttar Pradesh	3.98***	0.32	1.91***
2.	Maharashtra	6.17***	-0.80	2.53**
3.	Tamil Nadu	4.33***	1.53**	1.66**
4.	Karnataka	7.89***	-5.02	2.02*
5.	Andhra Pradesh	-4.53	1.91	0.57
6.	Gujarat	7.25	1.63**	5.65***
	India	**4.41*** **	**0.81**	**2.31*** **

***, **and*= Significant at 1, 5 and10 Per cent level of probability, respectively

Source: Indian Sugar, 1995, 2009

The production of sugarcane in India has been increased at the rate of 2.31 per cent per annum during the entire period. The annual compound growth rate in production of sugarcane in India during Pre-WTO period was 4.41 and it was significant at 1 per cent level of significance. However, it remained stagnant i.e. 0.81 per cent per annum during Post-WTO period. This might be due to shift in acreages under sugarcane to other high value cash crops and due to decline in productivity of sugarcane.

As regards the growth rates of sugarcane production in major sugarcane growing states, the significant increase in Uttar Pradesh, Maharashtra, Karnataka, Gujarat and Tamil Nadu was noticed and it was 1.91, 2.53, 2.02, 5.65, 1.66 per cent per annum, respectively during the entire period. During Pre-WTO period, the annual growth rates of Uttar Pradesh, Maharashtra, Tamil Nadu and Karnataka were 3.98, 6.17,

4.33, 7.89 per cent, respectively and were significant. However, in case of Andhra Pradesh it was -4.53 per cent but non-significant and in case of Gujarat it was non-significant. The annual growth rate of sugarcane production in Tamil Nadu (1.63 %) and Gujarat (1.53 %) was significant and it was non-significant in Uttar Pradesh (0.32 %), Maharashtra (-0.80 %), Karnataka (-5.02 %) and Andhra Pradesh (1.91 %) during Post-WTO period.

Growth rates in productivity of sugarcane in India

Productivity is the most important criteria for measuring growth of any crop output. The success or failure of any improvement in the art of agriculture is measured by the resultant increase or decrease in the productivity. The annual compound growth rates in productivity of sugarcane in major six sugarcane growing states and country as a whole during Pre-WTO and Post-WTO periods as well as overall period are estimated and given in Table 3

The annual growth rate of sugarcane productivity during Pre-WTO period was 1.57 per cent which was found significant. During Post-WTO period, the annual growth rate of sugarcane productivity in India was -0.51 per cent and it was non-significant. The growth rate of sugarcane productivity was 0.38 per cent per annum and it was found significant during the overall period. The decline in productivity of sugarcane during Post-WTO period was mainly due to cultivating the sugarcane crop on same piece of land year after year with excessive use of irrigation water which led to saline condition of the soil.

Table 3 Growth rates in productivity of sugarcane in major sugar production states

Sr. No.	States	Pre-WTO period	Post-WTO period	Overall period
1.	Uttar Pradesh	2.21***	-0.34	0.66***
2.	Maharashtra	-0.92*	-2.56*	-0.99***
3.	Tamil Nadu	-0.26	-0.48	0.31*
4.	Karnataka	0.90	-1.62	0.21
5.	Andhra Pradesh	0.97	0.13	0.60***
6.	Gujarat	-1.15**	0.50**	-0.63**
	India	**1.57*** **	**-0.51**	**0.38****

***, **and*= Significant at 1, 5 and10 Per cent level of probability, respectively

Source: Indian Sugar, 1995, 2009

The state wise productivity of sugarcane indicated that the positively significant growth rates were recorded in Uttar Pradesh, Tamil Nadu and Andhra Pradesh i.e. 0.66, 0.31 and 0.60 per cent per annum, respectively and significantly negative growth rates were recorded in Maharashtra and Gujarat (0.99 and 0.63 per cent per annum) during the entire period.

During Pre-WTO period, the growth rate of productivity was found significantly positive only in Uttar Pradesh and it has increased by 2.21 per cent per annum. The productivity of sugarcane in Maharashtra and Gujarat has been significantly declined by -0.92 and -1.15 per cent per annum, respectively and productivity of sugarcane in Tamil Nadu, Karnataka and Andhra Pradesh has remained constant which was found non-significant at the magnitudes of -0.26, 0.90, and 0.97 per cent per annum, respectively.

During Post-WTO period, the growth rate of productivity of sugarcane found positively significant only in Gujarat and it was 0.50 per cent per annum and the growth rate of Andhra Pradesh remained constant. In case of Maharashtra, Tamil Nadu, Karnataka and Uttar Pradesh, the productivity of sugarcane has been declined by -2.56, -0.48, -1.62 and -0.34 per cent per annum, respectively but it was non-significant.

Growth rates in sugar production in India

The production of sugar of any country depends on availability of sugarcane for crushing, sugar recovery and number of sugar factories in operation, their crushing days in a year, market conditions and Government policies.. The sugar production in India is widely fluctuating due to uncertain climatic conditions. Under such circumstances, an attempt has been made to ascertain the changes in production of sugar over a period of time and accordingly the compound growth rates in sugar production in India were estimated and presented in Table 4.

Table 4 Growth rates of sugar production in major sugar producing states

Sr. No.	States	Pre-WTO period	Post-WTO period	Overall period
1.	Uttar Pradesh	6.51***	5.94***	5.33***
2.	Maharashtra	7.13***	1.75	3.56***
3.	Tamil Nadu	7.55***	3.67	3.88***
4.	Karnataka	12.74**	6.59**	7.22***
5.	Andhra Pradesh	6.37**	4.58**	5.09***
6.	Gujarat	6.66***	1.73	3.77***
	India	**6.81*** **	**4.95****	**4.69****

***,**and*= Significant at 1,5 and10 Per cent level of probability, respectively

Source : Indian Sugar, 1995, 2009

The production of sugar in India has been increased at the rate of 4.69 per cent per annum during the entire period. The annual compound growth rate in production of sugar in India during Pre-WTO period was found positively significant and it was 6.81 per cent. However, it has declined i.e. 4.95 per cent per annum and was found significant during Post-WTO period. This might be due to shift in acreages under sugarcane to other high value cash crops and due to decline in productivity of sugarcane.

The growth rates of sugar production in major sugarcane producing states revealed that the annual growth rates in Uttar Pradesh, Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh and Gujarat were positively significant at 5.33, 3.56, 3.88, 7.22, 5.09 and 3.77 per cent, respectively during the overall period. The annual growth rates during Pre-WTO period were found significantly positive in Uttar Pradesh, Maharashtra,

Tamil Nadu, Karnataka, Andhra Pradesh and Gujarat at 6.51, 7.13, 7.55, 12.74, 6.37 and 6.66 per cent, respectively. The growth rates for Post-WTO period were observed positively significant in Uttar Pradesh, Karnataka and Andhra Pradesh at 5.94, 6.59 and 4.58 per cent per annum, respectively and in case of Maharashtra, Tamil Nadu and Gujarat it was found positive but non-significant at the magnitudes 1.75, 3.67 and 1.73 per cent per annum, respectively.

Conclusions and Policy implications

The study has revealed that the area under sugarcane in India and especially in six major sugarcane growing states has been increased during Pre-WTO period and it has declined in Post-WTO period. This might be due to shift in acreages under sugarcane to other high value cash crops.

The production of sugarcane in India has been increased during Pre-WTO period and it remained stagnant during Post-WTO period. This might be due to shift in acreages under sugarcane to other high value cash crops and due to decline in productivity of sugarcane. As regards the state wise sugarcane production, the significant increase in Uttar Pradesh, Maharashtra, Karnataka and Gujarat was noticed during Pre-WTO period. However, in Andhra Pradesh it was declined during Pre-WTO period and sugarcane production in Maharashtra and Karnataka has been declined during Post-WTO period.

The productivity has increased only in Uttar Pradesh and declined in Maharashtra and Gujarat during Pre-WTO period. During Post-WTO period, the productivity of sugarcane has increased only in Gujarat and declined in Maharashtra, Tamil Nadu and Karnataka. The decline in productivity of sugarcane during Post-WTO period was mainly due to cultivating the sugarcane crop on same piece of land year after year with excess use of irrigation water which has led to saline condition of the soil.

The production of sugar in India has been increased at the rate of 4.69 per cent during the entire period. The increase in production of sugar in India during Pre-WTO period was relatively more as compared to Post-WTO period.

Policy implications

1. The drastic decline in sugarcane acreages was noticed in India and Karnataka state and sugarcane production in Maharashtra and Karnataka has been declined during Post-WTO period. Also, the decline in productivity of sugarcane was noticed during Post-WTO period. This suggests that the efforts should be made to improve the productivity of sugarcane in India.
2. The increase in production of sugar in India during Pre-WTO period was relatively more as compared to Post-WTO period. Hence, there is need to arrest the shift in acreages under sugarcane to other high value cash crops and improve the productivity of sugarcane in order to increase sugar production in India.

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Temporal changes in input-output prices and cost of cultivation of paddy in Vidarbha

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Abstract

In this study an attempt has been made to study the temporal changes in input- output prices and cost of cultivation of paddy in Vidarbha. The present study used cross sectional cum time series data of Vidarbha region for the paddy crop for the ten years i.e. from 1999-00 to 2008-09. Every year 100 farmers were selected for the present study. The study reveals that, the compound growth rates of inputs and output prices were increased during the period of study except prices of FYM. The study also reveals that, The cost of cultivation of paddy increased from ₹ 14031.21 per hectare in 1999-00 to ₹ 19976.26 per hectare in 2008-09 showing an increase of 1.42 times during the period of study. Among the items of operational costs, hired human labour, bullock labour, machine labour and fertilizer accounted for 23.54, 16.14, 13.85 and 11.61 per cent share respectively of the change in total cost. The share of seed and farm yard manure in the change in total cost was 6.72 and 2.72 per cent respectively, while the share of rental value of own land and share of depreciation was found to have declined in paddy. It is remarkable to note that the physical quantity of bullock labour, human labour, manure and seed has come down for paddy due to increase in the wage rate of bullock labour and human labour and prices of manure and seed.

Introduction

Rice is one of the important cereals in India which occupied 44.01 million hectares area with production of 105.31 million tones and productivity of 2393 kg ha^{-1} (Anonymous 2012). In Maharashtra the area under rice during 2011-12 was 1.54 million hectares and production and productivity of rice were 2.84 million tones and 1841 kg ha^{-1} respectively, while in Vidarbha the area under rice cultivation was 7.06 lakhs hectares with production of 10.29 lakhs tones and productivity was 1460 kg ha^{-1} (Anonymous 2012). Rising cost of inputs discourages the input use and reduces the output supply. The decline in output supply raises food prices. The rapid increase in population and the increase in money income as a result of economic development create a strong pressure on demand which also leads to increase in food grain prices. These cause hardship to the consumers. This can be corrected only by a large and adequate supply of agricultural output and a greater attention is, therefore, required to be focused for matching the demand for food-grains and agricultural commodities with the supply thereof. The rise in food-grains prices should be sufficiently high not-only to counteract the rising cost of inputs but also to leave a rate of profit conductive for investment in agriculture and thereby accelerating supply of agricultural output. In this context, one needs detailed knowledge about the net effect of price and non-price factors like factor and product prices, technology, irrigation, capital use,

acreage etc. so that required adjustment needed in price and non-price factors could be worked out to attain the specific goals of prices, production and crop income.

Methodology

The present study used cross sectional cum time series data of Vidarbha region for the paddy crop for the ten years i.e. from 1999-00 to 2008-09 from Agricultural Prices and Costs Scheme, Dr.P.D.K.V., Akola. Every year 100 farmers were selected for the present study.

Index of input prices: To study the temporal variation in input and output prices and cost of cultivation, the simple tabular analysis was carried out by using standard cost concept.

The input price indices are composite indices of prices of individual items of inputs. The indices were constructed using the cost of cultivation data for the period of last ten years with average of first triennium ending as the base year. First, the price indices of inputs of seed, labour, bullock labour, fertilizer, farm yard manure, capital, pesticide, rental value of lane and depreciation on implements were constructed.

The composite indices of input prices for Paddy were constructed as

$$\text{Index of Input Price} = \sum_{i=1}^{9} S_i \left(\frac{P_{it}}{P_{io}} \right)$$

Where,

S_i = average share of i^{th} input in total input cost

P_{it}/P_{io} is the price index of i^{th} input in the t^{th} year using average of first triennium as the base year,

i=1stands for Human wage index, i=2 Bullock wage index, i=3 Fertilizer price index, i=4 FYM price index, i=5 seed price index, i=6 Interest rate index, i=7 Pesticide expenditure index, i=8 Depreciation charges index, and i=9 Rental value of land index.

Changes in input and output prices and cost of cultivation

The data were subjected to tabular analysis to study the changes in input and product prices, cost and returns for paddy. Simple tabular analysis has been used to analyze the structural changes in the cost of cultivation of selected crops. Cost structure of each crop was analyzed by working out the share of each item of cost in the total cost of cultivation. The changes in the structure of cost of cultivation of crops were assessed by comparing the cost structure of each crop during the latest years with that of early years. The share of total temporal change as assignable to individual cost components has also been ascertained.

The cost of production of the grain yield on per quintal basis has been worked out after the apportionment of total cost of cultivation between the main product and the by-product in proportionate to their contribution to the gross value of output. The cost of production per quintal is obtained by dividing the cost of cultivation attributable to the main product by the grain yield on unit area basis. The compound growth rate of

values between the initial year and the later year has also been worked out by using formula

$Y = a.b^t$

Where,

Y = Quantity / prices of inputs / yield / prices of output / value of output / cost of production.

a = Intercept

b =Regression coefficient

t = Time variable

From the estimated function the compound growth rate was worked out by –

CGR (r) = [Antilog (log b) – 1] x 100

Where,

r = Compound growth rate

Results and Discussion

Changes in input and output prices

Transformation of agriculture from subsistence to profitable farm business is a techno-organizational process, the success of which largely depends on the relative prices of various inputs and outputs. Therefore, it would be interest to examine the changes in prices of inputs and outputs.

Compound growth rates of input and output prices at current prices

The rate of growth of average input prices and output prices of Paddy at current prices are presented in Table1. Table 1 reveals that prices of all inputs showed an increasing trend during the period 1999-00 to 2008-09. The compound growth rate of input prices for paddy were highest for bullock labour prices (6.27 per cent per annum) followed by prices of Fertilizer (4.27 per cent per annum). The per cent growth rates in wage rate and seed prices were observed to be 3.17 per cent and 2.27 per cent per annum respectively.

Table 1: Compound growth rates of input and output prices of Paddy

Items	**At Current Prices**	**At Constant Prices**
1) Input Prices		
i) Wage rate	3.17**	-2.10
ii) Bullock labour price	6.27***	0.84
iii) FYM price	2.76	-2.48
iv) Fertilizer price	4.27**	-1.06
v) Seed price	2.27**	-2.95**
2) Output Price	5.74***	0.34

(***, **,*denotes significant at 1%, 5% and 10% level)

The output prices increased at an annual compound rate of 5.74 per cent per annum for paddy during the period under study. The study also reveals, at constant prices price of seed has negative growth which was significant at 5 per cent level.

Parity between output price index and input price index for paddy

Table 2 presents input-output price indices for paddy crop. It is evident from the table that between 1999-00 to 2008-09, the input price index for paddy increased by 29 per cent, while the increase in output price was 90 per cent.

Table 2: Parity between output price index and input price index for paddy

(Base year- Average of Triennium Ending – 1999-00 to 2001-02)

Years	Input price Index	Output price Index	Parity Index
1999-00	98.52	104.00	105.56
2000-01	97.73	98.11	100.39
2001-02	105.46	97.89	92.82
2002-03	109.57	102.90	93.91
2003-04	120.47	109.30	90.72
2004-05	108.63	109.30	100.62
2005-06	145.91	115.86	79.40
2006-07	115.46	126.94	109.94
2007-08	125.50	145.02	115.56
2008-09	129.46	190.30	147.00

Further, the output-input price parity were decreased during year 2001-02 to 2003-04 and in year 2005-06, increased in the subsequent years, indicating thereby up to the year 2001-02 to 2003-04, and in year 2005-06, the output price were lower than input price and term of trade was unfavourable for paddy growers. However, the term of trade was favourable for the paddy growers afterward.

Changes in cost of cultivation of Paddy

The results in Table 3 indicate the changes in the cost of cultivation of paddy in Vidarbha. The cost of cultivation of paddy increased from ₹ 14031.21 per hectare in 1999-00 to ₹ 19976.26 per hectare in 2008-09 showing an increase of 1.42 times during the period of study. The increase in total cost is attributable to cost items such as hired human labour, family labour, bullock labour, machine labour, seed, fertilizer, and farm yard manure, interest on working capital and, interest on fixed capital. The costs of rental value of own land, and depreciation cost was found to have declined. The highest share in total cost was due to hired human labour, bullock labour, machine labour, and fertilizer.

Out of total increase of ₹ 5945.05 in the cost of cultivation of paddy per hectare, 93.01 per cent was contributed by operational cost items and remaining 6.99 per cent to fixed cost items. Among the items of operational cost hired human labour, bullock labour, machine labour and fertilizer accounted for 23.54, 16.14, 13.85 and11.61 per cent respectively of the increase in total cost. The share of seed and farm yard manure in the

increase in total cost was 6.72 and 2.72 per cent respectively, while the share of rental value of own land, and share of depreciation was found to have declined.

The share of interest on fixed capital and share of interest on working capital was 8.83 per cent and 4.58 per cent respectively. The relative shares of different inputs in the change of cost of cultivation of paddy in 1999-00 and 2008-09 are given in Table 3. The share of operational cost items in the total cost of cultivation has been 74.06 per cent in 2008-09 which is higher than that in 1999-00. But within the operational cost, the share of farm yard manure was found to decrease i.e. from 4.00 per cent in 1999-00 to 3.62 per cent in 2008-09 respectively. The operational cost items for which the relative share has increased are hired human labour, bullock labour, machine labour, seed and fertilizer for paddy but the share of family labour has found to have decrease i.e. from 14.60 per cent in 1999-00 to 11.05 per cent in 2008-09 respectively. The extent of change in physical inputs and their prices along with changes in physical output and their prices and gross return from paddy over time is given in Table 4. It is remarkable to note that the physical quantity of bullock labour, human labour, manure and seed has come down for paddy due to increase in the wage rate of bullock labour and human labour and prices of manure and seed. Only physical quantity of fertilizer is increase though the increase in the price of fertilizer. The gross return for paddy has recorded an increase of 49.12 per cent during period of study. This is attributable to the increase in the prices of main product and by-product as the yield has marginally declined. The cost production of paddy has increased from ₹ 614.60 per quintal in 1999-00 to ₹ 1014.54 per quintal in 2008-09, While, the cost of production of paddy was recorded an increase of 3.52 per cent per annum during period of study. In terms of annual growth of the estimated parameters of paddy during the period, the physical quantity of human labour and bullock labour has declined while the price of bullock labour for paddy has increased by 7.95 percent per annum.

The gross return has also increased by 5.84 per cent per annum; it is mainly due to increase the price of main product and the price of by-product has increased by 1.29 per cent per annum. The minimum support prices had increased by 4.30 per cent per annum which recorded an increase of 69.23 per cent over the period of time.

Table 3: Changes in cost of cultivation of paddy

Sr. No	Particulars	Cost of cultivation				Change in 2008-09 over 1999-00		Share in total change (per cent)
		1999-00		2008-09				
		₹/ha	Per cent	₹/ha	Per cent	₹/ha	Per cent	
A)	Operational costs							
	Hired human labour	2841.35	20.25	4241.08	21.23	1399.73	49.26	23.54
	Family labour	2048.08	14.60	2206.47	11.05	158.39	7.73	2.66
	Bullock labour	1345.60	9.59	2304.97	11.54	959.37	71.30	16.14
	Machine labour	37.59	0.27	861.15	4.31	823.56	2190.65	13.85
	Seed	753.74	5.37	1153.14	5.77	399.41	52.99	6.72
	F. Y. M.	561.33	4.00	722.85	3.62	161.52	28.77	2.72
	Fertilizer	1002.75	7.15	1692.94	8.47	690.19	68.83	11.61
	Insecticides	54.74	0.39	330.74	1.66	275.99	504.16	4.64
	Incidental charges	71.00	0.51	290.73	1.46	219.73	309.48	3.70
	Repairs	107.80	0.77	276.55	1.38	168.75	156.54	2.84
	Interest on working capital	440.44	3.14	713.00	3.57	272.56	61.88	4.58
	Sub-total (A)	9264.42	66.03	14793.62	74.06	5529.20	59.68	93.01
B)	Fixed costs							
	Land revenue and taxes	11.80	0.08	24.31	0.12	12.50	105.91	0.20
	Depreciation	580.06	4.13	503.89	2.52	-76.17	-13.13	-1.28
	Rental value of Land	3681.48	26.24	3635.90	18.20	-45.57	-1.24	-0.77
	Interest on fixed capital	493.45	3.52	1018.54	5.10	525.09	106.41	8.83
	Sub-total (B)	4766.79	33.97	5182.64	25.94	415.84	8.72	6.99
C)	(Total cost) Cost C (A+B)	14031.21	100.00	19976.26	100.00	5945.04	42.37	100

Table 4: The extent of changes in physical inputs, input prices, physical output, output prices and gross return for paddy

Sr. No.	Particulars	1999-00 (base year)	2008-09 (current year)	Percent change in 2008-09 over base year	Growth rate per annum (per cent)
A)	Quantity of inputs				
1	Seed (Kg/ha)	96.26	91.50	-4.94	-1.68*
2	Fertilizer (Kg/ha)	86.50	113.67	31.41	2.06
3	Manure (qtl/ha)	28.66	24.86	-13.26	1.40
4	Human labour (hrs/ha)	1083.47	1074.50	-0.83	0.56
5	Bullock labour (hrs/ha)	154.82	121.97	-21.22	-1.56
B	Prices of inputs				
1	Seed (₹/kg)	7.83	12.60	60.92	4.01***
2	Fertilizer (₹/kg)	11.59	14.89	28.47	2.16***
3	Manure (₹/qtl)	19.59	29.08	48.44	1.35
4	Human labour (₹/hrs)	4.51	6.00	33.04	2.59***
5	Bullock labour (₹/hrs)	8.69	18.90	117.49	7.95***
C	Yield (qtl/ha)				
1	Main product	22.83	19.69	-13.75	0.47
2	By-product	27.10	22.09	-18.49	-0.97
D	Price of output (₹/qtl)				
1	Main product	588.43	1043.78	77.38	5.74***
2	By-product	47.74	63.68	33.39	1.29
E	Value of output (₹/ha)				
1	Main product	13434.07	20554.41	53.00	6.32***
2	By-product	1293.71	1407.02	8.76	0.31
3	Gross return	14727.78	21961.43	49.12	5.84***
F	Cost of production (₹/qtl)	614.60	1014.54	65.07	3.52
G	Minimum Support Price	520	880	69.23	4.30***

(***, **, *denotes significant at 1%, 5% and 10% level)

Changes in Costs of paddy

The cost of production per unit of output depends on the per hectare cost of cultivation and yield. For computing the cost of production at constant factor prices, the unit cost of production at current prices was deflated by an input price index series taking initial triennium ending average as the base year.

The cost of production at current and constant prices for paddy is presented in Table 5. The Table revealed that, the increase in yield from 1999-00 to 2005-06, resulted in substantial fall in the cost per unit of output of paddy at current prices. Again in years 2006-07, a fall in yield per hectare brought about a further sharp escalation in per unit cost of output.

The examination of cost of production at constant price did not indicate any clear trend, neither upward nor downward. The remaining variation in unit cost could be explained in term of yield fluctuation over the year. It was further observed that, whenever there was any improvement in the yield, it brought down the cost of production per quintal.

Table 5: Cost of Production of paddy Cost "C" at constant prices.

Years	Cost C per qt. At current price (₹)	Input price index	Cost C per qt. At constant price (₹)	Yield per hectare (qt.)	MSP at constant prices
1999-00	614.60	98.52	623.83	22.83	520.00
2000-01	732.86	97.73	749.88	19.59	513.00
2001-02	608.23	105.46	576.74	26.30	520.80
2002-03	618.39	109.57	564.38	28.43	492.80
2003-04	626.60	120.47	520.13	29.06	464.00
2004-05	724.74	108.63	667.17	21.26	454.30
2005-06	658.22	145.91	451.11	33.80	444.00
2006-07	715.01	115.46	619.27	24.15	439.20
2007-08	696.98	125.50	555.36	27.32	438.75
2008-09	1014.54	129.46	783.67	19.69	554.40
CGR (%)	3.26**		-0.07		-1.03

The average cost of production varied from ₹ 608.23 with an average yield of 26.30 quintal in the year 2001-02 to ₹ 1014.54 per quintal with an average yield 19.69 quintal in the year 2008-09. This clearly indicates that technological breakthrough in the cultivation of paddy has not compensated the cost push inflation. Therefore per unit cost of output did not decline over time. It has been hypothesized that with the improvement in productivity of crops the production function must shift upward and cost of production at constant prices must decline. The analysis revealed that the cost of production did not decline. Thus it can be concluded that the technological development in paddy has not shown its impact in reducing the cost of production in Vidarbha.

Change in cost and returns from paddy

The data on cost and returns from paddy at different point of time are presented in Table 6. The result reveals the gross income from paddy increased at an annual rate of 5.83 per cent per annum between 1999-00 to 2008-09. The increased in gross income may be attributed to both increase in output price as well as increase in yield of main product and by product.

However, the rate of increase in cost of cultivation per hectare was 3.75 per cent. This resulted in an improvement in the net income per hectare of paddy crop over the years. This was further reflected by output-cost ratio, which increased from 1.050 in 1999-00 to 1.099 in 2008-09. However, in the year 2000-01 to 2001-02 and 2004-05, the output-cost ratio was not very impressive mainly due to low productivity per unit area while in 2007-08, the output-cost ratio was increased i.e. 1.217.

Table 6: Change in cost and returns from paddy

Years	Input price Index	Output price Index	Gross income per ha.	Cost C per ha.	Net income per ha.	Output-cost ratio
1999-00	98.52	104.00	14727.78	14031.21	696.56	1.050
2000-01	97.73	98.11	12098.35	14357.06	-2258.71	0.843
2001-02	105.46	97.89	15781.00	15998.12	-217.12	0.986
2002-03	109.57	102.90	18096.59	17579.02	517.58	1.029
2003-04	120.47	109.30	18548.51	18208.86	339.65	1.019
2004-05	108.63	109.30	14563.37	15404.54	-841.17	0.945
2005-06	145.91	115.86	23049.62	22246.06	803.56	1.036
2006-07	115.46	126.94	18254.04	17267.53	986.50	1.057
2007-08	125.50	145.02	23174.57	19043.79	4130.78	1.217
2008-09	129.46	190.30	21961.43	19976.26	1985.17	1.099
CGR (%)	3.34***	3.68***	5.83***	3.75**		

(***, **, *denotes significant at 1%, 5% and 10% level)

It is reveals from the table that the input price index for paddy crop increased at an annual compound growth rate of 3.34 per cent per annum while the output price index increased at an annual rate of only 3.68 per cent per annum.

Conclusion

It is concluded from the study that, the compound growth rates of inputs and output prices were increased during the period of study except prices of FYM and the output price also increased at an annual compound rate of 5.74 per cent per annum for paddy during the period under study. The study also concluded that the cost of cultivation of paddy has increased by 1.42 times during the period of study.

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Economics of Growth and Instability of Fruit Crops in India

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Abstracts

The role of fruit crops should not be underestimated in the development of process as they generate more employment and income, in horticulture sector of agricultural and applied sector. Major fruit crops viz., banana, grapes, citrus, guava and apple are very important in Indian economy, as they are economically and politically associated. Horticulture continues to be the major source of income for most of the population, and crucial dependence of its rural labour force on vulnerable agriculture less likely to reduce in the near future, this paper attempts to examine the performance including the growth and instability of important fruit crops in the light of shrinking resource base and risky horticulture. The results from this study were found that productivity of fruits is almost stagnant over last decade area and production has been almost double from 2001-02 to 2010-11. Banana, orange and apple are showing higher growth rate in production. Orange, apple and grape have shown higher instability in production. Relative share of orange in total export from India is continuously decreasing and that of banana is increasing year by year. The coefficient of variation in area for grape and orange for studied period was 6.23 per cent and 4.17 per cent respectively. The coefficient of variation in yield for grape, apple and orange was observed maximum. The instability index in area was found to be higher for grape and orange in studied period. As far as yield concerned the Instability Index was observed higher in grape, apple and orange.

Introduction

Horticulture in a broader sense is the science of growing and management of fruits, vegetables, ornamental, aromatic and medicinal plants, spices, plantation crops, their processing, value addition and marketing. Horticulture accounts for about 13.08% of gross cropped area (192.79 million hectares) in the country and contributes around 30% to Indian Agricultural GDP. Its share is about 37% of the total exports of agricultural commodities. Rising incomes and growing consumer interest in a variety of fresh fruits and vegetables year-round is stimulating international trade in horticulture. India has several advantages in the sector. It is one of the world's biggest producers of horticultural products. The production costs are less than half of those in other parts of the world. Despite these advantages, India's share in the global market is insignificant - it accounts for only 1.7 percent of the global trade in vegetables and 0.5 percent in fruits. India is the second largest producer of fruits and vegetables contributing 10 per cent and 14 per cent respectively in the world fruit and vegetable production. Horticulture sector received focused attention from 7th Five Year Plan onwards, as a result, there has been not only sustained increase in production of horticulture crops but hi-tech horticulture also been recognized as a commercial proposition. In fact horticulture sector provided opportunity for crop diversification resulting in the increased income from the land and also the nutritional security. The benefit of area expansion in horticulture in clusters supported by post harvest management infrastructure has percolated down to even small and marginal farmers, a

number of whom contribute to the export of horticulture produce too. During the last five decades the production and productivity of horticultural crops have increased manifold.

Today horticultural crops cover about 25 per cent of total agricultural exports of the country. The corporate sector is also showing greater interest in horticulture. An major shift in consumption pattern of fresh and processed fruits and vegetables is expected in the coming century. There will be greater technology adoption both in traditional horticultural enterprise as well as in commercial horticulture sector. Diversification and value addition will be the key words in the Indian horticulture in the 21st Century. India's biggest export markets are South Asian & Middle East countries.

Methodology

The study is based on secondary data which are compiled from various published source. Data on area, production, yield and export were collected from the National Horticulture Board, Database - 2011. Data were collected for five crops for the period 2001-02 to 2010-11.

The performance of different crops was examined by estimating (a) Growth rates of area, production, yield and export (b) Degree of instability in area, production and yield.

(a) Estimation of growth rates

The growth in area, production, yield and export were studied estimating compound growth rates at the period 2001-02 to 2010-11. The growth rate was estimated using exponential trend model.

$$Y = a\, b^{t}$$

Where,

Y= Area / production / yield / export. a= Intercept

b= Regression coefficient t= Time variable

From the estimated function the compound growth rate was worked out by

$$CGR(r) = [(\text{Antilog } (\log b - 1)] \times 100$$

CGR(r)= Compound growth rate

(b) The Degree of instability in area, production and yield of major crops at period 2001-02 to 2010-11 was measured using coefficient of variation and coefficient of instability.

Coefficient of Variation(CV)=(σ/ $\bar{X}$)100

Where,

σ= Standard deviation

$\bar{X}$=Arithmetic means

Coefficient of instability was worked out using Coppock Instability Index

$$\text{V log} = \frac{\sum \left(log\, \frac{Xt+1}{Xt} - m \right)}{N}$$

The instability index= Antilog (√v log-1) x 100

Where,

Xt = Area / Production / yield of crop in year t

N = Number of years minus one

m = Arithmetic mean of the differences between the log of Xt and Xt-1, Xt-2 etc.

V log = Logarithmetic variance of the series.

Result and Discussion

Growth rates in area, production, yield and export: The performance of fruit crops was estimated and a pertained through studding the growth in Area, Production, Yield and export of the study area. The compound growth rates of Area, Production, Yield and export of fruit crops where worked out for India the results which were obtained are presented in Table 1

Table 1: Compound Growth Rates of Area, Production, Yield and Export of fruit crops in India.

Sr. No.	Fruit Crop	Area	Production	Yield	Export
1	Apple	3.9194***	7.4158***	3.3359***	11.6813**
2	Banana	5.5668***	10.0667***	3.1470***	24.3465***
3	Grapes	9.2504***	-0.3188	-8.7583	19.4112***
4	Guava	3.9497***	4.5827***	0.5919	7.4776**
5	Orange	6.9865***	7.6838**	0.6410	-6.3296

Note: *, **, *** significant at 10, 5, 1 per cent level of significance.

The current status and growth performance of major fruit crops have been analysed for country. During the period 2001- 02 to 2010-11, the compound growth rate was examined in area, production, yield and export of major fruits in India and it was found increasing. The area under grapes was registered highest CGR of 9.2504 per cent followed by orange (6.9865 per cent), banana (5.5668 per cent), guava (3.9497) and lowest in apple. In the case of production highest CGR recorded of banana 10.0667 per cent followed by orange (7.6838 per cent), apple (7.4158 per cent), guava (4.5827 per cent) and negative for grape. The CGR in productivity was observed to be maximum in apple 3.3359 per cent followed by banana (3.1470 per cent) and lowest grapes. Whereas in export CGR was highest in banana 24.3465 per cent followed by grapes (19.4112 per cent), apple (11.6813 per cent) and guava (7.4776 per cent) while negative export was observed in orange.

Instability in area, production and yield:

The fruit crops performance of country during the period was measured not only from the point of view of increase in area, production and yield rate of any crop. Here, in order to examine the extent of instability, coefficient of variation and coppock instability index worked out. The result of Coppock instability index and Coefficient of Variation obtained were presented and discussed in the table 2 below.

Table2: Coppock instability index (%) & Coefficient of Variation (%) in area, production and yield of fruit crops in India.

Sr. No.	Fruit Crop	Area	Production	Yield
1	Apple	2.50 (2.52)	3.20 (3.31)	9.34 (9.64)
2	Banana	2.55 (2.69)	2.75 (3.00)	3.20 (3.26)
3	Grapes	6.23 (6.61)	3.00 (3.18)	13.40 (13.57)
4	Guava	2.22 (2.42)	2.00 (2.06)	1.95 (2.07)
5	Orange	4.17 (4.37)	4.18 (4.29)	7.00 (7.18)

(Figures in parentheses indicate the value of Coefficient of Variation.

The instability index in area, production and yield of major fruit crops has also been analysed. The instability index in area was observed to be maximum in grape (6.23 per cent), followed by orange (4.17 per cent), banana (2.55 per cent), apple (2.50 per cent) and lowest in guava (2.22 per cent). In case of production maximum instability index was observed in orange (4.18 percent) followed by apple (3.20 per cent), grapes (3.00 per cent), banana (2.75 per cent) and lowest in guava (2.00 per cent). As far as yield is concerned the instability index was very high in grape (13.40 per cent), followed by apple (9.34 per cent), orange (7.00 per cent), banana (3.20 per cent) and lowest in guava (1.95 per cent).

The variation in area, production and yield of major fruit crops has also been analysed. The variation in area was observed to be maximum in grape (6.61 per cent), followed by orange (4.37 per cent), banana (2.69 per cent), apple (2.52 per cent) and lowest in guava (2.42 per cent). In case of production maximum variability was observed in orange (4.29 percent) followed by apple (3.31 per cent), grapes (3.18 per cent), banana (3.00 per cent) and lowest in guava (2.06 per cent). As far as yield is concerned the variability was very high in grape (13.57 per cent), followed by apple (9.64 per cent), orange (7.18 per cent), banana (3.26 per cent) and lowest in guava (2.07per cent).

Conclusions

The present study has discussed the growth performance of major fruit crops of India. The yield growth rate of apple and banana was significant. The growth of area and production of all studied major fruit crops are significant except grape which was insignificant in production. Banana has led growth rate in area, production and export. The growth of export of all studied fruit crops was significant except orange.

The coefficient of variation in area for grape and orange for studied period was 6.23 per cent and 4.17 per cent respectively. The coefficient of variation in yield for grape, apple and orange was observed maximum.

The instability index in area was found to be higher for grape and orange in studied period. As far as yield concerned the Instability Index was observed higher in grape, apple and orange.

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Production and Marketing of Green Chilli in Akola District

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ABSTRACT

The present study on economics of production and marketing of Green Chilli in Akola district was carried out during the year 2011-2012. Two tahsil namely, Balapur and Patur of Akola district were selected purposefully for the present study. Chilli is the most important cash crop grown in Patur and Balapur tahsils of Akola district. Per hectare total cost of cultivation of Green Chilli was highest in the large size group i.e. Rs.39961.59 per hectare followed by medium group (Rs. 36393.54) and small size group (Rs.34375.24). The benefit cost ratio of Green Chilli at cost 'C' was 1.46 in small size group, 1.45 in medium group and 1.46 in large group. The marketing cost of Green Chilli was highest in channel III (Producer - Commission agent - wholesaler - Retailer - Consumer) i.e. Rs. 329.04 than channel II (Producer - Commission agent - Retailer - Consumer) i.e. Rs. 286.08 and channel I (Producer - Consumer) i.e. Rs. 45.61, respectively. Producer's share in consumer's rupee was highest in Producer → Consumer channel i.e. 97.08 per cent. whereas, 61.58 per cent in Producer → Commission agent → Retailer → Consumer channel and 49.34 per cent in Producer → Commission agent →Wholesaler →Retailer →Consumer channel. The price spread was highest in case of channel III i.e. Rs. 937.42 followed by channel II (Rs. 710.98) and channel I (Rs. 45.61).

INTRODUCTION

Chilli (*Capsicum annuum*) belongs to the genus Capsicum under Solanaceae family. Chilli is one of the most important cash crop grown in this area. In world, area, production and productivity of green chilli was around 1898 thousand ha, 29939 thousand tonnes and 15.8 tonnes/ha during 2010-2011. China tops the world in area (707 thousand ha) and production (22.0 tonnes/ha) of green chillies and Spain is at the top in terms of productivity (53.2 tonnes/ha). After China, Mexico, Turkey, Indonesia, USA, Spain, Egypt etc are the major producers of green chilli during 2010-11. (Vanitha *et al.,* 2013).

India has produced around 65.9 thousand tonnes of green chilli with area of 7.7 thousand ha and productivity 8.6 tonnes/ha during 2010-11 (Vanitha *et al.,* 2013). The most important chilli growing states in India are Andhra Pradesh (49%), Karnataka (15%), Maharashtra (6%) and Tamilnadu (3%), which constitute nearly 75 per cent of the total area under chilli. In Maharashtra major chilli growing districts are Nagpur, Amravati, Chandrapur, Nanded, Osmanabad, Aurangabad, Dhule, Jalgaon, Kolhapur and Sangali. In Maharashtra state area, production and productivity of chilli was around 99300 ha, 51214 tonnes and 520 kg/ha respectively during 2008-09. India is also the largest consumer and

exporter of chilli. India exported 46909.36 tonnes of green chilli valued Rs. 9895.21 lakhs during 2010-2011. (Vanitha *et al.,* 2013).

Akola is one of the important chilli growing district in Maharashtra. In Akola major chilli growing tahsils are Patur, Balapur, Telhara and Akola. The total area under chilli during 2007-08 was 166 ha. In Akola district the highest area under chilli in Telhara tahsil i.e. 75 ha followed by Patur and Balapur tahsil 70 ha and 25 ha respectively. (Source: District Socio-economic review 2009-2010). Chilli being a high value crop and has got tremendous scope to increase the income of farmers. Patur and Balapur tahsil in Akola district have emerged as the most popular for chilli production because of best suited climate, soil irrigation facilities, skill and intensive cultivation practices adopted by the farmers of this area.

Marketing system for farm products and also inputs for agricultural production plays an important role in the national economy of the country. Agricultural marketing plays a crucial role not only in stimulating production and development. It has been described as the most important multiplier of agricultural development.

The development of marketing is an important as that of increasing production. Farmers always desire to get handsome price for their farm produce. Therefore, for profitable transactions a careful planning of marketing is a must. Improvement of marketing conditions to enable the farmers to secure a fair share of the consumer's price is of utmost importance. Thus, keeping in view above need, the study was undertaken with following objectives.

1. To work out the economics of the chilli crop.
2. To study marketing channels and price spread for chillies.

METHODOLOGY

The present study was undertaken in Akola district of Vidarbha region. Two tahsils namely, Balapur and Patur were selected purposefully based on maximum area under Chilli. From each tahsil, 3 villages were selected randomly for the present study. The lists of all villages growing green chilli were collected from the office of Panchayat Samiti, Krishi Seva Kendra and Seed Shops of the respective tahsil of Akola district.for the year 2011-12. The list of green chilli cultivators were obtained from talathis of respective village. For present study, 15 farmers from each village i.e. total 90 farmers were selected randomly by using random sampling technique and then categorized into small, medium and large farmers according to their total size of land holding.

Analytical Tools Employed

Simple tabular analysis was carried out using standard cost concepts such as Cost A, Cost B, Cost C and B: C ratio to work out the cost of cultivation and returns from chilli crop and expenditure incurred by farmers for growing chilli crop.

The marketing of green chilli was worked out by marketing cost, market margin, price spread and producers share in consumers rupee.

By adopting the methodology discussed above, an attempt was made to study the economics of production and marketing of green chilli.

RESULTS AND DISCUSSION

Cost of cultivation of green chilli

Table 1: Per hectare Cost of cultivation of green chill (Rs. / ha)

Sr.No	Particulars	Size of land holding			
		Small	Medium	Large	Overall
1	Hired Human Labour				
	a) Male	1004.4 (2.92)	1232.4 (3.39)	1604.4 (4.01)	1280.4 (3.47)
	b) Female	3873.8 (11.27)	4146.1 (11.39)	4440.1 (11.11)	4153.33 (11.25)
2	Bullock labour	1680 (4.89)	1837.5 (5.05)	1417.5 (3.55)	1645 (4.46)
3	Machine charges	2290.68 (6.66)	2092.72 (5.75)	2432.08 (6.09)	2271.83 (6.16)
4	Manures	2293.88 (6.67)	2998.9 (8.24)	4303.76 (10.77)	3198.85 (8.67)
5	Irrigation	1436.35 (4.18)	1634.26 (4.49)	2018.24 (5.05)	1696.28 (4.60)
6	Fertilizers				
	N	929.43 (2.70)	949.16 (2.61)	975.3 (2.44)	951.30 (2.58)
	P	723.79 (2.11)	778.79 (2.14)	856.08 (2.14)	786.22 (2.13)
	K	257.03 (0.75)	276.53 (0.76)	299.03 (0.75)	277.53 (0.75)
7	Seed	3254.43 (9.47)	3343.23 (9.19)	3504.67 (8.77)	3367.44 (9.12)
8	Plant protection chemicals	1512.34 (4.40)	1787.12 (4.91)	1998.78 (5.00)	1766.08 (4.78)
9	Land revenue	25 (0.07)	25 (0.07)	25 (0.06)	25 (0.07)
10	Interest on working capital @6 per cent	553.43 (1.61)	608.05 (1.67)	691.25 (1.73)	617.58 (1.67)
11	Depreciation of assets	879.56 (2.56)	1023.54 (2.81)	1203.09 (3.01)	1035.40 (2.81)
12	Cost-A (Item 1 to 11)	20714.12 (60.26)	22733.30 (62.47)	25769.28 (64.49)	23072.23 (62.51)
13	Rental value of land	8336.97 (24.25)	8788.11 (24.15)	9680.77 (24.23)	8935.28 (24.21)
14	Interest on fixed capital @10 per cent	1357.54 (3.95)	1546.23 (4.25)	1943.64 (4.86)	1615.80 (4.38)
15	Cost-B	30408.64 (88.46)	33067.64 (90.86)	37393.69 (93.57)	33623.32 (91.10)
16	Family human labour				
	a) Male	2668.8 (7.76)	2300.4 (6.32)	1758 (4.40)	2242.4 (6.08)
	b) Female	1297.8 (3.78)	1025.5 (2.82)	809.9 (2.03)	1044.4 (2.83)
17	Cost-C (Item 15 to 16)	34375.24 (100.00)	36393.54 (100.00)	39961.59 (100.00)	36910.12 (100.00)

(Figures in parentheses indicate the percentage to 'Cost C')

It is revealed from Table.1 that, hectare-wise average cost 'A' of selected farmers was Rs. 20714.12, Rs.22733.30 and Rs. 25769.28 for small, medium and large farmers respectively. Cost 'B' was Rs. 30408.64, Rs.33067.64 and Rs. 37393.69 for small, medium and large farmers and Cost 'C' was Rs. 34375.24, Rs. 36393.54 and Rs.39961.59 for small, medium and large farmers, respectively.

The overall average cost 'A', Cost 'B' and cost 'C' for small, medium and large farmers was Rs. 23072.23, Rs. 33623.32 and Rs. 36910.12, respectively.

From the above discussed results, it is revealed that, cost 'A', cost 'B' and cost 'C' was higher in large farmers followed by medium and small farmers. Cost 'A' was found to be 60.26 per cent, 62.47 per cent and 64.49 per cent to cost 'C' for small, medium and large farmers respectively and at overall it was 62.51 per cent.

For small farmers rental value of land to cost 'C' was 24.25 per cent which was highest followed by cost of hired female labour to cost 'C' was 11.27 per cent, cost of seed to cost 'C' was 9.47 per cent and cost of manures to cost 'C' was 6.67 per cent. For medium farmers cost of rental value of land to cost 'C' was 24.15 per cent followed by cost of hired female labour to cost 'C' was 11.39 per cent, cost of seed to cost 'C' was 9.19 per cent and cost of manures to cost 'C' was 8.24 per cent.

Whereas, for large farmers cost of rental value of land was 24.23 per cent to cost 'C' followed by cost of hired female labour 11.11 per cent to cost 'C', cost of seed to cost 'C' was 8.77 per cent and cost of manures to cost 'C' was 10.77 per cent. The overall average of rental value of land, hired female labour, seed and manure was worked out to 24.21 per cent, 11.25 per cent, 9.12 per cent and 8.67 per cent for small, medium and large farmers, respectively.

Economics of green chilli production

It is revealed from Table.2 that, the per hectare average yield of green chilli was 41.96 quintal obtained by large farmers and in case of small farmers and medium farmers it was 38.87 and 40.35 respectively and the overall average was 40.39 quintals. The average gross returns were obtained was Rs. 50171.84, Rs. 52878.68 and 58234.61 for small, medium and large farmers respectively and overall it was Rs. 53761.71.

The average net returns over cost 'A', cost 'B' and cost 'C' obtained was Rs. 29457.72, Rs. 30145.37, Rs. 32465.33 and Rs. 19763.20, Rs. 19811.03, Rs. 20840.92 and Rs. 15796.60, Rs. 16458.13, Rs. 18273.02 for small, medium and large farmers respectively. The overall net returns over cost 'A', cost 'B' and cost 'C' was Rs. 30689.47, Rs. 20138.38, Rs. 16851.58 for small, medium and large farmers respectively.

Table.2: Per hectare economics of green chilli production (Rs. /ha)

Sr. No.	Particular	Size of land holding			
		Small	Medium	Large	Overall
1	Average yield (qt/ha)	38.87	40.35	41.96	40.39
2	Average price received per quintal	1290.76	1310.50	1387.86	1329.71
3	Gross returns(Rs.)	50171.84	52878.68	58234.61	53761.71
4	Cost of cultivations (Rs.)				
A	Cost – A	20714.12	22733.30	25769.28	23072.23
B	Cost – B	30408.64	33067.64	37393.69	33623.32
C	Cost – C	34375.24	36393.54	39961.59	36910.12
5	Net returns over cost (Rs.)				
A	Cost – A	29457.72	30145.37	32465.33	30689.47
B	Cost – B	19763.20	19811.03	20840.92	20138.38
C	Cost – C	15796.60	16485.13	18273.02	16851.58
6	Benefit – Cost ratio at				
A	Cost – A	2.42	2.33	2.26	2.34
B	Cost – B	1.65	1.60	1.56	1.60
C	Cost – C	1.46	1.45	1.46	1.46

The benefit cost ratio indicates the return of each rupee investment in chilli cultivation. The results revealed that, the highest return at cost 'A' in small group was 2.42 and followed by medium group i.e. 2.33 and then large group i.e. 2.26. At overall level the return at cost 'A' was 2.34 per rupee invested. At cost 'B' the B:C ratio declines due to high value of rental value of land. It was 1.65 in small followed by 1.60 in medium and 1.56 in large size group. At overall level B:C ratio at cost 'B' was 1.60. At cost 'C' the ratio was 1.46 in small group, 1.45 in medium group and 1.46 in large group. At overall level B:C ratio was 1.46.

Marketing channel and price spread for green chilli

The selection of marketing channel becomes imperative for the farmers, since the real benefit accrued to them is mainly depend upon the choice of agency and channel for disposal of their produce. The Channels of distribution for green chilli observed in study area were as follows:

Channel I : Producer → Consumer

Channel II : Producer → Commission agent → Retailer → Consumer

Channel III : Producer→Commission agent→Wholesaler→Retailer→Consumer

The channel-wise marketing cost, marketing margin and price spread were worked out and presented in Table 3.

Among these channel about 50 per cent of the major share of produce was routed through channel II, about 32 per cent share of produce was routed through channel III and about 18 per cent minor share was routed through channel I. In channel I i.e. producer →

consumer, quantity sold was low and this channel was mainly followed by small farmers at village level.

Table .3 : Channel-wise average marketing cost, marketing margin and price spread of different intermediaries
(Rs. / qtl)

Sr. No.	Particulars	Channel- I	Channel- II	Channel-III
1	Gross price received by farmer	1560.75	1350.76	1100.49
2	Marketing cost incurred by farmers			
	a)Cost of Packing material	22.63 (49.62)	22.56 (7.89)	22.75 (6.91)
	b)Cost of loading and unloading	5.63 (12.34)	7.80 (2.73)	8.59 (2.61)
	c)Transportation cost	15.66 (34.33)	37.67 (13.17)	37.93 (11.53)
	d)Octroi charges	-	3.00 (1.05)	3.00 (0.91)
	e)Weighing charges	-	2.00 (0.70)	2.00 (0.61)
	f) Commission (10%)	-	135.08 (47.22)	110.05(33.45)
	g)Other charges	1.69 (3.71)	2.87 (1.00)	3.10 (0.94)
	Total	45.61 (100.00)	210.98 (73.75)	187.42(56.96)
3	Net price received by farmers	1515.14	1139.78	913.07
4	Marketing cost incurred by commission agent			
	a)Labour cost	-	7.36 (2.57)	7.20 (2.19)
	b)License fee		2.38 (0.83)	2.55(0.77)
	c)Tax	-	13.54 (4.73)	13.55 (4.12)
	d)Other fee	-	2.42 (0.85)	2.31 (0.70)
	Total	-	25.70 (8.98)	25.6 (7.78)
5	Commission received by commission agent	-	135.08	110.05
6	Market margin of commission agent	-	109.38 (19.53)	84.44 (11.75)
7	Price paid by wholesaler	-	-	1100.49
8	Marketing cost incurred by wholesaler			

	a)Transportation cost	-	-	15.66 (4.76)
	b)Labour cost	-	-	6.77 (2.06)
	c)Market fees	-	-	13.10 (3.98)
	d) Tax	-	-	14.87 (4.52)
	d)Spoilage	-	-	15.46 (4.70)
	e)Other	-	-	3.56 (1.08)
	Total	-	-	64.87 (19.71)
9	Price received by wholesaler	-	-	1350.49
10	Market margin of wholesaler	-	-	185.13(25.77)
11	Price paid by retailer	-	1350.76	1350.49
12	Marketing cost incurred by retailer			
	a)Transportation cost	-	12.82 (4.48)	13.12(3.99)
	b)Market fee	-	11.44 (4.00)	11.96(3.63)
	c) Weighing charges	-	2.00 (0.70)	2.00 (0.61)
	c)Spoilage	-	20.76 (7.26)	21.67 (6.59)
	d)Other	-	2.38 (0.83)	2.39 (0.73)
	Total	-	49.40 (17.27)	51.14 (15.54)
13	Price received by retailer	-	1850.76	1850.49
14	Market margin of retailer	-	450.60 (80.47)	448.86(62.48)
15	Total marketing cost	45.61 (100.00)	286.08(100.00)	329.04(100.00)
16	Total marketing margin	-	559.98(100.00)	718.43(100.00)
17	Producer's net price	1515.14	1139.78	913.07
18	Consumers's price	1560.75	1850.76	1850.49
19	Producer's share in consumer's rupee (%)	97.08	61.58	49.34
20	Price spread Rs/Qtl.	45.61	710.98	937.42

From Table.3, it was observed that, total marketing cost was found to be Rs. 45.61 for channel I, Rs. 286.08 for channel II and 329.04 for channel III.

In channel I, the highest cost accounted for the packing material paid by the farmers Rs. 22.63 (49.62 per cent) followed by the transport cost of farmers Rs. 15.66 (34.33 per cent). In channel II the highest cost accounted for the commission charges the commission charges paid by the farmers was Rs. 135.08 (47.22 per cent) followed by the transport cost

of farmers Rs.37.67 (13.17 per cent). In case of channel III the highest cost accounted for the commission charges paid by the farmers Rs. 110.05 (33.45 per cent) followed by the transport cost of farmer Rs. 37.93 (11.53 per cent).

In channel II, the total market margin was found to be Rs.559.98, out of which the market margin of retailer was Rs. 450.60 (80.47 per cent) higher than the market margin of commission agent Rs. 109.38 (19.53 per cent). In case of channel-III, the total market margin was Rs.718.43, out of which the market margin of retailer Rs.448.86 (62.48 per cent) was comparatively higher than the market margin of wholesaler Rs. 185.13 (25.77 per cent) followed by market margin of commission agent Rs. 84.44 (11.75 per cent).

It was also observed that the price spread in channel I, channel II and channel III was Rs. 45.61, Rs. 710.98 and Rs. 937.42 respectively. From this it was revealed that, the price spread was higher in channel III. It was also observed that, in case of channel-I the producer's share in consumer's rupee was 97.08 per cent, in case of channel II, it was 61.58 per cent and in case of channel-III, it was 49.34 per cent. It was revealed that producer's share in consumer's rupee was higher in channel-I than channel II and channel-III.

CONCLUSIONS

- Per hectare cost of cultivation of green chilli was highest in the large group i.e. Rs. 39961.59 followed by medium group (Rs. 36393.54) and small group (Rs. 34375.24). The average yield and gross returns per hectare increased with the increase in size of farms.
- The benefit cost ratio of green chilli at cost 'C' was 1.46 in small group, 1.45 in medium group and 1.46 in large group. This indicates that, Cultivation of chilli crop was economically beneficial.
- Producer - Commission agent - Retailer - Consumer was the important channel through which maximum quantity was sold by the cultivators.
- The price spread was highest in case of channel III i.e. Rs. 937.42 followed by channel II (Rs. 710.98) and channel I (Rs. 45.61).

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Inter-district Variability in Agricultural Production

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Abstract

The analysis of growth is usually used in economic studies to find out the trend of a particular variable over a period of time and used for making policy decisions. The necessary secondary data were collected for a period of 30 years from 1980-81 to 2009-10.The growth and degree of instability in the production of selected four major crops namely, Tur, Gram, Kharif Jowar, and Cotton were estimated using the compound growth function and co-efficient of variation, respectively. The results revealed that, the overall compound growth rate of Latur district (5.405 per cent), Parbhani district (6.916 per cent), Jalna district (8.098 per cent), and Aurangabad district (9.432 per cent) were found significant and highest among all the districts in Marathwada region for Tur, Gram, Kharif jowar, and Cotton, respectively. Also, the extent of variability was observed more in Osmanabad district (70.41%), Nanded district (73.75%), Aurangabad district (62.02%) and Osmanabad district (306.19%) among all the districts in Marathwada region for Tur, Gram, Kharif jowar, and Cotton, respectively. Whereas, the overall compound growth rate of Gadchiroli district (7.29 per cent), Akola district (12.726 per cent), Wardha district (10.648 per cent) and Gadchiroli district (8.386 per cent) were found significant and highest among all the districts in Vidarbha region for Tur, Gram, Kharif jowar and Cotton, respectively. And the degree of instability was observed more in Gadchiroli district (66.20%), Yavatmal district (146.74%), Gadchiroli district (217.09%), and Gadchiroli district (192.26%) among all the districts in Vidarbha region for Tur, Gram, Kharif jowar, and Cotton, respectively.

Key words: Growth, production, major crops, variability

INTRODUCTION

Instability in agriculture has remained the subject of deep concern in the area of agricultural economics in India. Instability in agricultural production raises the risk involved in farm production and affects farmers' income and decisions to adopt high paying technologies and make investments in farming. It also affects price stability and the consumers, and increases vulnerability of low – income households to market. Instability in agricultural and food production is also important for food management and macro-economic stability. (Chand and Raju, 2009). Production of non-food grains has shown an increase in the instability during the past two decades but production of food grains and total crop sector has been much more stable in the recent period compared to pre green revolution phase and the first two decades of green revolution in the country. This indicates that Indian agriculture has developed resilience to absorb various shocks in supply caused by the climatic and other factors. (Chand *et al*., 2011)

In India, agriculture and other activities contribute significantly to the Gross Domestic Product, accounting for nearly 13.7 per cent of the total GDP during 2012-13. It provides employment to around 64 per cent of the total work force while contributing 18 per cent of the total export. India, with only 2.3 per cent of world's total land area supports 18 per cent of human and 15 per cent of livestock population in the world. The country has made an impressive progress on the food front, which has resulted in increased production of food grains.

The food grain production in the country was 57.47 million tonnes in 1950-51, which increased up to the level of 255.36 million tonnes in 2012-2013. The high yielding and input responsive varieties of Rice and Wheat and supportive government policies led to cereal based green revolution. This brought considerable unevenness in food production progress in different commodities. Rice and Wheat yield increased over time, but the production of most other crops grown is less endowed. The production of Pulses and Oilseeds rose from 22.05 and 23.46 million tonnes in 1993-94 to 24.13 and 50.17 million tonnes in 2012-13, but the growth in the production of Jowar, Gram and Tur is negligible in Maharashtra.

The state of Maharashtra is blessed with varied agro-climatic conditions which permit the farmers of the state to cultivate not only a variety of crops in a season but also a number of crops like cereals, pulses, oilseeds, commercial crops and horticultural crops across different seasons of the year.

In Maharashtra, the total food grain production has decreased from 13582.4 thousand tones during 1993-94 to 10689.0 thousand tones during 2012-13. Whereas, the production of pulses and cotton has increased from 2205.3 and 2625.4 thousand tones, respectively during 1993-94 to 2413.0 and 7650.0 thousand tones, respectively during 2012-13. Also, the production of coarse cereals from 1993-94 to 2012-13 decreased from 7836.8 to 4359.0 thousand tones, respectively. The estimated per capita per month consumption of cereals and pulses based on 66th round of National Sample Survey (2009- 10) were 9.43 kg and 0.85 kg resulting in annual requirement of cereals and pulses at 132.47 and 11.94 lakh million tonnes, respectively. (Economic Survey of India,2012-13).

With this view, the present study has been under taken in districts of Marathwada and Vidharbha region to examine the district-wise performance of major crops.

Objectives

- To examine the production performance of major crops in Marathwada and Vidharbha region.
- To measure the instability in production of major crops in Marathwada and Vidharbha region.

Methodology

The study covered a 30 year period of study predominantly based on the secondary data collected from various issues of epitome of agriculture and district socio - economic review, pertaining to the year 1980-81 to 2009-10. The districts selected for the present study were namely Aurangabad, Jalna, Beed, Parbhani, Latur, Nanded & Osmanabad from Marathwada region and Amravati, Akola, Buldhana, Yavatmal, Nagpur, Wardha, Bhandara, Chadrapur, Gadchiroli from Vidarbha region. The present study takes into consideration production of

four major selected crops i.e., Tur, Gram, Kharif jowar and Cotton. The data were cited for the period from 1980-81 to 2009-10.The entire study period split into three sub-periods as:
Period I: 1980 -1981 to 1989 -1990
Period II: 1990-1991 to 1999 –2000
Period III: 2000-2001 to 2009-2010.

Estimation of growth rates:

The growth rates in production of major crops were studied, estimating the compound growth rates at different periods.

The growth rate was estimated using exponential trend model.

$$Y = a.b^{t}$$

Where,
Y = Production
a = Intercept
b = Régression Coefficient
t = Time variable.
The above equation can also be written as,
Log Y = Log a × Log b
From the estimated function the compound growth rate was worked out by,

CGR(r) = [Antilog (log b) – 1] X 100

Where,
r = Compound growth rate

Degree of instability in production of major crops:

The degree of instability in production of major crops in different periods was measured using coefficient of variation.

Co-efficient of variation $$(C.V\,\%) = \frac{\sigma}{\overline{X}} \times 100$$

Where,
$\sigma -$ Standard deviation

$$\sigma = \sqrt{\frac{\Sigma (X - \overline{X})^{2}}{n}}$$

$\overline{X} -$ Arithmatic mean

Results and Discussion

Agriculture constitutes the backbone of the Indian economy. Agriculture development is a key element of rural development. Thus, to know the development of agriculture which is characterized by production of different crops, the data were analyzed with suitable statistical tools and the results of the analysis are presented below.

Growth rates and variability in tur production

It can be seen from **Table 1** that, in Marathwada region overall growth rate of tur production under Latur district was 5.405 per cent which was highest and found positively significant over the study period and lowest under Beed district which was 0.929 per cent.

The growth rate for tur crop under Aurangabad (-0.758), Beed (-2.008), and Nanded (-0.035) districts was found negative in Period-I among all the districts of Marathwada region. Whereas, under Jalna district annual growth rate was positive in Period -I and constantly increased over the decades. Under Jalna, Latur and Osmanadad districts the growth rate has increased in Period-I to Period – III. In contrast, the growth rate of tur production has reduced in Period-I to Period-III. As revealed from the Table 1, osmanabad district witness a high instability of production as indicated by high coefficient of variation value of 70.41 per cent for overall period. While, least variability was observed in Nanded district i.e.42.09 per cent.

Table 1. District wise growth rates and variability in tur production

Sr. No	Districts	Period-I	Period-II	Period-III	Overall	CV % (Period : 1980 to 2010)
	Marathwada Region					
1	Aurangabad	-0.758	2.648	14.912**	3.237**	53.15
2	Jalna	6.201	7.497	9.309**	3.808**	54.19
3	Beed	-2.008	4.444	11.684	0.929	49.17
4	Latur	6.808	14.377	11.942**	5.405**	67.66
5	Osmanabad	3.753	8.843	6.979	4.108**	70.41
6	Nanded	-0.035	8.445	1.148	1.895	42.09
7	Parbhani	13.842**	2.087	6.339**	3.218**	43.59
	Vidarbha Region					
8	Buldhana	10.356**	6.529	6.755	2.371**	38.30
9	Akola	15.071**	10.894**	2.174	4.419**	43.70
10	Amravati	13.386**	6.199	1.939	3.517**	32.70
11	Yavatmal	7.459**	8.869**	7.211**	3.350**	39.01
12	Wardha	5.986**	0.437	8.825**	1.902**	37.59
13	Nagpur	9.593**	2.496	1.452	2.966**	37.02
14	Bhandara	8.801**	3.738	0.0901	3.222**	36.29
15	Chandrapur	14.488**	4.076	7.357	4.345**	58.55
16	Gadchiroli	15.521**	5.317	8.816**	7.29**	66.20

** denotes significance at 1 per cent

In case of Vidarbha region, it is observed from **Table 1** that overall growth rate of production of tur under Gadchiroli district was 7.29 per cent which was highest and found positively significant over the study period and lowest under Wardha district which was 1.902 per cent. The annual growth rate of tur production under Wardha district (8.825 per cent), Akola district (10.894 per cent), Gadchiroli district (15.521 per cent) is highest in period III, period II and period I in Vidarbha region for tur crop, respectively. Under Yavatmal and Wardha districts the growth rate has slightly increased in Period-I to Period – III. In contrast, the growth rate of tur production has reduced under Buldhana, Akola, Amravati, Nagpur, Bhandara,and Chandrapur districts in Period-I to Period-III. The higher instability was observed in Gadchiroli district i.e. 66.20 per cent while, least variability was observed in Amravati district i.e. 32.70 per cent over the study period. Kalamkar (2011) reported the same result while examining the production performance of tur in Maharashtra.

Growth rates and variability in gram production

From **Table 2**, it is revealed that overall growth rate of production of Gram in Parbhani district was 6.916 per cent which was highest and found positively significant over the study period and lowest under Beed district which was 3.71 per cent.

Table 2. District wise growth rates and variability in gram production

Sr. No	Districts	Period-I	Period-II	Period-III	Overall	CV % (Period: 1980 to 2010)
	Marathwada Region					
1	Aurangabad	13.352	3.448	18.001**	5.848**	59.19
2	Jalna	-0.489	5.291	9.44**	3.773**	50.24
3	Beed	-1.140	4.641	15.507**	3.709**	64.29
4	Latur	-1.764	6.389	13.734**	6.03**	65.87
5	Osmanabad	10.746	4.806	12.076**	6.103**	66.24
6	Nanded	-9.869	11.804**	14.805**	6.729**	73.75
7	Parbhani	11.824**	8.564	8.826**	6.916**	64.74
	Vidarbha Region					
8	Buldhana	15.436**	14.773**	28.612**	10.139**	104.25
9	Akola	20.581**	15.831**	25.348**	12.726**	123.34
10	Amravati	16.961**	12.033**	19.917**	10.479**	92.94
11	Yavatmal	21.941**	6.068	20.285**	12.086**	146.74
12	Wardha	30.176**	0.756	-2.579	10.65**	139.15
13	Nagpur	15.053**	5.301	18.791**	7.888**	76.58
14	Bhandara	4.309	-3.756	6.390	0.454	59.86
15	Chandrapur	0.111	9.807**	21.816**	5.485**	73.04
16	Gadchiroli	2.258	1.93	-12.512	0.218	54.02

** denotes significance at 1 per cent

The annual growth rate of Gram production under Aurangabad district (18.001 per cent), Nanded district (11.804 per cent), and Aurangabad district (13.352 per cent) is highest in period III, period II and period I in Marathwada region for Gram crop, respectively. Under Aurangabad and Osmanabad districts the growth rate has increased from Period-I to Period – III. In contrast, the growth rate of Gram production has reduced under Parbhani district in Period-I to Period-III. The extent of variation in Gram production was observed more in Nanded district (73.75 percent) and least in Jalna district (50.24 per cent).

Whereas, in Vidarbha region at an overall level growth rate of gram production under Akola district was 12.726 per cent which was highest among all the districts and found positively significant over the study period and lowest under Gadchiroli district which was 0.218 per cent. The annual growth rate of Gram production under Buldhana district (28.612 per cent), Akola district (15.831 per cent), and Wardha district (30.176 per cent) is highest in period III, period II and period I in Vidarbha region for Gram crop, respectively. Under Buldhana, Akola, Amravati, Nagpur, Bhandara, Chandrapur districts the growth rate has increased in Period-I to Period – III. While, the growth rate of Gram production has reduced under

Wardha and Gadchiroli district in Period-I to Period-III. From **Table 2** it was observed that, Yavatmal district witness higher variability with value of 146.74 per cent and least variability was observed in Gadchiroli district i.e. 54.02 over the study period in gram production. Tingre *et al*. (2009) have also examined the production performance of major crops in Amravati district of Vidarbha region.

Growth rates and variability in Kharif jowar production

The performance of Kharif jowar production in terms of annual growth rate in Marathwada and Vidarbha region depicted in **Table 3**. Thus, it is observed that overall growth rate in production of Kharif Jowar under Jalna district was 8.098 per cent which was highest and and negative growth was observed in Parbhani district which was - 0.398 per cent. The annual growth rate of Kharif Jowar production under Jalna district (21.539 per cent), Latur district (2.576 per cent), and Latur district (0.289 per cent) is highest in period III, period II and period I in Marathwada region for Kharif Jowar crop, respectively. Under Latur district the growth rate has increased constantly in Period-I to Period – III. In contrast, the growth rate of production of Kharif Jowar has negatively increased under Osmanabad district in Period-I to Period-III. The highest extent of variation was observed in Aurangabad district (62.02 per cent) while least variability was observed in Latur district (41.20 per cent).

Table 3. District wise growth rates and variability in kharif jowar production

Sr. No	Districts	Period-I	Period-II	Period-III	Overall	CV % (Period: 1980 to 2010)
	Marathwada Region					
1	Aurangabad	-3.658	-4.566	13.595**	6.484**	62.02
2	Jalna	-1.815	-7.245	21.539**	8.098**	59.70
3	Beed	-7.314	-2.314	9.930**	4.317**	55.11
4	Latur	0.289	2.576	6.766**	0.709	41.20
5	Osmanabad	-11.098	-1.325	-5.579	3.178**	51.67
6	Nanded	-3.935	-2.069	8.149**	-1.595	43.77
7	Parbhani	-4.132	0.072	7.637**	-0.398	46.97
	Vidarbha Region					
8	Buldhana	-1.290	-3.660	7.219**	4.329**	49.89
9	Akola	7.945	-5.939	-1.569	-1.315	41.86
10	Amravati	0.467	-4.687	11.011**	4.052**	38.89
11	Yavatmal	0.550	-7.825	13.047**	5.152**	47.31
12	Wardha	-1.337	-6.456	30.843**	10.648**	68.17
13	Nagpur	1.965	9.362**	14.489**	7.037**	55.28
14	Bhandara	-4.601	7.855	-9.712	6.258**	92.85
15	Chandrapur	8.942**	-3.396	26.715**	6.092**	49.98
16	Gadchiroli	6.058	5.948	2.123	0.097	217.09

** denotes significance at 1 per cent

In case of Vidarbha region, from **Table 3** it is observed that, overall growth rate in production of Kharif Jowar was observed highest in Wardha district i.e.10.648 per cent while negative growth (-1.31 per cent) observed under Akola district. Among, all the districts of Vidarbha region the growth under Nagpur district increased constantly over the study period. The annual growth rate of Kharif Jowar production under Wardha district (30.843 per cent), Nagpur district (9.362 per cent), and Chandrapur district (8.942 per cent) is highest in period III, period II and period I in Vidarbha region for Kharif Jowar crop, respectively. Under Bhandara district negative growth was observed in Period-I and Period-III. The greater variation was observed in Gadchiroli district (217.09 per cent) while least variability was observed in Amravati district (38.89 per cent). Patil and Nage (2013) have also studied the performance of Kharif jowar production in pattern of the present investigation.

Growth rates and variability in cotton production

It is revealed from **Table 4** that, overall growth rate in production of Cotton under Aurangabad district was 9.432 per cent which was highest among all the districts and negative growth (-2.710) was observed in Latur district.

Table 4. District wise growth rates and variability in cotton production

Sr. No	Districts	Period-I	Period-II	Period-III	Overall	CV % (Period: 1980 to 2010)
	Marathwada Region					
1	Aurangabad	-2.372	12.528**	29.669**	9.432**	115.85
2	Jalna	-2.096	8.697**	20.781**	6.405**	88.72
3	Beed	-14.905	19.190**	21.178**	7.636**	92.53
4	Latur	-0.698	8.576	16.176**	-2.710	58.27
5	Osmanabad	52.263**	52.168**	23.432**	7.231	306.19
6	Nanded	26.30**	5.298	5.589	5.481**	45.67
7	Parbhani	4.524	8.374	14.085**	5.823**	64.47
	Vidarbha Region					
8	Buldhana	3.125	7.246	15.878**	4.942**	58.89
9	Akola	5.411	4.729	6.484	3.761**	44.63
10	Amravati	5.219	-3.036	3.878	2.198**	36.32
11	Yavatmal	4.035	4.518	12.403**	1.269	58.18
12	Wardha	5.221	-1.558	-8.349	2.678	35.72
13	Nagpur	5.308	5.981	1.702	4.178**	40.97
14	Bhandara	-	-	-	-	76.58
15	Chandrapur	14.939**	2.392	10.579**	4.274**	43.81
16	Gadchiroli	4.729	-4.417	33.494**	8.386**	192.26

** denotes significance at 1 per cent

Among, all the districts of Marathwada region the growth in Cotton production under Parbhani district increased constantly over the study period.The significant highest annual growth rate in Cotton production observed under Osmanabad district in period I, period II and period III in Marathwada region. The degree of instability was observed more in Osmanabad district (306.19 per cent) while least variability was observed in Nanded district (45.67 per cent).

Table 4 shows that among all the districts of Vidarbha region, overall growth rate in production of Cotton under Gadchiroli district was 8.386 per cent which was highest and and lowest under Yavatmal district which was 1.269 per cent. The annual growth rate in Cotton production under Gadchiroli district (33.494 per cent), Buldhana district (7.246 per cent), and Chandrapur district (14.939 per cent) is highest in period III, period II and period I in Vidarbha region for Cotton crop, respectively. Among, all the districts of Vidarbha region the growth of Cotton production under Buldhana and Yavatmal districts constantly increased over the study period. The higher instability was observed in Gadchiroli district (192.26 per cent) while less variation was seen in Wardha district (35.72 per cent). Gharke *et al*. (2013) have studied the production performance of major crops in Maharashtra in relation to present study.

Conclusions

Based on the compound annual growth rate of Tur production, it is evident that, at an overall level, higher significant growth is seen in Latur district and least significant growth in Beed district among all the districts of Marathwada region. While, higher variability was observed in osmanabad district and least variability observed in Nanded district .In contrast, among all the districts of Vidarbha region significant higher and lower growth seen in Gadchiroli and Wardha districts, respectively. And extent of variability seen more in Gadchiroli district while, least variability was observed in Amravati district over the study period.

In Marathwada region, at overall level the significant higher growth in Gram production observed in Parbhani district and lower in Beed district. And, the extent of variability was seen more in Nanded district and least in Jalna district. Whereas, in VIdarbha region Akola district registered higher growth and least in Gadchiroli district. While, greater variability seen in Yavatmal district and least variability observed in Gadchiroli district.

From annual growth rate analysis of Kharif Jowar production at overall level, it can be concluded that, Jalna district registered higher growth rate and least growth which is negative observed under Parbhani district among all the districts of Marathwada region. More variation was seen in Aurangabad district while least variability was observed in Latur district. In contrast, among all the districts of Vidarbha region higher growth in Kharif Jowar production seen in Wardha district and least but negative under Akola district. Also, the degree of instability observed more in Gadchiroli district while least variability was observed in Amravati district.

The overall compound growth rate of Cotton production is found to be highest in Aurangabad district and lowest but negative under Latur district among all the districts of

Marathwada region. The degree of instability was observed more in Osmanabad district while least variability was observed in Nanded district. In contrast, among all the districts of Vidarbha region, higher growth in cotton production seen in Gadchiroli district and least under Yavatmal district .The higher instability was observed in Gadchiroli district while less variation was seen in Wardha district.

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Economics of Production of Greengram in Parbhani District

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ABSTRACT

An attempt has been made to examine the economics of production of pigeonpea in Parbhani district. The investigation was based on the data collected by survey method from 60 Pigeonpea growers from Parbhani district.

The results indicated that the main product of pigeonpea was 10.25 q/ha. In production process, rental value of land, bullock labour, hired human labour and interest on fixed capital were the major items in the total cost. Per hectare total cost (cost 'C') was Rs. 22487.54. The proportion of cost 'A' in total cost was 57.76 per cent, while proportion cost B was 90.72 per cent and output-input ratio was 1.85.

INTRODUCTION

Pigeonpea (*Cajanus cajan*) is commonly known as tur or arhar. It is the world's second important pulse crop after chickpea. It is the major pulse crop of the semiarid tropics and has been used for centuries in intercropping systems. Pigeonpea belongs to the family leguminous, genus Cajanus, species cajan. Dal contains as much as 22 per cent protein and seed contain 57.8 percent carbohydrate, 1.2 to 8 per cent crude fiber and 0.6 to 3.8 per cent lipid. Pigeonpea is good source of calcium, phosphorus, magnesium, iron, sulphar also it is good source of soluble vitamins especially thiamin, riboflavin and niacin. Tender leaves are rarely used as a potherb. Ripe seeds may be germinated and eaten as sprouts.

Pigeonpea is second largest pulse crop in India accounting about 20 per cent of total pulse production. India ranks first in area and production of pigeonpea. It is grown on area of about 3.47million hectares with the production of 2.72 million tonnes. The crop is extensively grown in Maharashtra, Uttar Pradesh, Karnataka, Andhra Pradesh, Gujarat and Madhya Pradesh. Pigeonpea, in the Indian context, is the second most important crop after peas.

Objectives

1. To study socio-economic characteristics of pigeonpea growers.
2. To examine cost and returns in pigeonpea cultivation.

METHODOLOGY

Multistage sampling design was adopted for present study. In the first stage Parbhani district of Maharashtra state was selected purposively because this district is well known for growing pigeonpea.In second stage Parbhani and Jintur tehsils were selected on the basis of highest proportionate area. In third stage five villages from each tehsils were selected on the basis of highest area. A list of pigeonpea growers was obtained from revenue record, six pigeonpea growers were selected from each village, and thus 60 pigeonpea growers were selected for present investigation. Required cross section data was

collected in specially designed schedule by interview method. Data pertained for the year 2011-12. Statistical tools like arithmetic mean, percentage and ratios were used for estimating the results. Cost concepts like cost 'A', cost 'B' and cost 'C' were used.

RESULTS AND DISCUSSION:

Socio-economic characteristics of pigeonpea growers:

From Table 1 it is revealed that the middle age (55.00 per cent) farmers are involved more in this profession. Educational status revealed that more than half samples were attended high school (51.67 per cent) and on an average family size of selected pigeonpea growers composed of 6.29 members in their family. As regards occupation it was noticed that majority of pigeonpea growers having agriculture as main source of occupation. The average size of land holding was 3.01 hectares.

Table 1 Socio economic characteristics of pigeonpea growers. (N=60)

Age wise distribution			
Sr. No.	**Age groups**	**Number**	**Per cent**
1	Young (upto 30 yrs)	10	16.67
2	Middle (30 to 45 yrs)	33	55.00
3	Old (above 45 yrs)	17	28.33
Educational status			
1	Illiterate	14	23.33
2	High school	31	51.67
3	College	15	25.00
Family size			
1	Male	2.47	39.26
2	Female	2.07	32.89
3	Children	1.75	27.85
Occupational distribution			
1	Only Agriculture	47	78.33
2	Agriculture and other	13	21.67
Per farm land use pattern		**Area in ha**	**Per cent**
1	Total area	3.01	100.00
2	Irrigated area	1.00	33.22
3	Rainfed area	2.00	66.45
4	Permanent fallow area	0.01	0.33
5	Net sown area	3.00	99.66

Input and output of pigeonpea production.

Input utilization for pigeonpea cultivation was worked out and presented in Table 2. Input utilization for pigeonpea showed that per hectare hired human labour utilized was 28.12 mandays. While family human labour utilization in pigeonpea cultivation was 15.36 mandays. While, use of bullock labour was 4.50 pair days/hectare. Per hectare seed used in

pigeonpea production was 11.35 kg. Plant protection used was 2.69 litres. Chemical fertilizer was to the tune N 16.1 kg, P 34.2 kg and K 8.36 kg in pigeonpea production.

It was noticed from the table that per hectare main produce yield was 10.25 quintals while by produce yield was 4.75 q.

Table 2 Per hectare physical input and output of pigeonpea cultivation.

Rs/ha

Sr. No.	Particulars	Unit	Unit Required
	Input		
1	Hired human labour	Man day	28.12
	Male		11.52
	Female		16.62
2	Bullock labour	Pair day	4.50
3	Machine labour	Hour	6.50
4	Seed	Kg	11.35
5	Manure	Q	3.31
6	Nitrogen	Kg	16.12
7	Phosphorous	Kg	34.29
8	Potash	Kg	8.36
9	Plant protection	Lit	2.69
10	Irrigaiton	No.	2.32
11	Family human labour	Man day	15.36
	Male	No.	8.15
	Female	No.	7.21
	Output		
1	Main produce	q	10.25
2	By produce	q	4.75

Cost of cultivation of pigeonpea production

Per hectare cost of cultivation was computed and presented in Table 3. Per hectare total cost with regards to pigeonpea was Rs. 22487.54 while cost A was Rs. 12989.18 and cost B was Rs. 20399.84. Per cent share of cost A was 57.76 per cent while cost B was 90.72 per cent. Among the various items of expenditure the per cent share of rental value of land was predominant as 30.50 per cent followed by hired human labour 16.54 per cent, machine labour 8.67 per cent and family human labour 9.28 per cent.

Table 3 Per hectare cost of cultivation of pigeonpea.

(Rs/ ha)

Sr. No.	Particulars	Cost	Per cent
1	Hired human labour	3719.4	16.54
a	Male	1725.00	7.67
b	Female	1994.40	8.87
2	Bullock labour	1575	7.00
3	Machine labour	1950	8.67
4	Seed	454	2.02
5	Fertilizers	517.16	2.30
	Nitrogen	112.84	0.50
	Phosphorous	291.46	1.30
	Potash	112.86	0.50
6	Manures	1992.00	8.88
7	Plant protection	906.50	4.03
8	Irrigation	348.00	1.55
9	Land revenue	87.17	0.39
10	Incidental expenditure	252	1.12
11	Interest on working capital	692.95	3.08
12	Depreciation on asset	495.00	2.20
13	Cost – A (∑ 1 to 10)	12989.18	57.76
14	Interest on fixed capital	552.00	2.45
15	Rental value of land	6858.66	30.50
16	Cost – B (∑ 12 to 13)	20399.84	90.72
17	Family human labour	2087.70	9.28
a	Male	1222.50	5.44
b	Female	865.20	3.85
18	Cost – C (∑ 14 to 15)	22487.54	100

Profitability of pigeonpea

Per hectare gross return, farm business income, family labour income, net profit, output input ratio and per quintal cost of production of main product were calculated and presented in Table 4.

It was observed that gross return on pigeonpea farm was Rs. 41675.00. Farm business income, family labour income and net profit were 28685.82, 21275.16 and 19187.46 respectively. Output input ratio was 1.85 indicating that the pigeonpea is a profitable enterprise Per quintal cost of production was Rs.2193.91.

Table 4 Per hectare profitability in pigeonpea production.

Sr. No.	Particulars	Rs/ha
1	Return from a main produce	41223.75
2	Return from by produce	451.25
3	Gross return (∑ 1 to 2)	41675.00
4	Cost – A	12989.18
5	Cost – B	20399.84
6	Cost – C	22487.54
7	Farm business income (Gross return minus cost - A)	28685.82
8	Family labour income (Gross return minus cost B)	21275.16
9	Net profit (Gross return minus cost-C)	19187.46
10	Output input ratio (Gross return divided by cost-C)	1.85
11	Per quintal cost of production (cost-C divided by main produce quality)	2193.91

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ABSTRACTS

Indicators of Economic and Agricultural Development in India and Maharashtra

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Agriculture plays an essential role in the process of economic development of less developed countries like India. Policy makers always need statistical data on various indicators for making the policy for economic and agricultural development of the country as well as the state. In view of this, an attempt is made to present few indicators of economic and agricultural development for the country as well as state. The time series data for the period of 60 years i.e. 1951 to 2011 on various indicators mentioned above were collected from the different published sources.

Maharashtra is the second and third largest state in India in terms of population and area, respectively. More than fifty per cent of the jowar, grape and pomegranate production of India is alone shared by Maharashtra. Besides, nearly, one third production of the total pigeon pea. India ranks second next only to China in world population and ranks seventh in geographical area. India ranks first in the production of sorghum, jute, total pulses, banana,papaya, mango and guava and in total milk production also, rank first in buffalo population.

The pattern of land distribution in the country and state level is still iniquitous. This has created the problem of uneconomic and non-viable units of cultivation, which possesses no capacity to adopt modern technologies. The cereal crops are dominating the cropping pattern even though the area under cereals declined during the entire period both at the state and national level. However, the area under sugarcane had steadily increased both at state and national level, especially, the area under sugarcane had increased nearly two times during the last sixty years in the state. The area under fruits and vegetables has increased considerably both at national and state level.The growth rates in area, production and production of sugarcane, cotton, soybeans, and wheat were observed to be significant for the period II and III under study, in general. It can be thus, seen that for all the crops under study at state and national level, the growth rates of productivity followed by the growth rates of production were significant to highly significant. However, during the periods I, II and III, the mixed trend was noticed in the growth rates of all the three indicators. In case of primary, secondary and tertiary sector, the tertiary sector is playing a dominant role in the gross domestic product (GDP) both at the National and State level.

In case of import- export, the India's share in the total World exports has remained more or less constant/stagnant, i.e. from 0.5 to 0.6 per cent during the period 1960-61 to 2001-02, however, it reached to a record high of 1.70 per cent during the year 2010-11.

It is o an important feature of agriculture that is to be noted that growth of other sectors and overall economy depends on the performance of agriculture to a considerable extent. Because of these reasons agriculture continues to be the dominant sector in Indian Economy. Since independence, India has made much progress in agriculture. Expansion of area was the main source of growth in the period of fifties and sixties after that the contribution of increased land area under agricultural production has declined over time and increase in productivity have became the main source of growth in agricultural production.

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Agricultural Development in Amravati Division of Maharashtra

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Agriculture is backbone of Indian economy. The present study was conducted in Amravati division. The data were collected from different public records of State Governments, co – operatives and private institutions. The compound growth rates of area, production and productivity of major crops were calculated and the composite index of agricultural development suggested by Prem Narain was calculated at different periods. Therefore present study will indicate whether the rate of development has been uniform or whether their area any imbalance in Amravati division.

There was reduction in area and production under total cereals and cotton in Amravati district. Reduction in area under total cereals was also observed in Buldhana, Akola and Yavatmal district. Area under total food grain was found significantly increasing in Buldhana, Akola and Yavatmal district. It was prominent to note that there was an increase in area over a period of 26 years under total oilseeds in all districts. There was a positive growth in productivity of cereals, pulses, oilseeds, food grain and cotton. Area and production of cotton was observed more in Yavatmal district. The production of total food grain was observed more stable in Amravati district.

There was good agricultural development in Amravati and Akola district while decrease in Yavatmal and Buldhana district. Amravati was identified as model district over a period of time. The rank of Amravati was 1st and remains constant. The rank of Akola district was came down from secondin 1996-97 to 2001-02. The rank of Buldhana district was came down from thirdin 2001-02 to fourth in 2006-07. The rank of Yavatmal district was improved from third to second but came down from third in 2006-07 to second in 2010-11.

Agricultural development of model district (Amravati) was significantly superior, over all other districts in all five-time periods. Agricultural development of district significantly differed from each other over a period of time (26 years).

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Crop Diversification in Agriculture Development

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Diversification primarily involves a substitution of one crop or other agricultural product for another or an increase in the number of enterprises, or activities, carried out by a particular farm. Agricultural diversification as measured by increase in the percent of non-food crops has grown; whereas diversification as measured by the concentration indices has remained unchanged in the recent decade. There have been significant changes in the pattern of agricultural diversification at the regional level. Within a region, smaller sub-regions or pockets of specialization in certain crops and crop-groups have emerged. Diversification originated from the word "diverge", which means to move or extend in a different direction from a common point. In this sense diversification is the opposite of concentration, therefore, most of the techniques of measuring diversification actually measures concentration in the system. In economics, diversification refers to a situation in which decrease in the dominance of an activity, alternately increase in the share of many activities in a system is depicted. Extending the same notion to agriculture means increase in the share of many commodities in agricultural income may be termed as income diversification in agriculture; whereas increase in the share of withdrawal of a resource by many crops may be termed as resource diversification in agriculture. Crop diversification is intended to give a wider choice in the production of a variety of crops in a given area so as to expand production related activities on various crops and also to lessen risk.

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Economics of Turmeric Cultivation in Yavatmal District of Maharashtra.

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The present study attempts to examine the production and marketing of turmeric in Yavatmal district of Maharashtra state, India. Primary data for the study was collected through a sample of 60 turmeric producers in the study area during year 2011-12. Data was

collected by personal interview in a specially designed schedule. The per hectare cost of cultivation at cost 'A', cost 'B' and cost 'C' were Rs.106510.98, Rs.174220.44 and Rs. 182699.13 respectively. At overall level gross return worked out to Rs. 293373.40. The net return obtain at various costs were Rs. 186862.42 at cost 'A', Rs. 119152.96 at cost 'B' 110674.27 at cost 'C'. At overall level the input output ratio at cost 'C' was 1.61. Thus the turmeric cultivation was profitable to selected farmers. In the study area, following marketing channels have been observed.

Channel I: Producer→ Consumer, Channel II: Producer→Village trader → Consumer.

Channel-III: Producer→Village trader→Wholesaler→Consumer.

Channel IV: Producer→Village trader→Wholesaler→Retailer→Consumer.

Out of four channels, highest quantity was sold through the channel, Producer→Village trader→Wholesaler→Consumer. The net price received by producer in channel-I, channel-II, channel-III and channel IV were Rs.7216.59, Rs. 6813.47, Rs.6650.35 and Rs.6505.64 per qtl. respectively. The producer's share in consumer's rupee was highest in channel-I i.e. 99.64 per cent.

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Diversification of land use and Cropping Pattern in Western Maharashtra

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The information on land use and cropping pattern is necessary to develop future research strategies on land use planning and land use policies. The study aimed at analyzing the changes in land use and cropping pattern in Western Maharashtra. The necessary secondary data were collected for a period of 40 years from the year 1970-71 to 2010-11. The simple tabular analysis and statistical tools were employed for working out the percentages and correlation coefficients for quantification of land holding per family from year to year, which gave an idea for prediction of operational land holding for future.

The land use pattern is ultimately determined by the factors like human inhabitation, socio-economic, political, technical and institutional changes. The area sown more than once in the Western Maharashtra was observed to be 4.06 and 17.54 per cent during the year 1970-71 and 2010-11, while it increased by 306.13 and 370.85 per cent in 2010-11 as compared to the year 1970-71. The cropping pattern is indicative of development of particular region. It is noticed that, there was 23.34 per cent increase in gross cropped area in Western Maharashtra during the study period.

In the Western Maharashtra, the area under fodder crops decreased by 20.16 per cent over the period. The area under fruits and vegetable over a period increased steadily

from 1.22 to 4.47 lakh hectares i.e. 266.53 per cent in Western Maharashtra, due to effective implementation of Horticultural Development Programme linked with Employment Guarantee Scheme (EGS) during the year1990. The Correlation Coefficient analysis revealed that, the large and medium groups are negatively correlated with marginal, small and semi medium groups. There is continuous decrease in the operational holding in every size group which indicates the division of families and reduction of joint family system. In Western Maharashtra, the per family operational holding was decreased from 3.96 hectares to 1.32 hectares per family over the period.

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Assessment of Agricultural Development disparities in Western Maharashtra

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Maharashtra state is unique state in Indian Union as far as the varying agro-climatic conditions are concerned. The variability's in topography of soil and climatic factors have colossal impact on crop and land use patterns use of inputs and adoption of technological innovations in crop production inclusive of area and of 116.28 lakh hectares cropping integrity in Western Maharashtra was 71.25 lakh hectares (61.27 per cent). The growth rates of area production and productivity of total food grains were 2.42 per cent in Western Maharashtra. The growth rate of area under sugarcane in Western Maharashtra region, while the growth rate of production of sugarcane was the highest in Western Maharashtra (6.15 per cent). According to SWOT analysis, small size of operational holding, low irrigation, rainfed agriculture, low productivity of crops and low electricity generation are the weakness of agricultural development of Maharashtra.

Crop diversification is intended to give wider choice in the production of variety of crops in a given area. Better irrigation facilities, mechanization in agriculture to the maximum possible extent should be done. The Western Maharashtra is better endowed with adoption of new technology, availability of infrastructural facilities, market, educational, institution. Agro-based industries transport fertility, credit availability etc., and there facilities provide better opportunities to the people of Western Maharashtra region for better socio-economic development. Thus, there is a sort of complementarily between reduction in disparities and accelerated economic growth.

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Technology of Organic Sugarcane Farming for Sustainable Agriculture in Kolhapur District of Western Maharashtra

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The present study was focused on organic sugarcane farming (OSF) and inorganic sugarcane farming (ISF) in the state of Maharashtra with specific focus on costs, yield, returns and profit, An attempt has also been made to critically examine the OSF with respect to important sustainability indicators such as conservation of soil, water, power and farmer's economics well being and livelihood security.

This study was undertaken purposively in Kolhapur district as the highest area under organic sugarcane. Out of 12 tehsils Hatkanangale and Kagal tehsils were purposively selected on the basis of area under organic s,cane farming cultivation. From two tehsils, 6 villages were selected randomly, from each villages 10 cultivators comprising 5 cultivators with organic s.cane farming(OSF) and 5 with inorganic s.cane farming(ISF) were selected, Thus total sample comprised of 60 cultivators, (30 from OSF & 30 ISF)

The primary data for the study pertained to the s.cane crop grown during 2012-13 agricultural year. To have uniformity in the data only suru(seasonal) crop i.e., planting in Jan-Feb 2012 and harvesting in Feb-Mar.-2013 was considered for present study, The obtained datawereanalysed by tabular method.The average size of land holding of the sample cultivators in the Kolhapur district farmers was 2.23 & 2.55 ha. in both the organic and inorganic surus.cane growers. The maximum organic s.cane growers rearing owned livestock in his farm(55.50 percent) as compared to 37.30 percent in inorganic s.cane growers. The majority of the s,cane growers in Kolhapur district cultivation of organic s.cane for the purpose of jaggery making. The cropping pattern of the sample cultivators was clearly observed that near about 65 percent farmers have planted the s.cane. The per hectare resource use in organic **surus.cane** was Rs.93493 and inorganic Rs.114505.Here clearly observed that the per hectare resource use was higher in ISF than the OSF .Organic farmers save 3.12 percent in human labour, 1.12 percent in seed and 7.9 percent in fertilizer, 1.75 percent in plant protection and 0.27 percent in irrigation charges as compared to the inorganic sugarcane cultivation. The amount saved to the resource use is used for livelihood purpose to the sample cultivators. The per hectare cost of cultivation in inorganic surus.cane was (Rs.234000) is higher than the organic s.cane (Rs.205500). Also the per hectare cost of production of surus.cane was higher in the inorganic s.cane (Rs.1937.20) than organic s.cane (Rs.1804.63). The OSF system the yield of sugarcane was found (79ton) it is lesser than the ISF (90ton) but the profit of organic farming is higher than inorganic farming because of saving of input material. The highest saving in organic farming was observed in labour and fertilizer.The organic surus.cane was profitable than inorganic surus.cane.Organic farming is more helpful to the sustainable and livelihood of the farmer. In organic surus,cane reduced 40 percent of water than inorganic surus.cane

farming. The OSF has substantial potential in reducing the use of scare water for irrigation, providing an opportunity for its conservation and sustainable use.The organic surus.cane farming reduce 20 percent the cost of labour. This is helpful for livelihood of the farmer.Reduce cost and save money is the main concept of sustainable agriculture.

It is observed that the per hectare cost of cultivation of organic s,cane was Rs.150566.00 and Rs.183393.66 in inorganic surus.cane. The gross income of surus.cane in organic s.cane was Rs.213300.00 and Rs.234000.00 was in inorganic s.cane. The net profit was also highest in organic surus.cane Rs.70334.00 than Rs. 50606.34 in inorganic surus.cane. The per ton cost of production in organic s.cane was Rs.1804.6 is less as compaired to inorganic surus.cane Rs.1937.70. The 8.38 percent of amount is more than the inorganic cultivation of sugarcane and these amount is usefull for the livelihood of the s.cane cultivation. There for the organic surus.cane cultivation is sustainable cropping system in livelihood of the people.

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An Economic Appraisal of Agricultural Development In Himachal Pradesh

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Present study carried out to appraise the agricultural development in Himachal Pradesh. This deals with the trends in land use and cropping pattern, growth rate in production of livestock products, development of infrastructure facilities and identification of major variables influencing the agricultural production. The study is based on the secondary data collected and published by various agencies of Himachal Pradesh Government for the period from 1975-76 to 2007-08.

The careful examination of the changes in demographic features of Himachal Pradesh State indicated that, the population of state increased from 34.6 lakh in 1971-72 to 68.56 lakh during 2011 census. The total literacy rate increased from 31.96 per cent in 1971 census to 83.78 per cent during 2011 census. There is increase in working population dependent upon agriculture from 12.79 lakh in 1975-76 to 29.92 lakh in 2007-08.

The land utilization pattern over the years showed that most of the geographical area of the state was under forests and pastures. The area under forests which increased from about 21.71 per cent in 1975-76 to 24.67 per cent during 2007-08. The area under pastures declined marginally from 40.62 per cent to 32.67 per cent during the period of 32 years.

The total livestock population in the state increased from 47.02 lakh in 1975-76 to 50.46 lakh in 2007-08. The population of cattle was higher among total livestock population. The poultry population also increased from 1.89 lakh in 1975-76 to 7.64 lakh in 2007-08. There is considerable increase in milk, meat, egg and wool production during the study period. Total milk production was 832.95 thousand tonnes in 2009-10.

The area under the high yielding varieties of cereal crops increased during the study period. The area under HYV of maize increased by 382.19 per cent over the base year. The consumption of fertilizers was 7587 MT in the year 1975-76, which is increased upto 46253 metric tonnes in the year 2007-08.

The average annual rainfall in state is increased by 26.48 per cent in 1995-96 and 3.64 per cent in 2007-08 over the base year. The number of licensed fisherman were 10975 during 2007-08.The production of fish increased by 672.32 per cent over the base year. The use of tractors increased by 624.11 per cent in the year 2007-08 over base year 1975-76. The number of wheat thresher, ricethresher and maize shellers has been also increases during the study period. It is confirmed that cereal crops dominated the cropping pattern in state. The area under cereals at the state level exhibited marginal decrease from 83.69 per cent in 1975-76 to around 82.42 per cent in 2007-08. The area under fruits and vegetable increased consistently over the years. The net irrigated area of the state was 78.5 thousand hectares in the year 1975-76 which is increased upto 116.2 thousand hectares in 2007-08.

There is increase in number of educational institutions in the state during the study period. The number of co-operative societies increased by 56.45 per cent over the base year. The membership and working capital of societies also increased during the study period.

The multiple regression analysis revealed that the independent variables *viz.,* consumption of fertilizer (NPK) per hectare (X_5), amount of loan disbursed through various Govt. institutions (X_6), and percentage of high yielding varieties to gross sown area (X_7), have shown a significant association with the increase in the value of aggregate crop output in Himachal Pradesh State.

The forests area, gross sown area, total food grains, fruits, vegetable crop area and rainfall has increased whereas pastures and net area sown has decreased. Further, production of livestock products and the area under HYV's of cereal crops, irrigated area, consumption of fertilizers and production of fishes has increased during the study period. Further, less availability of quality seeds, irrigation, roads, transportation, storage facilities and marketing area some of the obstacles in the agricultural development of the state. The study suggested that construction of water reservoirs, use of micro-irrigation techniques, extension programmes on improved farming, improvement in productivity proper supply of quality seed and planting material, provision of co-operative storage and diversification of agriculture towards fruits and vegetables and establishment of value added units etc; are some of the remedies to minimize the problems in agricultural development.

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Economic of milk processing of co-operative Vs private dairy units in Western Maharashtra

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Maharashtra is the sixth largest milk producing state in the country and accounts for 7.24 per cent share in the total milk production of the country. The study was undertaken to examine the milk collection, distribution and relevant costs of milk and milk products of selected co-operative and private dairy units in Western Maharashtra. The investigation was based on both macro and micro level data for year 1999 to 2008. Per litre cost of purchase of milk (Rs. 12.96) was relatively higher in private dairy than co-operative units (Rs. 12.90), while per litre cost of collection (Rs.0.99), processing (Rs. 0.75), distribution (Rs. 0.65) and management cost (Rs. 0.74) were relatively high in co-operative than private dairy unit (Rs. 0.66, Rs. 0.57, Rs. 0.36 and Rs. 0.19), respectively. It was mainly due to efficient management of private dairy unit. The per kg cost of marketing in co-operative dairy unit was high (Rs. 13.50) in the case of ice-cream followed by SMP (Rs. 7.20), ghee (Rs. 6.85), *shrikand* (Rs. 7.50) and white butter (Rs. 3.95), whereas, it was least for table butter (Rs. 3.65).In private dairy unit, the per kg cost of marketing was high (Rs. 6.10) in the case of *shrikand* followed by ghee (Rs. 5.85), white butter (Rs. 3.10), milk pedaRs. 2.98 and khoaRs. 2.00 during the year 2008. The per unit cost of marketing management of co-operative dairy unit was higher (Rs. 1.95 per kg) than private dairy unit (Rs. 1.02 per kg) in the year 2008. The net returns over variable cost and fixed cost for co-operative and private dairy units has shown an increasing trend, over the period of time.

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Dairying: Immense scope to women work

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Dairy development in India has taken place under a well knownprogramme known as Operation Flood. Co-operative and private dairy being an integral part of the Operation Flood Programme, have played a major role in the production and marketing of milk.

A study was carried out to estimate the contribution of dairy and crop production enterprise towards employment and income in relation to different herd size groups in Western Maharashtra of Maharashtra state. To assess the change in employment and income due to dairy enterprise the non-dairy farmers were selected purposively from the three districts of the study area. The non-dairy sample cultivators were selected purposively for a sample of 90 consisting of 30 each of small, medium and large size groups having similar area holding of as like the selected milk producers. In order to it a comparative study

a sample of 90 non-dairy cultivators who did not had any linkage with dairy enterprise, were taken randomly from selected villages of Western Maharashtra.

The total employment of adult male was 313.95 days and for female 301.71 days for dairy households, respectively. Dairy enterprise has generated more employment of 21 per cent for male and 43 per cent for female. The total employment of adult male and adult female, at the overall level 297.19 days for male and for female 255.59 days, respectively of which 44 per cent for male and 34 per cent for female were derived from crop production enterprise. The proportion of income from dairy enterprises in the total farm income was relatively high on dairy sample households as compared to the non-dairy sample households. It was mainly due to the adoption of dairy enterprise that resulted into higher income. Dairy enterprise absorbs the major portion of the available labour force particularly the women. Therefore, the training programmes on dairy management for women be arranged.

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Extent and Determinants of Crop Diversification: A Micro Analysis

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Diversification of cropping pattern at farm level is supposed to be best policy for increasing farm income, mitigating climate and market risk and increase in employment. Eventhough, all farmers could not adopt this as extent of diversification depends upon agro-climatic conditions, resource endowment and household demand for food, feed and fodder. The present study is the attempt to find out the degree of diversification and the factors responsible for diversification by analysing primary data of 240 sample cultivators form four agro-climatic zones of Western Maharashtra during the year 2004-05. The study concludes that the cropping pattern of sample cultivators was dominated by cereals followed by fruit crops and sugarcane. The large size class had higher magnitude of diversification and farm size, number of family members engaged in agriculture, income from livestock and per hectare capital investment have positive impact on diversification. The study suggests thatthe mechanization at farm level, supply of livestock and availability of capital should be given prime importance which will lead to crop diversification.

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Perspectives and Prospects of Milk production in Western Maharashtra

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Maharashtra is the sixth largest milk producing state in the country and accounts for 7.24 per cent share in the total milk production of the country. The study examines the status of livestock, infrastructure and milk production in Maharashtra with special reference to Western Maharashtra on the broad indicators of dairy development activities like livestock population, animal husbandry, veterinary facilities, breeding and health cover programmes.The dairy development in Western Maharashtra and Maharashtra was studied with the help of linear and compound growth rates for the various selected parameters.

The population of less productive bovine (indigenous cattle and male cattle) has declined whereas that of productive animals like crossbred cows has increased. The population of ovines (like sheep and goat) has increased at faster rate compared to bovines. The different indicators of livestock development programme viz; artificial insemination, number of cases treated, vaccinations, number of veterinary aid centres and development of infrastructure such as hospitals, polyclinics and mobile vans, etc. has made progress over the period of time. The total milk production showed the increasing trend in Western Maharashtra and the state as a whole.

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Sustainable Agricultural Development in India

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The main objective of this research paper is to know the concept of sustainable development and agricultural sustainable development in globalization Era. It discusses the Indian sustainable agricultural development by using three important factors : Agricultural Production , Productivity and Globalization era.

The agricultural sector is facing a crisis. In post-globalization period(1991-92 to 2010-11) agricultural production and productivity of major crops rice, wheat, cereals, pulses, sugarcane, oilseeds and cotton has been increased. This growth in agricultural production and productivity of major crops due to, per hectare consumption of fertilizers more than double as well as irrigation facilities also increased in post-globalization period (1991-92 to 2010-11) as compared to pre-globalization.

Production and productivity of the most important crops including wheat and rice, sugarcane, oilseeds decelerated considerably compared with the Pre-Globalization period

(1980-90). From given data, it can clearly say that, in Post-Globalization period ,cotton and pulses have become two 'star performance in India. But a serious problem for the livelihood of cotton farmers is to driving some to utter desperation leading to suicides. This analysis proves that, in Post-Globalization period, production and productivity growth rate increased of some major crops but it is not sustainable for long term. So that the agricultural technology needs to move from production oriented to profit oriented sustainable farming. The conditions for development of sustainable agriculture are becoming more and more favorable. New opportunities are opening the eyes of farmers, development workers, researchers and policy makers like agriculture related business dairy farming, poultry farming, and fisheries. Now the time is to see the potential and ecological sustainability. A small farm management to improve productivity, profitability, and sustainability of the farming will go a long way to ensure all round sustainability.

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Sustainable Farm Income through Different Farming Systems

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Indian agriculture is known for its multi-functionalities of providing employment, livelihood, food, nutrient and ecological securities. The income from cropping alone on small and marginal farms is hardly sufficient to sustain the farmer's family with the decline in farm size (0.15 ha. /person) due to explosion of population and this situation gets further weakened due to failure of monsoon. The farmer, has to be assured of a regular income for a satisfactory living (above the poverty line), a judicious mix of any one or more enterprises with agronomic crops ensures better farm income. Therefore, in the present study, comparative economics of various farming systems have been workout for ascertaining the sustainability of most profitable one.

The three widely adopted farming systems were selected for the study viz; I) Crops only, II) Crops + Livestock, III) Crops + Livestock + Horticulture crops. The two districts viz; Ahmednagar and Solapur were selected purposively. In Ahmednagar district, Sangamnertahsil was selected as irrigated tahsil and Patharditahsil was selected as rainfedtahsil. From Solapur district, Pandharpur as irrigated tahsil and Sangola, as rainfedtahsil were selected. From each tahsil, three villages were selected, randomly and from each village, 15 farmers were selected in such way that, 5 farmers from each farming system (F.S.I-Crops only, F.S.II-Crops + livestock, and F.S.III- Crops + livestock + horticulture) were get selected. As such, 180 sample farmers were selected for the study. The primary data were collected by survey method from the selected farmers with the help of specially designed schedules for the year 2007-08.

The comparative picture of the employment pattern showed that, the employments generated were more in irrigated region as compared with the rainfed region because in irrigated region, irrigated crops such as sugarcane, wheat, fodder etc. required more

labours. The own farm employment was more in farming system-III of irrigated region. In all the farming systems, owned and hired male-female played significant role in crop production activity as compared to other activities of production.

The per farm income pattern indicated that, the total income in farming system- II was double than the farming system-I, while total income of farming system- III was four fold than that of farming system- I. The total income from farming system- I (crop production activity) was very less as compared to farming system- II and III. The itemwise income indicated that, the more than 50 per cent income was derived from crop production in farming system- I and II, while in farming system- III, more than 50 per cent income was derived from horticulture and in the farming system- I, 31.52 per cent income was derived from other than farm business activity but in farming system- II and III, correspondingly, just 3.09 and 1.79 per cent income was derived from other than farm business activity. This has indicated that farming system- I, depends more on other than farm business activity as compared to farming system- II and III.

In expenditure pattern, out of the total expenditure more than 70 per cent was the farm expenditure in all the farming systems. The expenditure on crop production was the major expenditure in farming system- I and II, while expenditure on horticulture was major expenditure in farming system- III. The regionwise total expenditure was more in irrigated region than the rainfed region

The economic sustainability depends on profitable enterprises, family saving and the family debt. The sustainable farm income means the annual income from farm activities which meets the annual expenditures of farm and family and remains surplus to the farm family for saving or repayment of debt. The regionwise sustainable farm income indicated that, farming system- II and III, were having the sustainable farm incomes in both the regions. But farming system- I of irrigated and rainfed region could not meet their requirements on farm business income i.e. income from crop production activity alone. They have a deficit in income.

Farmers of farming system-II and III of both regions were having sustainable farm income, but the farming system- I was not having sustainable farm income. After adding the income from other sources, farmers in farming system-I, had sustainable farm income, in both the regions. Therefore, the income from other sources (wages, service and business etc.) was the only factor, which helped them to become sustainable.

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Agricultural Development in Maharashtra

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The present study discusses the patterns and trends in agricultural growth in Maharashtra. Data on important variables like rainfall, area, production and yield were compiled for the period 1960-61 to 2009-2010 from various published sources. It is observed that there was shift in cropping pattern of Maharashtra from food crops to non-food crops. There was dominance of traditional as well other crops in terms of area under cultivation, output and yield growth. It can lead to suggest that, there is alternative in terms of area under cultivation to concentrate another crop inspire of tradition dominant crop. The increase the rate of growth of agricultural production instead of increasing more area under cultivation, the productivity growth rate, which was also remained low, had to rise in the Maharashtra. Policy interventions are required to encourage production of pulses and coarse cereals. Further, crop productivity has to be improved through better soil and water management, profitable crop rotation, innovative marketing and investment in farm education and rural infrastructure. Among these factors, the former two are essential in ensuring sustainability of agricultural production through effective maintenance of soil fertility and controlling pests and diseases. The latter factors are important in making agriculture profitable through efficient marketing, access to and adoption of new technologies and providing incentives for making on-farm investment.

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Cotton Area Diversification in Akola District of Vidarbha Region

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The present research study was conducted to know the diversification of cotton area to other crops. Findings revealed that more than half of respondents had moderate crop diversification of cotton under other crop. Findings of relational analysis revealed that, land holding, annual income, area under cotton, crop pattern and socio-economic status were found to have negative and significant relatonship with crop diversification of cotton to other crops. Furher,the findings of the multiple regression analysis revealed that land holding, cropping pattern were found negative and significant influenced on crop diversification. Then socio-economic status and extension contact were found to have positive and significant influence on crop diversification. Reasons for decline in area under cotton were unavailability of seed, insecticide and labour at proper time, lack of knowledge about resistant variety and fertilizer doses, lack of contact with extension personnel. Then obtain low prices in market, high cost of seed and insecticide. Also long dry spell, lowering water table and costly intercultural operations were the main reasons for decline in area under cotton.

Sector-Wise Growth in Income of Maharashtra and India

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The present study attempts to examine the income growth in India and Maharashtra. Secondary data for the study were collected from Handbook of Statistics on Indian Economy and Economic Survey of Maharashtra for the year 1992-93 to 2011-12. The findings of the study reveal that the share of industrial sector of Maharashtra state in national income was highest among all the sectors. The annual growth rate of national income of India was highest in service sector i.e. 14.67 per cent followed by Industry sector (12.56 %), and agriculture and allied sector (9.65%). The annual growth rate of state income of Maharashtra was highest in service sector i.e. 15.38 per cent followed by Industry sector (12.78 %), and agriculture and allied sector (9.04%).

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Shift in the land utilization pattern of Maharashtra state

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In this paper ,an attempt is made to analyze the pattern of land utilization in Maharashtra state and how these patterns have changed over a period of time in Maharashtra state. This study revealed that the distribution of total geographical area under different category of land utilization that land under cultivable waste land, land under mice trees, grooves not included in area sown, net sown are decreased in 2009-10 as compared to 1990-91. On other proportion of area under forest, barren and uncultivable land, permanent pasture, current fallow, area was high in 2009-10 as compared to 1990-91. No change was observed in total area.

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Cropping Pattern changes and Crop diversification in Marathwada region of Maharashtra state

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Diversification is an integral part of the process of structural transformation of an economy, diversification in agriculture can mean any of the two situations i.e, (1) A shift from less profitable crop (or enterprise) to more profitable crop (or enterprise) (2) Using resources in diverse but complementary activities (Vyas,1996). Due to variations in the soil type, rainfall, cropping pattern and natural conditions for cultivations, the analysis for the

study was extended to two divisions of Marathwada i.e. Aurangabad and Latur and for Marathwada region as a whole to examine the cropping pattern changes in different districts of Marathwada region over a period of time and to study extent of crop diversification in different districts of Marathwada region .The districts selected for the present study are viz. Parbhani, Nanded, Latur, Jalna, Beed, Hingoli, Aurangabad and Osmanabad. The study was based on secondary data.Time series (secondary) data on the area, production and productivity of selected crops,total food production ,etc have been collected for the period 1980-81 to 2010-11. The data was pertain to a period of 31 years i.e. from 1980-81 to 2010-11. The time points at which analysis of cropping pattern has been done are 1980-81,1985-86,1990-91,1995-96,2001-05 and 2010-11.(Venkatramanan and Prahaladachar, 1980). Cropping pattern in terms of percentage share of individual crops in gross cropped area was worked out at points of time.Crop diversification index and cropping intensity are indicators for observing and quantifying cropping pattern changes. Entropy index (EI), Modified Entropy index (MEI)and Composite Entropy Index(CEI) was used to quantify the crop diversification.The result showed that there exist wide temporal change in cropping pattern i.e area of Sorghum replaced by soybean and soybean attained prestigious position in the cropping pattern of Marathwadaregion. Latur division and Marathwada region diversified more than that of Aurangabad division.Osmanabad, Parbhani and Nanded districts showed increasing level of diversification while Jalana and Latur districts showed low level of diversification.Aurangabad and Beed are more or less stable in the case of crop diversification

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Irrigation scenario in Parbhani district of Maharashtra state

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By giving priority to agricultural development, attempt has been made to achieve irrigation development in a planned manner.Keeping these things in view, this paper attempted to study irrigation scenario in Parbhanidistrict.The study indicated that in general the overall growth of wells in the district was some what not constant. The overall the growth rate of number of oil pumps highest at Selu and lowest at Jintur i.e. in Jinturtaluka there was negligible use of oil pumps. This may be due to electrification and the alternative as electric pumps available which might have replaced the oil engines and this can be seen in the growth of number of electric pumps in almost all the talukas. The number of electrical pump was constantly increased at each talukas. It may be due to facilities of electricity of easy to handle. The electrical pump was easily worked and there capacity of work was also different. So that as per need that electrical pump could become activated.

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Growth Assessment in Agriculture Sector in Maharashtra

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Any change in agriculture sector, positive or negative, has a multiplier effect on entire economy. Though, Maharashtra is one of the richest states in terms of per capita income, its agriculture performance is not very appreciable. The share of primary sector (agriculture and allied sector) in the state GDP is declining year after year. The agriculture sector in the state does not receive due importance as there is only 4.98 per cent of the total plan outlay for agriculture sector, which contributes more than 13.60 per cent of State GDP. Maharashtra is one of the most heterogeneous states in India. In view of this the study on "Performance of Agriculture in Maharashtra: A Critical analysis", was undertaken to probe into changes in share of different sectors of economy and sub-sectors of agriculture and different crop groups over the time period.

For judging the performance of the agriculture sector in the state since inception (i.e. 1960-61), decadal changes in share of sectors of economy in Net State Domestic Product (NSDP) were estimated.The analysis of value of output of agriculture and sub-sectors of agriculture was carried out since 1993-94.The statistical tools viz, percentage change, compound growth rates, coefficient of variation and Herfindahl index were used

The study brought out that, the share of agriculture in the Net State Domestic Product declined continuously during the period under study. The share of crop enterprise in the gross value of output in agriculture had also declined. The share of cereals and pulses declined whereas, share of fruits and vegetables increased in the gross value of output of agriculture indicating the diversification of cropping pattern.

The gross value of output from agriculture and allied sectors has increased significantly during the period 1993-94 to 2004-05 at the rate of 1.18 per cent per annum. The gross value of output from livestock sector increased at the rate of 3.05 per cent per annum whereas, there was impressive growth in value of output from sub-sectors, viz.; agriculture (crops), forestry and fishery.

The share of cereals, pulses and sugarcane has declined significantly in the totalvalue of output, whereas share of fruits, vegetables and floriculture has increased considerably.

Among the cereals, the share of wheat, bajra, and maize recorded increase since 1993-94. Amongst pulses, the share of gram showed slight increase, whereas share of udid declined slightly, but the share of mung declined drastically. Among oilseeds, the value of share of output from soybean has increased, whereas share of all other oilseeds, viz, groundnut, safflower and sunflower decreased during the period has major contribution.

The oranges, mangoes, grapes, banana, onion, tomato and brinjal had major contribution in the output value of fruits and vegetables with fluctuating trends during the period of 1993-94 to 2004-05.

Since, the share of output of agriculture (crop sector) is declining over the period, the study suggested that the diversification of cropping pattern towards economically profitable and high value crops is essential to increase the share of the output from this sector.

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Dynamics of land ownership Pattern

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Much of the human history is dominated by the relationship of man to land. A sense of well-being and security is inherent in the ownership of land. The ownership of land and its distribution pattern have a direct bearing on distribution, accumulation and generation of wealth, particularly in an agrarian country like India where agriculture contributes approximately 28 per cent of the national product.

The present study has been undertaken with specific objective.

1. To measure the temporal and structural changes in agricultural holdings since independence.
2. To study the changes in the inequality of ownership of land holdings.
3. To study the ownership pattern in the land holding.
4. To study the land sales pressure in rural sector.
5. To identify the buyer and seller classes in rural sector.

The present study has been undertaken to study the land transfer mechanism in rural sector. For the purpose of this study, a typical ryotwari village viz. Palso (B.K.) from Akola district of Maharashtra was purposively selected. The secondary data of the village which was available in tahasil office and village revenue office were taken. The data has been taken for a period starting from 1950-51 to 2000-2001. For the purpose of analysis, eight broad size group of cultivators were taken to know the inequality over a period of time at Micro level. To study the land sale pressure in rural sector, 40 land sale purchase traction were recorded during 200-2001.

Lorenz curve has been fitted for studying the trends to the inequality in the distribution of land in village. These curves related to the cumulative percentage of Khatedar i.e. and holders and the cumulative percentage of area held by the khatedar.

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Infrastructure Development in Maharashtra

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The infrastructure covers power irrigation ,communication and transportation by railway, road, air and water etc in the present study. In this contest, the major objectives is to analyses the role of infrastructure in accelerating agricultural development..the secondary data has been selected for the present study on the two point of time i.e. 1990 and 2004. Simple tabular analysis was used in the present study.

Based on the results of the study, in case of projects of big, medium and small, the percent change over the base year (1990-2004) in Vidarbha were estimated to 433.33 per cent, 42.00 per cent and 422.53 per cent , respectively while in case of Maharashtra, it was estimated to 52.38 per cent, 4.09 per cent and 94.70 per cent, respectively.

Similarly it. is is revealed in the results of electricity situation i.e. electricity pump set supplied, town and village electrified and electricity completed villages in vidarbha vis –a Maharashtra, percent change over the base year (1990-2004) were 138.22 per cent and 50.79 per cent , 2.50 per cent and 4.36 per cent , 2.41 per cent and 4.67 per cent , respectively. It also observe in diesel pump in vidarbha vis –a –vis Maharashtra, percent change over the base year was 44.73 per cent and 44.50 per cent.

In case of primary agriculture credit society, government warehouse, APMC and primary health centre, the percent change over the base year (1990-2004) were estimated to 19.21 per cent and 6.90 per cent , 35.93 per cent and -16.07 per cent , 40.65 per cent and 425 per cent ,32.47 per cent and 8.07 per cent in vidarbha vis –a-vis Maharashtra, respectively. Similarly in case transportation facilities i.e .railway lengths (km), road lengths(km), NH length(km) and state high way length(km), the percent change over the base year were estimated to 18.70 per cent and 1.60 per cent , 39.70 per cent and 31.41 per cent , 17.05 per cent and 42.78 per cent ,14.24 per cent and 8.23 per cent in vidarbha vis –a-vis Maharashtra, respectively.

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Performance of Major Crops in Maharashtra

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The present study discusses the growth performance of major agricultural crops in Maharashtra. Important variables like area, production and yield were compiled for the period 1992-93 to 2011-12 from various published sources. There is a marked shift from the cultivation of food grains to commercial crops. Among food grains, the yield under coarse wheat declined 1.34 per cent between 1992-93 to 2011-12. Similarly, the performance of cotton, soybean, maize and gram in terms of area, production and yield was impressive

during the study period. The use of modern varieties, irrigation and fertilizers were important factors that ensured higher growth in crop production. The results of crop growth indicate that the enhanced capital formation, better irrigation facilities, normal rainfall and improved fertilizer consumption helped to improve crop output in the state.

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Study to Determine Changes in Cropping Pattern in Maharashtra

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An attempt has been made to study the extent of change in cropping pattern over a period of time in Maharashtra. The study was based on time series data for a period of 10 years beginning from 2003-04 to 2012-13. The shift or deviation in the cropping pattern was measured by Spearman's rank correlation coefficient. The total change over the period was examined with the help of concordance coefficient 'W'. The analysis reveals that there is a no shift in the cropping pattern between 2003-04 to 2012-13 in Maharashtra state. However, the acreage allocation between different crops was observed during the period of study.

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Storages of Food Grains – An Economic Anlysis

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Indian agriculturist is a large scale sector with the fact that 60 to 70 per cent of the produce is stored at farm level in villages. It is well known that farmers does not have the economic strength to retain the produce with himself till the market prices are favourable. Keeping this in view, there is need to provide the new look to farming community with facilities for scientific storage so that wastage and produce deterioration are avoided and also to enable it to meet its credit requirement without being compelled to sell the produce at a time when prices are low.

Now a days farmers are inclined to store there food grains in the warehouses so as to sell their produce in the off season so that they can take the advantage of better prices to tie lean period demand beside earning profit when market prices have gone up.

Based on the results of the study, the attempts has been undertaken with specific objective.

1. To estimate the quantity stored by various size of land holding farmers
2. To examine the cost of storage for different farm products.

3. To study the economics of storage of different farm products.

Buldana district of vidarbha was purposively selected for the study. The 85 sample farmers was selected from Mehkar and shegaon taluka randomly. The data pertains to the year 2009-2010.

The gross returns from storing workout to Rs. 112 per quintal. Total cost involved in storage were 62 per quintal. The per cent margin on storage of jowar, tur, mung, udid, soybean, wheat, gram and maize were found to be 11.65 per cent, 17.82 per cent, 10.80 per cent, 9.25 per cent, 13.87 per cent, 10.24 per cent, 11.91 per cent and 20.99 per cent respectively.

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Economics of Production and Marketing of Safflower in Latur District of Maharashtra

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Safflower (Carthamustintorious) is an important oilseed crop. Safflower belongs to family compositae. Safflower plant has deep taproot that gives the plant significant drought tolerance. It is cool season crop in dry land cultivation. In Maharashtra Latur district is an important safflower growing district. Similarly, Latur Market is famous for oilseed produces because of more number of oilseed crushing mills. By considering these aspects, the present study, "Economics of production and marketing of safflower in Latur district of Maharashtra" has been undertaken with following objectives. Multistage sampling design was used for selection of district, tehsil, villages and safflower growers.In first stage, Latur district was purposively selected on the basis of safflower higher area under oilseed crops. In second stage, Renapur tehsil of was selected on the basis of highest area under safflower crop. In third stage, three villages were selected on the basis of highest area under safflower crop. The selected villages were Renapur, Shera and Samsapur. In the fourth stage from each village ten safflower growers were randomly selected. Thus, 30 safflower growers were selected for present study. Per hectare cost of cultivation and gross return of safflower in Latur district was found to be Rs. and Rs.31184.5. Net profit from safflower cultivation was Rs.8433.83. Output-input ratio was 1.27 and per quintal cost of cultivation of safflower was Rs.3130.69. From result it was observed that safflower crop was found to be profitable venture in Latur district. Agricultural universities should arrange training at village level safflower growers to understand the balanced and judicious use of their scare inputs like manures and costly inputs like fertilizers. Co-operative society should provide seeds, fertilizers and pesticides at cheaper cost and at time. Concerned ADO's will put their demand for fertilizers, seeds, insecticides, pesticides and other inputs requirement. Minimum support price should be announced before commencement of the crop season.

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Marketing of Food-Grain in Wardha District

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The main objective of the present investigation was to study the Producer's share in Consumer rupee for food-grain marketing in Wardha district.

For the present study data was collected from 120 cultivators for the year 2009-10 and secondary data were collected from various government Publications for the period 1989-90 to 2008-09. All the major agencies involved in marketing of food-grain i.e. commission agent, wholesaler and retailer each 10 was selected for the present study. The food-grain selected for the present studyareJowar, Wheat, Tur and Gram.

The average size of family for selected farmer member is 4 and of which male, Female and children were 1, 1 and 2. The gross cropped area was 12.39 hectare which consists of 50.92 per cent under Kharif crop, 49.08 per cent under rabi crop. The area under Wheat, Tur and Gram is increasing with mixed performance in production and productivity and area under Jowar is shifting towards Wheat, Tur and Gram. Area, production and productivity of Tur showed significant positive trend. Area of Wheat was more or less stable and productivity of Wheat is increasing as production rate is 1.92 per cent which was higher as compared to area i.e.0.80 per cent. The decreasing trends of Jowar indicate that farmers were shifted from Jowar to other crops like cash crops which are profitable as compared to Jowar. The area, production and productivity of Jowar, Wheat, Tur and Gram crops in Wardha district were unstable during the period of study. After harvesting of that particular crops there is glut in the market means arrivals are high in the market and when arrivals are low generally the prices are high.

In respect of Jowar, Wheat, Tur and Gram there are three marketing channels in the study area,

1) Channel-I –Producer-Consumer
2) Channel-II –Producer-Retailer-Consumer
3) Channel-III –Producer-Wholesaler-Retailer-Consumer

The producer's share in consumer's rupee in case of Jowar was highest in channel-I i.e. 96.19 per cent followed by channel-II and channel-III. The producer's share in consumer's rupee in case of wheat was highest in channel-I i.e.97.33 per cent. The producer's share in consumer's rupee was highest in case of Tur in channel-I i.e.99.07 per cent followed by channel-II and channel-III. The producer's share in consumer's rupee was highest in case of Gram in channel-I i.e. Rs.98.43 followed by channel-II and channel-III.

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Resource Use Efficiency in Green Chilli In Akola District

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The present study of resource use efficiency in Green Chilli in Akola District was carried out during the year 2011-2012. Two tahsils namely, Balapur and Patur of Akola district were selected purposefully for the present study. Chilli is the most important cash crop grown in Patur and Balapurtahsil of Akola district. Although, it is cultivated on small scale, it contributes sizeable share in total earning of the farmer. However, yields and profits from Chilli crop are uncertain. In small group, the regression analysis revealed that, the variable seed (2.0714) could show significant contribution in ChillI production and total variation explained by explanatory variables to the tune of 68.41 percent. The MVP (Marginal Value Product) to factor cost ratio in small group for variable machine power was greater than unity which indicated that by increasing the use of these resources, profits could be maximized.

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Price Analysis of Pigeonpea (*Cajanus cajan Lin*) in Major Markets of India.

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Pigeonpea is the major crop grown across India. The last decade showed large fluctuations in prices of pigeonpea. The present study aimed to study price movement of pigeonpea i.e. seasonal variation, price volatility and co-integration among the major pigeonpea markets in India. For study purpose the data related to monthly average prices of pigeonpea collected from major markets from different States viz. Akola and Latur (Maharashtra), Alwar (Rajasthan), Sedam (Karnataka) and Thandur (Andhra Pradesh) for the period 2003-2011. Moving average method used to study seasonal variations. The econometric tools like ADF test, Johansen's Multiple Co-integration test, Granger Causality Test, ARCH-GARCH and Vector Correction model were used to analyse integration of markets across the locations. The results of the study showed that the prices of pigeonpea were higher in the months from June to August in all selected markets. All the price series were stationary at first difference. The selected markets show long run equilibrium relationship and co-integration between them. The selected markets showed uni as wel as bidirectional influence on pigeonpea prices of each other. Akola, Latur and Thandur

markets showed persistent price volatility. Alwar, Sedam and Latur markets influenced by their own lag. Latur market two months lag price is affecting current prices of Akola market. Latur market one month lagged price is affecting current prices of that market. Alwar and Thandur markets attain short run equilibrium rapidly.

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Districtwise growth in area, production and productivity of important foodgrain crops in Konkan region of Maharashtra

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Agricultural development is an integral part of overall economic development of any country. It provides not only food and raw material, but also employment to a very large portion of the population. The findings of the study revealed that, at overall level area under rice declined as a evident of negative growth rate of 0.348 per cent. Growth rate for rice production for overall period was positive with magnitude of 0.873 per cent. It is an impact of new HYVs and hybrid varieties evolved by the University. The growth rates of nagli production for all the districts of Konkan region were negative and non- significant. The growth rate of productivity of nagli in Ratnagiri and Sindhudurg district were positive. The growth rate of total foodgrain production as well as per hectare yield in all the district of Konkan region at overall period was positive.

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Economics of Capsicum Production in Akola District

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The Capsicum generally seen in India and Maharashtra under open condition, though the same can be cultivated under green house condition for boosting productivity. In view of this, present study has been conducted in Akola district of Maharashtra State to study the economics of production of Capsicum. Total 120 farmers from four tahsils of Akola district were selected. The samples were categorized on the basis of size holding i.e. small, medium and large in capsicum cultivation under different conditions and irrigation systems (drip and traditional furrow). Capsicum cultivated on small scale, it contributes sizeable share in total earning of farmers. Per hectare cost `C′ and gross return positively correlated

with size of holding in capsicum crop under both conditions, highest in green house condition followed by open condition. Per hectare cost of production was highest in open condition under traditional furrows irrigation system in medium size group. Results revealed that, higher per quintal net return in case of medium size group (Rs.1311.20) followed by large group (Rs.1297.90) in greenhouse condition. Input output ratio was highest in greenhouse condition and it is inversely related to size of holding.

Key words: Cost of production, Gross return, Input-output ratio, etc.

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Innovation in Vegetable Markets

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How do people regulate distress? Several common responses to distress have been documented such as smoking, alcohol consumption, overeating, rumination and surprisingly 'shopping' is also one of them; it's true in a sense as the scientist have found an explanation for the "retail therapy" phenomena in view of the fact, action of shopping cheer oneself up and help psychologically to come out of distress. Shopping commodities through different markets possibly act to regulate happy hormone in human body but it's hardly true when it comes to vegetable markets and vegetable purchasing because of the unhygienic and badly maintained vegetable shops with its dirty surrounding so the present vegetable markets are badly in need of transformation. The idea of renovation and sophistication of vegetable shops is a ray of hope to make them more acceptable and to make innovation in vegetable markets not only to assure us about hygiene but also to make work vegetable purchasing as on retail therapy perception.

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Economics of Production of Pigeonpea in Parbhani District

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An attempt has been made to examine the economics of production of pigeonpea in Parbhani district. The investigation was based on the data collected by survey method from 60 Pigeonpea growers from Parbhani district.

The results indicated that the main product of pigeonpea was 10.25 q/ha. In production process, rental value of land, bullock labour, hired human labour and interest on fixed capital were the major items of the cost. Per hectare total cost (cost 'C') was Rs. 22487.54. The proportion of cost 'A' in total cost was 57.76 per cent, while proportion cost B was 90.72 per cent and output-input ratio was 1.85.

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THEME – II] AGRICULTURAL TECHNOLOGY

Manufacturing of Micro-Nutrients By Farmers: A Better Way To Utilize Time And Money

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In this study an attempt has been made to study the economic analysis of domestic and factory making micro-nutrients by using some cost consideration in Amravati district. The study reveals that the per quintal cost of micro-nutrient in domestic making was only Rs. 3187.00 for all 10 essential elements with one bonus elements 'S' is also enlisted while the per quintal cost of micro-nutrient manufactured in factory exceeds by Rs. 12589.78. In this study it is also seen that the consumer farmer has to bear unnecessarily an additional burden of cost to the limit of 395.04%, if the product is sold as per profit of 20% and commission of 20%. Finally the study shows that the rates of Factory and company making micro-nutrients are exorbitant and there is exploitation of the farmer upto the 395.04 per cent.

Introduction:

Agricultural production is an essential prerequisite for the process of economic development in agriculture oriented country like ours. Farmers have proved their potential in producing bumper yields, which everybody has seen, that there is no sufficient storage facilities due to lack of infrastructure. In such a country, there are still some pockets where a substantial financial condition of the farmers is so poor that they are tending to commit suicide. Our resources in the field of agriculture being both scarce and costlier are to be invariably used on the basis of what is called as "Least cost and highest profit combination".

At the basic level, efforts are to be directed primarily to extending use of inputs like manures, fertilizers, improved seeds, plant protection measures, micro nutrients and new methods of tillage, congenial to particular areas. Since agriculture production is subjected to high degree of risk and uncertainty, and government of law of diminishing returns, an excessive and unwanted use of costlier inputs, especially fertilizers be avoided, and in the line, therefore, growth promoting specific micro nutrients identified to be applied at the particular stages of the crop growth be used, the consideration of which is a concern of this paper.

Authors of this paper thinks, much can be done at farmers level by farmers themselves, if they are properly entrained in manufacturing the important crop growth inputs like rich organic manures, low cost plant protection means and especially needed micro nutrients.. in this paper, therefore economics of low cost technology for the required of needed micro nutrients required for area oriented agricultural and horticultural crops at

farm level through the use of indigenous means in comparison to factory making is worked out for communication.

Methodology:

The study has been undertaken the comparative analysis of cost required for manufacturing the domestic as well as factory making micro-nutrients. The study has been undertaken the cost consideration and fact of manufacturing the all essential micro-nutrients which are required for plant growth. For domestic making micro-nutrients the cost related to all essential micro-nutrients with one bonus micro-nutrient say 'S' and for factory/company making micro-nutrients the cost related to seven micro-nutrients with cost of marketing is estimated.

Results and Discussion:

Cost consideration in domestic manufacturing of micro-nutrients

The rates specified in Table 1 are the retailer rates including local taxes etc. The ex-factory rates are still cheaper.

S.N.	Ingredients	Grade (%)	Quantity required	Cost (Rs/kg)	Total Cost	% to total cost
1	N	8.0	DAP - 3.13 Urea – 4.87	DAP – Nil Urea – 5.68	59.64	2.38
2	P	8.0	17.39	23.62	410.75	16.41
3	K	8.0	13.33	17.96	239.40	9.56
4	Mg	3.0	30.51	15.00	457.65	18.28
5	Fe	2.5	12.44	20.00	248.80	9.94
6	Mn	1.0	3.07	45.00	138.15	5.51
7	Zn	3.0	12.64	35.00	442.40	17.67
8	Cu	1.0	3.92	50.00	196.00	7.83
9	B	0.5	4.40	50.00	220.00	8.79
10	Mo	0.1	0.18	500.00	90.00	3.59
Total		**-**	**102.75**		**2502.81**	**100.00**

In this Table above the major and minor elements required for manufacturing of foliar spray (powder form) in the form of micro-nutrients are given. The quantities of each of these elements along with the corresponding rates are also furnished therein. The cost incurred on account of use of each of these elements based on the quantity required as recommended, but modified it with minor changes for the case of farmers has been made to manufacture of one quintal of micro-nutrients is calculated here.

Table 1: Quantity required for convenience of farmers

1) Ingredients						
S.N.	**Ingredients**	**Grade (%)**	**Quantity required**	**Cost (Rs/kg)**	**Total Cost**	**% to total cost**
1	N	8.0	DAP - 3.13 Urea – 4.87	DAP – Nil Urea – 5.68	5.68	1.06
2	P	8.0	17.00	23.62	401.54	16.67
3	K	8.0	13.00	17.96	233.48	9.96
4	Mg	3.0	30.00	15.00	450.00	18.68
5	Fe	2.5	12.00	20.00	240.00	9.96
6	Mn	1.0	3.00	45.00	135.00	5.60
7	Zn	3.0	12.50	35.00	437.50	18.16
8	Cu	1.0	3.50	50.00	175.00	7.26
9	B	0.5	4.40	50.00	220.00	9.13
10	Mo	0.1	0.18	500.00	90.00	3.73
11	S	7.82	100.00	-	2408.08	100.00

On the basis of total cost involved, it is seen that all 10 elements with one bonus element 'S' taken together involves total cost of Rs. 2408.08 or simply Rs. 2408.00.

Table 2: Quantity required for convenience of farmers

2. Wages				
S. N.	**Particulars**	**Quantity**	**Rates (Rs.)**	**Total cost**
1	Unskilled labour	2	200.00	400.00
2	Skilled Labour	1	300.00	300.00
Total				**700.00**
3. Electricity (domestic) (upto 300 units)				
Five (5) units per day @ Rs. 3.36				**16.80**
Therefore for 30 days				**504.00**
Fixed Charges per month @Rs.130.00				**130.00**
FCA @ 5 %				**21.76**
Total				**655.76**
Therefore electricity charges per day				**21.85**
4. Depreciation on Machinery				
One 1 HP Pulverizer				**20000.00**
One 1 HP Motor				**7000.00**
10 years life therefore the depreciation per annum				**2500.00**
Therefore depreciation per day				**6.84**
5. Rent				
300 sq. ft. @ Rs. 5 per sq ft.				**1500.00**
Therefore rent for one day (Rent)				**50.00**
Cost/quintal for manufacturing micro nutrients at domestic level				

Raw material	**2408.08**
Wages	**700.00**
Electricity	**21.85**
Depreciation on machinery	**6.84**
Rent	**50.00**
Total	**3186.77**

It is also revealed that the highest cost is involved on the use of Mg (Rs. 450.00) followed by Zn (Rs. 437.50), P (Rs. 401.54), Fe (Rs. 240.00), K (Rs. 233.48), B (Rs. 220.00), Cu (Rs. 175.00), Mn (Rs.135.00), Mo (Rs. 90.00) and N (Rs. 25.56). In terms of percentage it is seen that the use of Mg involves 18.68 per cent followed by Zn (18.16 per cent), P (16.67 per cent), Fe (9.96 per cent), K (9.96 per cent), B (9.13 per cent), Cu (7.26 per cent), Mn (5.60 per cent), Mo (3.73 per cent) and N (1.06 per cent).

In order to bring about most appropriate form of micro-nutrient, the total cost for manufacturing of Rs. 2408.08 is involved cost of raw material, wages (Rs.700.00), electricity (Rs.21.85), Depreciation (Rs. 6.84) and Rent (Rs. 50.00). Therefore, total cost to manufacture one quintal of micronutrient is Rs. 3187.00 and cost of per kg micro-nutrient is Rs. 31.87 or Rs. 32.00. The use of all 10 elements with one bonus element 'S' enlisted in Table 1 are required for the manufacturing of appropriate micro-nutrient foliar spray (powder spray), the statement is being made as the paper reader have experience in the concerned unit if manufacturing, selling and creating awareness amongst farmers about use and important of micro nutrients.

Cost per quintal involved in manufacturing micro-nutrients commercially

1) **Ingredients**: As per the act stated earlier, micro-nutrient manufacturers are entitled to manufacture micro-nutrient only. Therefore it is imperative to change the ingredients that are shown in Table 3. Here the major nutrients like N, P, K and secondary nutrient like Mg is removed.

Table 3: Cost per quintal involved in manufacturing micro-nutrients commercially

S.N.	Ingredients	Grade	Quantity required	Cost Rs/Kg	Total Cost	% to total cost
1	Fe	2.50	12.00	20.00	240.00	18.49
2	Mn	1.00	3.00	45.00	135.00	10.40
3	Zn	3.00	12.50	35.00	437.50	33.71
4	Cu	1.00	3.50	50.00	175.00	13.48
5	B	0.50	4.40	50.00	220.00	16.95
6	Mo	0.10	0.18	500.00	90.00	6.93
7	S	3.89	Nil	Free	-	-
Total					**1297.50**	**100.00**

Table 4: Cost per quintal involved in manufacturing micro-nutrients commercially

2) Wages			
S.N.	**Name of Post**	**Quantity (No.)**	**Salary (Rs.)**
1	Production Manager	01	Rs. 6000.00
2	Marketing Manager	01	Rs. 6000.00
3	Sales officers @ Rs. 4000.00/month	03	Rs. 12000.00
4	Chemist @Rs. 4000.00/month	01	Rs. 4000.00
5	Laboratory attendant @Rs. 3000.00/month	01	Rs. 3000.00
6	Watch man @Rs. 2000.00/month	01	Rs. 2000.00
7	Field Assistants @Rs. 4000.00/month	03	Rs. 12000.00
8	Unskilled labours @Rs. 4000.00/month	02	Rs. 8000.00
Total			Rs. **53000.00**
Per day salary is (Rs.)			Rs. **1766.66**
3) Electricity			
Per day 5 units @ Rs. 5.85, for 30 days (Upto 200 units) Fixed charges per month			Rs. 877.50 Rs. 190.00
FCA @ 17 % per month			Rs. 181.39
Per month charges (Rs.)			Rs. 1067.50
Total			Rs. **1248.89**
Therefore per day consumption of electricity			Rs. 41.62
4) **Depreciation on Machinery**			
One HP pulverizer with motor			Rs. 27000.00
One Mixer			Rs. 5000.00
One sealing machine			Rs. 1200.00
Total			Rs. **33200.00**
Therefore, depreciation comes to			Rs. 27.28
Establishment of laboratory on AAS worth			Rs. 10000.00
Therefore the depreciation			Rs. 821.91
Total			Rs. **849.28**
5) Rent			
Establishment of plants in MIDC Amravati **a) MIDC Amravati has two industrial areas**			
1) MIDC Amravati and Saturna @ Rs. 425/sq.mt 2) MICD Nandgaon Peth @ Rs. 235/sq.mt			
1) Plot size 1000 sq.ft .@ Rs. 425/sq.mt 2) Plot size 1000 sq.ft. @ Rs. 235/sq.mt (1000 sq.ft. = 92.90 sq.mt)			Rs. 39482.50 Rs. 21831.50
b) Construction of 500 sq.ft. @ Rs 1000 sq.ft.			Rs. 500000
Total			**Rs. 539482.50**

Therefore per day value	Rs. 1478.03
Marketing Concept	
6) Packaging	
a) 200 duplex board boxes @ Rs. 5.50 per box	Rs. 1100.00
b) Plastic inner @ Rs. 100/kg, for ½ kg	Rs. 50.00
c) Gum ½ kg for 200 boxes @ Rs.200/kg	Rs. 100.00
d) 5 Corrugated boxes @ Rs. 20.00 each	Rs. 100.00
e) Stripes and clips @ Rs. 3.00	Rs. 15.00
Total	**Rs. 1365.00**
7) Transport	Rs. 200.00
8) Advertisement	Rs. 1000.00
9) Registration fees (One time)	Rs. 13000.00
Therefore per day charges is Rs.	Rs. 35.61
10) Miscellaneous	Rs. 1000.00
Total (6 – 10)	**Rs. 16565.00**

As given in Table - 4, the authors tried to bring to the notice that, under factory manufacturing of micro-nutrients, the cost of raw material is low, as only six elements has been used, which amount to Rs. 1297.50 as compared to domestic manufacturing where 10 elements with one bonus element 'S' had been used, which comes to Rs. 2408.08.

Table 5: Cost per quintal involved in manufacturing micro-nutrients at factory level

S.N.	Particulars of cost	Units/Numbers	Rates	Amount (Rs.)
1	Raw material	As specified in Table - 2	As specified in Table – 2	1297.50
2	Staff salary/wages	As specified in Table – 3	As specified in Table - 3	1766.66
3	Electricity	As specified	As specified	41.62
4	Rent	As specified	As specified	1478.00
5	Depreciation on machinery	As specified	As specified	850.00
Total				**5433.78**

However, the factory manufacturing of the raw material envisages components of cost rather different and at different rates of payments than the domestic making of these micro-nutrients. These cost components are salary to the regular staff appointed and wages, electricity, depreciation on machinery, rent on land and quality control measures specially. The cost worked out on these components respectively comes as under Salary/Wages (Rs. 1766.66/-), Rent (Rs. 1478.00/-), Packaging (Rs. 1365.00), Ingredients (Rs. 1297.50), Advertisement (Rs. 1000.00), Depreciation on machinery (Rs. 850.00), Transport (Rs.

200.00), electricity (41.62/-), Registration (Rs. 35.61) and Miscellaneous (Rs. 33.33), which are calculated for per quintal of micro-nutrient manufacturing. The total costs of manufacturing of one quintal of micro-nutrients therefore come to Rs. 8067.72 for only six elements. It is therefore, seen that the per quintal cost of manufacturing of micro-nutrients by farmers (domestic) is Rs. 3187.00 for 10 elements. Thus per quintal cost of micro-nutrients manufactured in factory exceeds by Rs. 4880.72. This is perhaps the reason of more prices being charged by factory owners of micro-nutrients.

The authors have further to state that, under domestic making of micro-nutrients, the delivery to the consumer farmers has to be directly made from the place of production and therefore the question of adding value to actual selling cost does not arise.

Apart from above consideration the product is sold to the consumer after having made a profit to the tune of 20 per cent and commission to the retailer th the tune of 20 per cent and Octroi to be paid up to 4 per cent.

Table -6: Comparative statistics of domestic and factory making micro-nutrients

S.N.	Particulars	Cost per quintal		% cost to factory cost	
		Domestic	Factory	Domestic %	Factory %
1	Cost of raw material	2408.00	1297.50	75.55	10.30
2	Staff salary	-	1100.00	-	8.77
3	Wages	700.00	666.66	21.96	5.29
4	Electricity	21.85	41.62	0.68	0.33
5	Dep. On machinery	6.84	850.00	0.21	6.75
6	Rent	50.00	1478.00	1.56	11.73
7	Packaging	-	1365.00	-	10.84
8	Transport	-	200.00	-	1.58
9	Octroi	-	323.00	-	2.56
10	Profit 20%	-	1614.00	-	12.81
11	Commission 20%	-	1614.00	-	12.81
12	Advertisement	-	1000.00	-	7.94
13	Loading/Unloading	-	40.00	-	0.31
14	Miscellaneous	-	1000.00	-	7.94
Total		**3187.00**	**12589.78**	**100.00**	**100.00**

The comparative statistics of the cost consideration relative to per quintal manufacturing of micro-nutrients under domestic process and factory process is shown in Table – 6. It is apparently seen that the manufacturing of micro-nutrients comes to Rs. 3187.00 as specified in Table-6, which is available to the consumer farmers at the manufacturing centre itself. Whereas, under factory manufacturing micro-nutrient have to be sold at Rs. 12589.78. As variable cost consideration in this process are like manufacturing cost of Rs. 5434.00, till the product reaches to dealers for disposal to the consumer farmers, additional marketing cost of Rs. 2643.00/- is to be added per quintal as

seen in Table 7. It means, in terms of percentage, it is seen that the consumer farmer has to bear unnecessarily an additional burden, if the product is sold as per profit of 20% and commission of 20% as specified.

Table 7: Cost per quintal involved in marketing of micro-nutrients

S.N.	Particulars	Amount (Rs.)
1	Packaging as specified	1365.00
2	Transport as specified	200.00
3	Advertisement	1000.00
4	Registration fees Rs. 13000/-, for one day	35.61
5	Miscellaneous Rs. 1000/-, for one day	33.33
Total (Rs.)		**2633.94**
Thus total cost is		
a) Manufacturing cost		5434.00
b) Marketing cost		2634.00
Total Cost		**8068.00**

Conclusion:

It is concluded from the study that the micro-nutrients is not make available to farmer consumers at the rates mentioned i.e. Rs. 125.00, which are quite practical but it is observed that the rates are exorbitant and there is 395.04 per cent exploitation of the farmers in factory making as compared to domestic making micro-nutrients.

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Impact Assessment of Agricultural Mechanization on Productivity in Vidarbha Region

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ABSTRACT

Agriculture coming up as a business to make it profitable, farm mechanization is a key for remuneration and reducing labour force which is need of the day. The present study was carried out in Amravati and Nagpur division of Vidarbha region of Maharashtra state, where Cotton, Tur, Gram, Jowar, Rice and Bajra are grown by the farmers. The study is based on secondary data for the year 1970-71 to 2010-11, collected from various sources of Government and non-government publications. The study concluded that, the availability of farm implements increased over study period i.e. 20.72 per cent in puddler for Chandrapur district, 29.39 per cent in tractors for Wardha district. However, wooden plough use exhibited declining trend which is symbol of mechanization. Wider variability was recorded in Electric pumps as well as tractors over the study period. During 1970-71 Buldhana stood first in Agricultural Mechanization, while during recent period 2010-2011 Akola district stood first in Agricultural Mechanization. Gadchiroli and Yavatmal are lagging in mechanization. The agricultural mechanization index explained 89.92 per cent contribution in explaining productivity of crops in Akola district. While agricultural mechanization index explained 52.97 per cent , 26.65 per cent , 40.46 per cent in explaining the productivity of crops in Amravati Division, Nagpur Division and Vidarbha respectively.

Key word: Mechanization, productivity, mechanization index, composite index.

INTRODUCTION

Farm mechanization is regarded as sine-*qua-non* to reduce the human drudgery and enhance the agricultural productivity.

During the post-green revolution period, the impact of farm mechanization on agricultural production and productivity has been well recognized in India. Depending upon the use of other inputs such as irrigation, high yielding seed varieties, chemical fertilizers, herbicides and pesticides, different States in India have attained different levels of mechanization. Consequently, the agricultural production & productivity has witnessed three to four fold increased. Studies have been conducted by various organizations & individuals which have highlighted the impact of agricultural mechanization on farm production and productivity.

Singh and Singh (1972) concluded that tractor farms gave higher yields of wheat, paddy and sugarcane and produced a higher overall gross output per hectare than non-tractor

farms. NCAER (1973) compared the values of annual farm output per hectare of net sown area under different levels of mechanization. The output per hectare was found to increase as the level of mechanization increased from irrigated non - mechanized farms to tube well, tractor-thresher farms.

Agricultural mechanization implies the use of various power sources and improved farm tools and equipment, with a view to reduce the drudgery of the human beings and draught animals, enhance the cropping intensity, precision and timelines of efficiency of utilization of various crop inputs and reduce the losses at different stages of crop production. The end objective of farm mechanization is to enhance the overall productivity and production with the lowest cost of production. The contribution of agricultural mechanization has been well recognized in enhancing the production together with irrigation, biological and chemical inputs of high yielding seed varieties, fertilizers, pesticides and mechanical energy. Indian Green Revolution is regarded as one of the greatest achievements of the 20th century. It has been adopted in India on a large scale benefiting small, medium and large size farms. Some of its aspects such as its impact on human labour employment in a labour abundant economy have always evoked sharp responses from the policy makers. Several studies have been conducted on the impact of agricultural mechanization on production, productivity, cropping intensity, human labour employment as well as income generation. (*Shahare, 2012).*

In view of studying, impact of agricultural mechanization on farm productivity, the present study was proposed with the following objectives.

- To study the district-wise availability of farm implements in Vidarbha region.
- To study the district-wise average productivity of selected crops.
- To assess the impact of agricultural mechanization on agricultural productivity.

MATERIALS AND METHODS

The present study was carried out in Amravati and Nagpur division of Vidarbha region of Maharashtra state, where Cotton, Tur, Gram, Jowar, Rice and Bajra are grown by the farmers, which is selected for the study. The secondary data on 16 selected indicators of agricultural (farm) mechanization and production of crops grown in the region was collected from various Government and non-government publications for the period 1970-71 to 2010-11.

To measure the degree of mechanization of different districts, the composite index of agricultural mechanization were computed by using methodology suggested by Prem Narain.

To assess the impact of agricultural mechanization on agricultural productivity, the Cobb-Douglas type of Production Function was used and is usually defined as follows:

$Y=aX_1^{b1}e^u$

Where,

Y = Productivity (kg. /ha).

a = Constant term, the efficiency parameters.

X_1=Agricultural Mechanization Index.

b_1 = Regression coefficient

e = Napier base

u = Error/disturbance term

RESULTS AND DISCUSSION

Table 1. District-wise farm implements during 2010-11.

Sr. no.	Implements	Buldhana	Akola	Amravati	Yavatmal	Wardha	Nagpur	Bhandara	Chandrapur	Gadchiroli
1	Wooden Plough	11076	16064	22116	11569	2247	152216	11361	10494	3087
2	Steel Plough	17713	24970	34056	18152	1953	6275	3063	3477	861
3	Disc Harrow	8813	12660	16945	9117	8332	305165	12316	21740	3031
4	Cultivator	11238	15841	22016	9032	10303	24717	19763	23433	5989
5	Puddler	60686	15658	21604	11625	11999	34411	19859	27867	9678
6	Sowing device	14741	19418	18056	14835	184276	45817	23590	23131	4798
7	Levelling Karcha	4354	3653	3365	3469	3255	8043	3757	3152	738
8	Thresher	150	127	117	122	193	483	161	128	42
9	Crusher	284	222	221	233	284	1474	276	332	63
10	Pearsian Wheel	282	184	169	178	286	1455	375	9300	85
11	Bullock Cart	4741	4015	3734	4410	4868	5361	1124	5205	3433
12	Spray Duster	5436	4555	4198	4451	4823	33799	5092	9895	816
13	Electric and Diesel pumps	31813	14614	31030	14493	18571	34121	19715	10101	1979
14	Tractors	737	407	686	205	2022	3116	2290	2047	340

It is revealed from Table-1 that, the availability of farm implements increased over study period i.e. 20.72 per cent increases in puddler for Chandrapur district, 29.39 per cent in tractors for Wardha district. However, wooden plough use exhibited declining trend which is

symbol of mechanization. Wider variability was recorded in Electric pumps as well as tractors over the study period.

Table 2. District-wise composite index of agricultural mechanization

Sr. No.	Districts	1970-71	1975-76	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2010-11
1	Buldhana	0.776346	0.677677	0.605934	0.5496	0.5035	0.4656	0.4283	0.4236	0.3917
2	Akola	0.9015	0.786924	0.703616	0.6382	0.4591	0.4525	0.3111	0.2772	0.2489
3	Amravati	0.895708	0.781868	0.699095	0.6341	0.5665	0.5264	0.514	0.4801	0.4628
4	Yavatmal	0.9993	0.9984	0.983981	0.8925	0.877	0.8677	0.8319	0.824	0.7994
5	Wardha	0.9583	0.868699	0.802157	0.711433	0.689165	0.665527	0.650752	0.6151741	0.6013
6	Nagpur	0.9162	0.830535	0.766916	0.680178	0.658888	0.636289	0.622163	0.588691	0.5689
7	Bhandara	0.9067	0.821924	0.758964	0.673125	0.652057	0.629691	0.615712	0.582587	0.5723
8	Chandrapur	0.9149	0.829357	0.765828	0.679213	0.657954	0.635386	0.62128	0.587855	0.5626
9	Gadchiroli				0.9482	0.9164	0.8942	0.8812	0.8473	0.8219

To study the behavior of mechanization index in the districts of Vidarbha, the mechanization indexes are presented in Table 2. For all the districts, the composite index of mechanization approaching towards unity indicates less mechanization; whereas departure from unity shows the more mechanization.

It is observed from the Table- 2 that, during 1970-71 Buldhana stood first in Agricultural Mechanization, while during recent period 2010-2011 Akola district stood first in Agricultural Mechanization. Gadchiroli and Yavatmal are lagging in mechanization. The changes in mechanization level over the period were observed in all the districts of Vidarbha region.

Table 3. District-wise average productivity of selected crops in vidarbha.

YEAR	Buldhana	Akola	Amravati	Yavatmal	Wardha	Nagpur	Bhandara	Chandrapur	Gadchiroli
1970-71	461.12	341.28	363.14	377.58	457.89	366.63	405.23	426.24	0.00
1975-76	629.14	526.45	592.60	580.85	626.96	604.78	515.86	663.73	0.00
1980-81	710.29	576.18	645.27	584.99	556.97	706.94	474.06	814.19	0.00
1985-86	549.55	620.19	665.36	681.72	718.20	739.98	440.18	782.64	722.02
1990-91	889.51	812.02	699.09	762.59	744.95	892.59	542.54	754.51	419.02
1995-96	803.65	948.95	942.95	724.39	843.66	783.82	581.76	683.77	567.23
2000-01	686.33	1152.00	668.67	649.83	559.00	528.67	399.67	575.67	343.33
2005-06	448.83	1003.67	572.33	344.67	579.33	492.00	362.17	426.17	213.83
2010-11	600.83	1259.33	686.67	575.50	513.17	700.50	618.58	705.00	641.00

It is observed from the Table-3 that, during 1970-71 Buldhana stood first in Average Productivity of crops, while during recent period 2010-2011 Akola district stood first in Average Productivity of crops.

Table 4. Impact of agricultural mechanization on productivity of crops in vidarbha.

Sr No.	Districts	Intercept	Coefficient	R^2
1	Buldhana	2.7409	-0.2002	0.0398
2	Akola	2.6034	-0.8523**	0.8992
3	Amravati	2.6434	-0.7156***	0.4247
4	Yavatmal	2.7354	-0.4011	0.01553
5	Wardha	2.7345	-0.3662	0.0904
6	Nagpur	2.6811	-0.7126	0.1743
7	Bhandara	2.6462	-0.1839	0.02531
8	Chandrapur	2.7673	-0.2048	0.01847
9	Gadchiroli	0.5738	-33.3990**	0.6485
10	Amravati Division	2.6559	-0.7993**	0.5297
11	Nagpur Division	2.5809	-1.0514	0.2665
12	Overall	2.6172	-0.9269***	0.4046

** and *** denotes significance at 5 % and 10 %,respectively.

It is observed in Table-4 that, the results of regression analysis based on Cobb-douglas type function revealed that, the agricultural mechanization index explained 89.92 per cent contribution in explaining productivity of crops in Akola district. While, agricultural mechanization index explained 52.97 per cent , 26.65 per cent , 40.46 per cent in explaining the productivity of crops in Amravati Division, Nagpur Division and Vidarbha, respectively. Rao (1978) conducted a study to investigate the effect of the use of tractors on yield, employment of labour and cropping pattern. Also, Singh (2000) suggested an analytical approach to study the growth dynamics of agricultural inputs and their effect on productivity in Madhya Pradesh.

Conclusions

1. Agricultural Mechanization level changed over the study period.
2. Akola district stood first in Agricultural Mechanization during 2010-2011.
3. The agricultural mechanization index explained 89.92 per cent contribution in explaining productivity of crops in Akola district. While agricultural mechanization index explained 52.97 per cent , 26.65 per cent , 40.46 per cent in explaining the productivity of crops in Amravati Division, Nagpur Division and Vidarbha, respectively.

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Economic Analysis of Mechanization of Sugarcane Harvesting in Kolhapur District

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The present study was undertaken to study the economic viability of the mechanical harvesting of sugarcane and the problems faced by sugarcane harvester owners and sugarcane cultivators in the operational area of Shri.Tatyasaheb Kore Sahakari Sakhar Karkhana, Warananagr in Kolhapur district. The detail data on harvesting of sugarcane by 4 sugarcane harvester operating in the factory area for the year 2011-12 were collected to know the average investment required for sugarcane harvester and to estimate average fixed cost and variable cost, net profit, per tone cost of sugarcane harvesting by personnel visits. The data were also collected from sugar factory officials, sugarcane harvesters and 30 sugarcane cultivators, whose sugarcane has been harvested by sugarcane harvester to know the problems regarding mechanical harvesting of sugarcane and suggestions to overcame them. The statistical tools viz., averages, percentages and standard cost concepts viz., fixed costs, variable costs, net profit were utilized to fulfill the objectives.

The study revealed that an investment of ₹ 113 lakh was made to have sugarcane harvesting unit including a Sugarcane Harvester, two Enfielders, two Tractors and a shed for harvester. The Sugar factory assisted the producer members to purchase sugarcane harvester by providing interest free amount of ₹ 10 lakh having repayment period of five years. The major item of fixed costs for having sugarcane harvester was interest on working capital which accounts for 56 to 61 per cent followed by depreciation on harvester. The variable costs of sugarcane harvester was to the tune of ₹20.15 lakh out of which 60 per cent spent on diesel and 11.66 per cent on expenditure on salary. The quantity harvested by a sugarcane harvester was 14300 tonnes and income generated by the machine was ₹ 43.15 lakh. The different financial efficiency ratios showed that for earning one rupee income from sugarcane harvester one has to spent 42 paisa on fixed and 47 paisa on operating expenses. Considering the present cost and investment situation and providing Rs. 50 lakh subsidy, it would take 10 years to repay investment made on sugarcane harvester. The Sugarcane harvester is more economic viable under ₹ 50 lakh subsidy as the magnitudes for BCR (1.63), NPW (166.75 lakh) IRR (17.53 %) and Break Even Point (6986 tonnes) better than the no subsidy situation. Quick and ground level harvesting, increase in production, addition of sugarcane trash, good emergence of ratoon, low incidence of pests were major benefits reported by the sugarcane cultivators who, harvested their cane by machine, whereas small plot size, planting distance, non availability of green fodder were the constraints faced by them in mechanical harvesting of sugarcane. They suggested to develop harvester useful for small plots with less weight. Delay in getting amount of subsidy, low rate for harvesting, unavailability of technicians and costly

spare parts were the major problems faced by the Sugarcane harvester owners. The study suggested that the mechanical harvesting of sugarcane should be motivated by providing subsidy to the purchaser of sugarcane harvester as the investment in the venture is found economically viable.

Introduction

Sugarcane is an important commercial crop which is cultivated on more than 23.77 million hectares and mainly used for sugar production through out the world. India ranks second in area (44.20 lakh ha) and production (2850.29 lakh tones) of sugarcane in World (Agriculture Stat at a Glance, 2011). Maharashtra ranks second in area (9.64 lakh ha) and production (788.38 lakh tones) of sugarcane and ranks first in sugar production (70.67 lakh tones) in the country due to good recovery percentage. Maharashtra has largest (143 out of 490) number of sugar factories in operation in the country and majority (75 per cent) of them are in co-operative sector (Co-operative Sugar Aug.2011).

Manual harvesting of sugarcane is vogue in India. Sugarcane harvesting is highly labour intensive operation which requires 850 to 1000 man hours/ha (i.e.100 to 125 man days). Sugarcane harvesting involves base cutting of sugarcane, stripping and detrashing of sugarcane, detopping and bundle making. It was reported that during 2006, about 10 lakh laboures were available for sugarcane harvesting but today their number has dwindled to about five lakh. Among the various reasons, strenuous nature of job, availability of other jobs and school going children of the labourers are getting education and moving on to other jobs are major ones. In order to tide over acute labour shortage and reap the benefits of mechanization viz., speedy, continuous, efficient and reduction in cost of harvesting, mechanical harvesting is the need of the hour. The sugarcane harvester can cut about 120 tonnes of sugarcane daily but the sugarcane harvester alongwith ancillary equipment costs more than 117 lakhs.

Against this backdrop, the present study was undertaken to study the economic viability of the mechanical harvesting of sugarcane and the problems faced by sugarcane harvester owners and sugarcane cultivators in the operational area of Shri.Tatyasaheb Kore Sahakari Sakhar Karkhana, Warananagr in Kolhapur district.

Methodology

Kolhapur district was selected for the study as it has highest sugar recovery in the state. The cropping pattern of the district is dominated by sugarcane crop. The district has 20 sugar factories in operation which has crushed 108.89 lakh tones of sugarcane and produced 13.73 lakh tones sugar during the year 2010-11. Shri. Tatyasaheb Kore Warana Sahakari Sakhar Karakhana Ltd. Warananagar was selected because this sugar factory is the first in the country which has assisted 4 sugarcane producer/grower members to purchase sugarcane harvesters during 2010-11 to overcome the labour problem in sugarcane harvesting.

The detail data on harvesting of sugarcane by 4 sugarcane harvester operating in the factory area for the year 2011-12 were collected to know the average investment required for sugarcane harvester and to estimate average fixed cost and variable cost, net profit, per tone cost of sugarcane harvesting by personnel visits. The data were also collected from sugar factory officials, sugarcane harvesters and 30 sugarcane cultivators, whose sugarcane has been harvested by sugarcane harvester to know the problems regarding mechanical harvesting of sugarcane and suggestions to overcame them. The statistical tools viz., averages, percentages and standard cost concepts viz., fixed costs, variable costs, net profit were utilized to fulfill the objectives. The partial budget technique was utilized to judge the increased economic efficiency of sugarcane harvester.

Results

i. Economics of Sugarcane Harvester

The general information of Shri. Tatyasaheb Kore Warana Sahakari Sakhar Karakhana Ltd. Warananagar and the sugarcane harvester is given in Table 1.

Table 1 General information of the sugar factory

Sr. No.	Particulars	
1	Year of establishment	1955
2	Members	20013
3	Operational area (No. of villages)	80
4	Daily crushing capacity (tones per day)	7500
5	Total number of crushing days	167
6	Total area under sugarcane crushed (ha)	16425
7	Harvested by machine (ha)	732.50 (4.46%)
8	Total Sugarcane crushed (tones)	1390123
9	Harvested by machine (tones)	62037 (4.46%)
10	Amount provided to producer member for purchasing of Sugarcane harvester (Rs. in lakh))	10
11	Rate for manual harvesting (Rs. /tones)	189.50
12	Rate for Mechanical harvesting (Rs. /tones)	300.00

Shri. Tatyasaheb Kore Warana Sahakari Sakhar Karakhana Ltd. Warananagar was started in the year 1955 and have completed 58 years of its operation. It can be observed from the Table 1 that, sugar factory has its jurisdiction or area of operation in 80 villages from Kolhapur and Sangli districts. The crushing capacity of the sugar factory is 7500 TCD and crushing season for the year 2011-12 was of 167 days. During the year 2011-12 the sugar factory has crushed 13.90 lakh tones of sugarcane which was harvested sugarcane from 16425 hectares of land. The sugarcane harvested by machine was to the tune of 62037 tones which was harvested from 732.5 hectares. The sugar factory has given **Rs.** 189.50 per tonne for harvesting of sugarcane manually and **Rs.** 300 per tonne for mechanical harvesting. The sugar factory has assisted producer member by providing an amount of **Rs.** 10 lakh (without interest) for each which has to be repay within five years.

ii. Investment details of Sugarcane harvester

The sugarcane harvester is self-propelled machinery which harvests the cane from the field in segments and fill it into trolley. The machine cuts the stalks at the base, strip the leaves off and then cuts into segments, then these are deposited either in container of separate vehicle travelling alongside and waste material is then ejected on a back on to the field. The information on technical details and investment of sugarcane harvester operating in the jurisdiction of Shri. Tatyasaheb Kore Warana Sahakari Sakhar Karakhana Ltd. Warananagar is depicted in Table 2.

Table 2. Investment details of the Sugarcane harvester

Sr. No.	Particulars	Qty.	Name of Supplier	Rate (Lakh Rs.)	Value (Lakh Rs.)
1	Sugarcane Harvester CASE IH AUSTOFT A-4000	1	New Holland Fiat (India) Ltd	85.00	85.00 (75.22)
2	Tractor New Holland 3630TX-55 HP	2	New Holland Fiat (India) Ltd	6.35	12.70 (11.24)
3	Enfilder New Holland Enfilders	2	New Holland Fiat (India) Ltd	6.50	13.00 (11.50)
4	Shed	1	-	-	0.50 (0.45)
5	Salary (Operator)	1	-	-	1.80 (1.59)
6	**Total**	-	-	-	113.00(100.00)

It can be seen from the Table 2 that, the sugarcane harvesters operating in the sugar factory area are of type CASE IH AUSTOFT A-4000 alongwith two New Holland Enfilders and two New Holland 3630TX-55 HP tractors were supplied by New Holland Fiat (India) Ltd. The initial investment for the sugarcane harvester was **Rs.** 113 lakh. The major investment of **Rs.** 85 lakh was in the sugarcane harvester which contributes more than 75 per cent of total investment followed by investment on Enfielders and Tractors.

iii. Profitability of Sugarcane harvester

To know the profitability of sugarcane harvester, it is essential to estimate average annual total cost incurred on operating sugarcane harvester and average annual income generated from harvesting of sugarcane. Total annual costs comprises of fixed costs and variable or operating costs. The information regarding fixed costs and variable costs of the sugarcane harvesters are presented in Table 3 and Table 4, respectively.

a. Fixed cost of Sugarcane harvester

The average fixed cost comprised of depreciation of sugarcane harvester, enfielder, tractor, shed, annual payment for the manager and interest on fixed capital. Previously, it was decided that, the State Government will provide subsidy of Rs. 25 lakh and Central Govt. will provide subsidy of Rs. 25 lakh to the sugarcane harvester buyers. Recently during the year 2012-13, the State Government has taken decision to give Rs. 50 lakh subsidy to the buyer of sugarcane harvester under RKVY scheme. So fixed cost was estimated under there different situations and presented in Table 3.

Table 3. Average Fixed cost of the Sugarcane Harvester (Rs.)

Sr. No.	Particulars	Without subsidy	Subsidy (Rs.. 50 lakhs)
1	Depreciation of Harvester	3.50625 (19.51)	144375 (12.99)
2	Depreciation of Enfilder	73959 (4.12)	75706 (6.81)
3	Depreciation of Tractor	75706 (4.21)	81529 (7.33)
4	Depreciation on building/ Shed	4950 (0.28)	4950 (0.45)
5	Interest on fixed capital	1112000 (61.87)	625000 (56.23)
6	Permanent labour / Manager	180000 (10.02)	180000 (16.19)
	Total	1797240 (100.00)	1111560 (100.00)

It can be revealed that, fixed costs under without subsidy situation was Rs. 17.97 lakh whereas it was only Rs. 11.12 lakhs under situation when subsidy of Rs. 50 lakh is provided. The interest on fixed capital was the major item which contributes 56 per cent to 60 per cent of total fixed costs followed by depreciation on sugarcane harvester and payments to the manager.

b. Variable costs of Sugarcane harvester

The information on average variable costs of sugarcane harvesting unit are depicted in Table 4.

The variable costs regarding sugarcane harvesting unit includes the expenditure on fuel i.e. diesel and lubricating oil, grease, insurance, repairs and maintenance, salary paid to the operators and assistants and interest paid on working capital. The total number of working days of the Sugarcane Harvester were 130 days and total cane harvested during study year was to the tune of 14300 tonnes with average harvesting of 110 tonnes per day.

Table 4 Average annual variable cost of Sugarcane harvester (Rs.)

Sr. No.	Particulars	Qty.	Rate (Rs.)	Value (Rs.)	Percent to total
1	Diesel (Lit.)	28600	41.50	1186900	58.90
2	Lubricant Oil (lit)	500	250	125000	6.20
3	Grease			50000	2.48
4	Insurance			54000	2.68
5	Repairs			150000	7.44
6	Salary			235000	11.66
	Operators				
	a) Driver	2	42500	85000	4.22
	b) Assistant	4	37500	150000	7.44
7	Miscellaneous			100000	4.96
8	Int. on working capital			114054	5.66
	Total variable cost			2014954	100.00

It can be concluded that the average annual variable costs for sugarcane harvesting unit was Rs. 20.15 lakh, out of which cost on fuel i.e. diesel has major share of about 59 per cent. The share of expenditure on the salary of operator, drivers and assistant was 11.66, whereas repairs and maintenance also contributed significantly in total variable cost.

c. Economic viability of Sugarcane harvester

Different undiscounted (pay back period) and discounted measures viz., BCR, NPW and IRR has been considered for economic appraisal of any project. To assess the economic viability of investment in sugarcane harvesting project at different situations i.e. without subsidy, subsidy of ` 25 lakh and Subsidy of ` 50 Lakh different appraisal measures has been estimated and presented in Table 5.

It is evident from the Table 6 that the fixed costs decreased from ` 17.97 lakh to ` 11.11 lakh as subsidy of ` 50 lakh has been considered. The net benefit increased from ` 5.02 lakh to ` 11.88 lakh for the same situation. The pay back period which was 23 years would decrease to 10 years by providing the subsidy to the purchasers of Sugarcane harvesters. The per tone cost of sugarcane harvesting was observed to be ` 267 in without subsidy situation and ` 219 in ` 50 lakh subsidy situation.

The present value of costs and returns for 10 per cent discount rate for different situations were considered to estimate discounted Benefit Cost Ratio (BCR), Net present Worth (NPW) and Internal Rate of Return (IRR). The magnitudes of BCR (1.37 to 1.63), NPW (` 116.75 to 166.75 lakh) and IRR (15.27 to 17.53 per cent) has improved under ` 50 lakh subsidy. It could be concluded that, the provision of subsidy for purchasing Sugarcane Harvester is essential to improve BCR, NPW and IRR

Table 5. Economic viability of Sugarcane harvester

Sr. No.	Particulars	Without Subsidy	Subsidy 25 lakhs	Subsidy 50 lakhs
1	Quantity of Sugarcane harvested (tones)	14300	14300	14300
2	Total Returns (₹)	4315000	4315000	4315000
3	Fixed Cost (₹)	1797240	1464685	1111560
4	Variable cost (₹)	2014954	2014954	2014954
5	Total cost (₹)	3812194	3479639	3126514
6	Net Benefits (Rs.)	502806	835361	1188486
7	Per ton cost of harvesting (₹)	267	243	219
8	Payback period (Years)	23	14	10
9	B:C Ratio (at 10 % Discounting Rate)	1.37	1.49	1.63
10	NPW at 10 % discount rate (₹. Lakh)	116.75	141.75	166.75
11	Internal Rate of Return	15.27	16.4	17.53

d. Break Even Analysis of Sugarcane harvester

The break-even analysis helps sugarcane harvester owner to take the decision regarding how much quantity of sugarcane must be harvested during the season. The break-even quantity of sugarcane harvested by the machine at different situation is worked and presented in Table 5.

The sugarcane harvester under the no subsidy situation must harvest 11296 tonnes of sugarcane in a year to meet the expenses incurred on the machine or avoid the losses. The sugarcane harvesters under study has harvested more than 14000 tonnes of sugarcane indicated that they are operating in profit or in benefit zone. The quantity of sugarcane to be harvested decreased when the amount of subsidy is considered. The margin of safety quantity for sugarcane harvested by harvester was around 3000 and 7300 tonnes in without and with subsidy situation.

Table 6. Break even analysis for Sugarcane harvester

Sr. No	Particulars	Without Subsidy	Subsidy Rs. 50 lakhs
1	Rate for Sugarcane harvesting (Rs../tonne)	300	300
2	Total Fixed Costs (Rs.)	1797240	1111560
3	Av. Variable Costs (Rs../t)	140.91	140.91
4	Break-Even Point (tonnes)	11296.71	6986.81
5	Margin of safety (tonnes)	3003.29	7313.19
6	Break-Even Point (Rs.)	3389013	2096042

iv. Opinion of sugarcane cultivators regarding use of sugarcane harvester

The opinion regarding benefits and problems in mechanical harvesting of sugarcane were collected from 30 sugarcane cultivators in the operational area of the sugar factory and presented in Table 7.

It can be revealed from the Table 7 that, all sugarcane cultivators i.e. 100 per cent opined that mechanical harvesting of sugarcane is beneficial as it clears the sugarcane field within short period of time. More than 80 percent sample cultivators reported that mechanical harvesting resulted in to reduction in cost of stubble shaving and addition of organic material in small pieces which can be easily decomposed. Most of the sample cultivators (73.33 per cent) thought that mechanical harvesting is useful in good ratoon crop due to

harvesting at one stoke and good beneath the ground. Around two third sample cultivators reported that, the reduction in incidence of white grub and shoot borer attack in the field due to mechanical harvesting.

Most of the sample cultivators reported that, the existing sugarcane harvester are not suited for small fields (93.33 per cent), unavailability of good approach roads (86.67 per cent), wastage of cane while filling in Enfielder and under the tyres of machine (66 per cent) are the major constraints in mechanical harvesting of sugarcane. Majority of sample cultivators (90 per cent) suggested that the sugarcane harvester with less weight and suited for small fields should developed and some of them opined that there should be special arrangement for getting sugarcane tops which can be utilized for green fodder.

Table 7 Opinion of sugarcane cultivators regarding use of sugarcane harvester

	Particulars	**Number**	**%**
	I. Benefits		
1	Harvesting of sugarcane within short time	30	100.00
2	Increased yield due to harvesting of cane at ground level	28	93.33
3	Saves additional expenses spent on stubble shaving	26	86.67
4	Addition of valuable organic matter which are left in the field as small pieces get easily decomposed	24	80.00
5	Better ratoon rejuvenation as harvesting is done well beneath the ground level	22	73.33
6	Reduced attack of white grub in next season	20	66.67
7	Results in better ratoon performance as harvesting operations are taken up in one stretch	18	60.00
8	Reduced attack of early shoot borer due to sugarcane trash cover in the field	16	53.33
9	Increase in yield as harvested cane is delivered to the factory within 1- 2 hours of harvest	13	43.33
	II. Constraints		
1	Requires large plots/ not applicable to small holding lands	28	93.33

2	Good approach roads are needed to reach machine to field	26	86.67
3	Wastage of cane while filling cane in Enfielder and under the tires of the machine	20	66.67
4	More expenditure on tillage operation as field became compact due to heavy weight of machine	19	63.33
5	Non availability of green fodder	18	60.00
6	Irrigation has to stop before one month of harvesting which may cause loss in weight	16	53.33
7	Loss in weight as cane cut into small segments	12	40.00
	III. Suggestions		
1	The weight of harvester be reduced to avoid compacting of the field	27	90.00
2	Small harvester be developed to harvest small field	26	86.67
3	Machine should be developed which has arrangement to cut green fodder	22	73.33
4	Machine should be developed separately which cut sugarcane in to two to three pieces	18	60.00

v. Problems faced by sugarcane harvester owner

The information regarding problems faced by the sugarcane harvester owners is presented in Table 8.

The cent per cent sugarcane harvester owners have problem regarding subsidy for their machine. The sugar factory has provided an amount of ` 10 lakh without interest for five years, but they received the subsidy declared by the government during the year 2013. They complained about the low rate of sugarcane harvesting and high rate of interest charged by the bank for the loan. They were also facing problems regarding repair and maintenance of sugarcane harvester because there are only two company technicians available to attend their complaints. Unavailability of spare parts and high cost of spare parts is another problem reported by all sugarcane harvester owners. Problems regarding the harvesting at field level were small size of plot, spacing between the rows, lodging of cane and bad approach roads.

Table. 8. Problems faced by sugarcane harvester owners

Sr. No.	Particulars	Number	%
1	Subsidy not received in time	4	100.00
2	Low rate for per tone harvesting of sugarcane	4	100.00
3	High interest rate for finance	4	100.00
4	Costly spare parts	4	100.00
5	Bad condition of approach roads	4	100.00
6	Non availability of technician in time	3	75.00
7	More number of tractors should made available for transporting the cane to the factory	3	75.00
8	Small size plots, different spacing , lodged sugarcane	3	75.00

vi. Opinion of the sugar factory officials

The opinions of officials working in the agriculture development section of the sugar factory regarding mechanical harvesting of cane were collected. The officials strongly recommended to increase acreage sugarcane harvesting as they are facing problem of labour shortage. They pointed out that, the sugar factory would receive fresh cane continuously which will result in increasing sugar recovery and avoid no cane situation. No cane situation for one hour results in loss of ` 50000/- for the sugar factory.

Conclusions

1. Shri. Tatyasaheb Kore Warana Sahakari Sakhar Karakhana Ltd.Warananagar, District Kolhapur harvested 13.90 lakh tones sugarcane during the year 2011-12 out of that 4.46 per cent (0.62 lakh tones) sugarcane was harvested mechanically by Sugarcane harvester

2. An investment of ` 113 lakh was made to have sugarcane harvesting unit including a Sugarcane Harvester, two Enfielders, two Tractors and a shed for harvester. The Sugar factory assisted the producer members to purchase sugarcane harvester by providing interest free amount of ` 10 lakh having repayment period of five years.

3. The major item of fixed costs for having sugarcane harvester was interest on working capital which accounts for 56 to 61 per cent followed by depreciation on harvester.

4. The variable costs of sugarcane harvester was to the tune of ` 20.15 lakh out of which 60 per cent spent on diesel and 11.66 per cent on expenditure on salary.

5. The quantity harvested by a sugarcane harvester was 14300 tonnes and income generated by the machine was ` 43.15 lakh. The different financial efficiency ratios showed that for earning one rupee income from sugarcane harvester one has to spent 42 paisa on fixed and 47 paisa on operating expenses.

6. Considering the present cost and investment situation and providing Rs. 50 lakh subsidy, it would take 10 years to repay investment made on sugarcane harvester.

7. The Sugarcane harvester is more economic viable under ` 50 lakh subsidy as the magnitudes for BCR (1.63), NPW (166.75 lakh) IRR (17.53 %) and Break Even Point (6986 tonnes) better than the no subsidy situation.

8. Quick and ground level harvesting, increase in production, addition of sugarcane trash, good emergence of ratoon, low incidence of pests were major benefits reported by the sugarcane cultivators who, harvested their cane by machine, whereas small plot size, planting distance, non availability of green fodder were the constraints faced by them in mechanical harvesting of sugarcane. They suggested to develop harvester useful for small plots with less weight.

9. Delay in getting amount of subsidy, low rate for harvesting, unavailability of technicians and costly spare parts were the major problems faced by the Sugarcane harvester owners.

9. Suggestion

Based on the results of the study, it is revealed that mechanical harvesting of sugarcane was found good for all parties i.e. sugarcane harvester owners, sugarcane growers and sugar factory. For sugarcane harvester owners the investment on purchase of sugarcane harvester was economically viable (BCR>1, positive NPW and IRR is greater than the market rate of interest), it was beneficial to sugarcane growers as it saves more than ` 4000/- per hectare, good ratoon and lowers the pest attack whereas for the sugar factory, it mitigate the problem of labour shortage, receives continuous and fresh sugarcane which helps in increased sugar recovery and there is no fear of no cane situation.

So, it is suggested that the mechanical harvesting of sugarcane should be motivated by providing subsidy to the purchaser of sugarcane harvester as the investment in the venture is found economically viable.

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ABSTRACTS

An Exploratory Study of Farmers' view Improved sorghum cultivars in Solapur District, Maharashtra

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The study reported here involved a survey of rabi sorghum farmers of Solapur district, Maharashtra, India, in 2012-13 to determine the level of rabi sorghum and what producers thought were the preferences to improved sorghum cultivars. Rabi sorghum is a major part of Solapur district's agricultural economy. The data was collected from three talukas of Solapur district namely North Solapur, South Solapur and Mangalewada. 100 farmers were involved in the study. Secondary source of data was used for collection of information on the area, production and yields of sorghum in the district.

The assessment of rabi local landraces revealed that these have distinctly lustrous, bold and globular grain, unlike the improved cultivars. Farmers prefer tall sorghums with long and large leaves without lodging at maturity and with globular, bold and lustrous grain on an ear, semi-compact ear head with little exertion for cultivation in rabi.

Suggested preferences towards improved cultivars were generally ranked as significant, but the top three preferences were identified as high yielding, fodder quality and roti quality Consequently, research and extension programming has to focused on good sorghum cultivars with the above three characters.

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Comparative economics of onion production under drip and surface irrigation methods in Ahmednagar district

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This study is based on a sample of 30 drip adoptors and 30 drip non-adoptors drawn from 10 villages (5 each from Kopargaon and Parner tahsils). The NPW, IRR and BCR were computed to judge the economic viability of investment on drip set. The study reveals that the area occupied by onion was 21.20 per cent of the GCA of drip adoptors and that of drip non-adoptors, it was 20.81 per cent. Cropping and irrigation intensities were 150.77 and 169.62 per cent. While, such intensities in case of drip non-adoptors were 152.53 and 55.21 per cent. The per hectare total investment on drip set for onion was Rs.

109868.50. The important investment items were expenditure on purchase of inline (65.43 per cent), PVC pipe for main line (13.68 per cent), screen filter (5.30 per cent) and vat (4.76 per cent). The per hectare drip set net investment was Rs. 51176.94 (46.58 per cent). The per hectare cultivation cost of onion produced by drip adoptors was Rs. 128632.05 and it was Rs. 115788.84 for drip non-adoptors. The rental value, hired human labour, interest on fixed capital, seed, machine labour and depreciation on drip components were major items of total cost. The per hectare total human labour saving was of 36.65 mandays in case of drip adoptors as compared to latter. The per hectare saving of bullock labour use for drip adoptors was 1.23 pairdays than that of non-drip farms. The highest human labour saving was in case of irrigation operation for drip farms (204.52 per cent). In absolute terms, it was of 20.82 mandays. As against non-drip farms, the human labour saving for weeding was 23.13 mandays for drip farms. The onion productivity was higher by 22.45 per cent in case of drip adoptors than that of latter. In respect of drip farms, the net returns from onion crop were estimated to Rs. 88294.23. Such returns were higher by Rs. 32451.44 than the latter. In case of former, the per quintal cultivation cost of onion was Rs. 446.59 and it was Rs. 492.24 in regard to non-drip farms.The investment on drip irrigation set was found economically viable since BCR was more than unity (i.e.1.69, 1.61 for with/without subsidy options) and present worth of gross income was higher than that of costs at 20 per cent discount rate. The high investment cost, irregular electric supply, spare parts are costly and procedure intricacies to obtain loan/subsidy, problem of rodents were major problems in operation of drip set. The drip farmers pointed out minor problems as lack of after sale service, spare parts do not available locally, inconvenience to perform interculturing operations. Based on the study results, it is recommended that the adoption of drip irrigation method be encouraged among the farmers with increased government subsidy on drip set investment for efficient use of water and nutrient.

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Study of Engineering Properties of Low Cost Roofing Material

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The roofing material was made by the oxides of Aluminium, silicon,magnesium are the most important basic materials used in manufacturing of roof tiles and the shape of mould was hollow cylindrical tapering glass for this study. The goal of this study was to see the engineering properties& comparison between the conventional low cost roofing material and non- conventional roofing materialby using a mixture ofclay soil with 20% saw dust.The engineering properties such as compressive strength, dead load and water absorption capacity were studied.The temperature oflow cost material (non-conventional)was found less as compare to the conventional material.The compressive strength for non-conventional material was found in the range of 2 – 2.20 KN and for conventional material was 1-1.12KNThe water absorption was found 17.42% for

conventional material and for non-conventional material was found to be 21.41%.The dead load was also found less as compare to the conventional material. Thestructure made by non-conventional material will be more suitable for earthquake resistancezone. It was found that about 26.11% and 22.68% construction cost, including materials and labour cost, can saved by using the low cost housing Structure in the comparison with traditional construction method for walling and roofing respectively.

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Water Resource Management in Vidarbha

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The study focused on the water as resource in vidarbha and its management in all districts of Vidarbha region. For this study secondary data were collected from handbook of statistics on Indian Economy and Economic Survey of Vidarbha for the year 2010 and 2011. The finding of the study reveals that, the in vidarbha area estimates of wetland in Vidarbha was 284396 ha. Potential created 1102.35ha.while actual area was about 522.09 ha. and the percentage of actual area to potential created was 47.36 %.

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Response Surface Methodology of Osmotic Dehydration for Sapota Slices

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Osmotic dehydration is a widely accepted pre-treatment method of partial removal of water by submersing fruits in sugar/salt solution. The goal of this work was to optimize the process parameters during osmotic dehydration of sapota. Water and sugar transfer were quantitatively investigated during osmotic dehydration of sapota slices using response surface methodology with the temperature (40–60 ^{o}C), processing time (120 - 240 min), sugar concentrations (40–60 ^{o}B) and solution-to-sample to ratio was constant (5:1) being the independent process variables. Quadratic regression equations describing the effects of independent process variables on the water loss (WL), solid gain (SG) and water reduction were developed. It was found that concentration of sugar solution and temperature were the most significant factors affecting the water loss and sugar gain during osmotic dehydration of beet root followed by temperature. Effect of temperature and time were more pronounced for SG than the concentration of sugar solution. The osmotic dehydration process was optimized for water loss and sugar gain. The optimum conditions were found to be: temperature 47.36 ^{o}C; immersion time 167.85 min; sugar concentration 53.53 ^{o}B. At

these optimum values, water loss and solid gain were found to be 27.72% and 8.25%. Conformance of experimental results with the empirical model was evaluated using correlation coefficient (R) which was found for the proposed model as, R = 0.997 for water loss and sugar gain, respectively.

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Farm Mechanization for Sustainable Agriculture

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The role of agricultural mechanization is very important to bring the improvement in the present scenario of agriculture in the state. Various farm operations need to carry out using agricultural machinery, implements and tools. Availability of adequate farm power viz. mechanical, animal, human etc. is very crucial for timely operations for operating machinery, implements and tools for increasing production , productivity and handling crop produce to reduce the losses. Agricultural mechanization is essential for timeliness in agricultural operation, better quality work; reduction is human drudgery and cost of operation and healthy agriculture. Most of the state is under rain fed agriculture and land holding per head is very less and going down drastically. Promotion to custom hiring practice of machinery, tractors, power tillers, cooperative management of machinery through social groups, better sale-service network, increase in direct subsidy to marginal and medium farmers, credit facility from banks at lower interest rate, massive awareness amongst farmers etc. are some of key points for betterment of small and marginal farmers. Production and making available the identified tools and equipments, identification of local agency for its sales promotion and also for custom hiring services will have to emphasize. The transfer of technology will take a boost if the strong linkage between researchers, extension workers and farmers is established. Key word – Mechanization, Sustainable, Farm Power, Mechanization Status.

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Stochastic Production Function Approach in Gram Production

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Gram is one of the most important of pulse crop grown in the region during rabi season. The production technology include the adoption of improved and recommended practices for yield maximization. The impact of different package of practices on productivity and their by production is the need of day.

The frontier production function approach helps in estimated the allocative, technical and economic efficiency in the crops production. The average variation among the adoption of technical efficiency ranges between 66.48 per cent to 94.50 per cent with the average technical efficiency of the farmer 89.42 per cent. The human labour and Bullock labour and seed are the most significant contribution in gram production. The 73 per cent cultivator have more than 80 per cent technical efficiency while 26.50 per cent farmers are cultivating the Gram with lesser efficiency. The allocative efficiency and economic efficiency can be increased 11.37 per cent and 18.58 per cent respectively.

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Statistical aspects of production function in Tur production

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As per the population census 2011. The Maharashtra population is above 11 crores. Tur is one of the important kharif pulse crop grown in rainfed region. The increase in productivity as a source of economic growth has been devised as technological change. In the present study is the use of resources efficiency across the farmers with respect to production on Tur. In the present study, the technical efficiency in tur production with the use of frontier production function has been studied.

The result of production function analysis indicated that almost that all variable who contributed significantly in Tur production are not used optimistically. The 67 – 97 per cent variation was observed in technical efficiency across the individual cultivator. The average technical efficiency was 86 percent indicate the scope for increased the technical efficiency. The allocative efficiency and economic efficiency can also be increase by 17 per cent and 29 per cent respectively.

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Impact of Drum Seeder Technology on Rice Cultivation

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The drum seeder technology has impact on reducing cost of cultivation of rice. Hence, a study was conducted on farmers field in the year 2012-13. The results of study on use of drum seeder for direct seeding in rice field revealed that due to direct seeded method there was saving in human labour [21.1 human days], bullock labour [3 pair days]. The total per hectare cost of cultivation of rice in transplanting method was more [Rs. 59422.62] than direct seeded method [Rs. 54929.57]. There was increase in yield by 1

quintal in direct seeded method. The net profit at cost A was more in direct seeded method [Rs.36634.63/ha.] than transplanting method [Rs.28129.78/ha.] due to saving in hired labour cost (Rs.6248.4/ha.). This technology of drum seeder is of immense use on *wapsa condition* [70% farmers opinion], it would be very convenient in rabi season [100% farmers].

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Impact of Dead Furrow Planting Method on Productivity of Soybean in Amravati Region under Rainfed Situation

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Taking into consideration the problems of soybean Cultivators in nearby areas of Amravati such as soil moisture shortage at grain development stage, excessive growth of soybean crop, heavy infection of Girdle beetle, Semilooper, hairy caterpillar, tobacco leaf eating cater pillar; improper grain setting in pods etc. Accordingly, Dead Furrow planting method was suggested to soybean cultivators to overcome above problems in farmers meet held during summer season i.e. April – May 2013 at adjoining place of Amravati as well as through an article published in Agrowon daily news paper. Accordingly some of farmers have adopted Dead Furrow planting method during Kharif season 2013-14 for sowing sole soybean crop. Productivity of soybean crop under dead furrow method of sowing and conventional method of sowing was compared to identify efficiency and effectivity in terms of grain yield. Accordingly overall 51.95% increase in grain yield was observed in Dead Furrow method of sowing as compared to conventional sowing method. Average productivity in Dead Furrow method is 23.79 qt/ha as compared to 15.66 qt/ha in conventional method of sowing. It means on an average 8.13 qt / ha yield increases in Dead Furrow method is obtained as compared to conventional method. Thus monetary advantage in Dead Furrow method of sowing is Rs. 28886.35 per ha taking into consideration current market price of Rs.3550/- per qt of soybean grain.

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Economic Impact of Gram Technologies developed by MPKV, Rahuri in Western Maharashtra

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Pulses play a vital role in improving soil health and conserve natural resources which are essential for sustainable agriculture. The pulse crops are important to provide high value food, nutritional security and to alleviate malnutrition of poor masses. In India, the area under total pulses during the year 2011-2012 was 24.8 Million ha.(kharif-11.3Mha and rabi-13.4 Mha) with the production of 17.2 million tones. The area under

gram crop during the specified period was 8.3 Million ha. with production 7.6 million tones while in Maharashtra, the area under total pulses was 3297 thousand ha with 2,310 thousand MT of production and average productivity of 701 kg/ha during 2011-12. The area under gram was 1075 thousand ha with 857 thousand MT of production and average productivity of 797 kg/ha during 2011-12.

This study has been carried out in 16 tahsils of Western Maharashtra. On the basis of operational holding, 30 farmers were selected randomly i.e. 10 from each of the category of small (up to 2.00 ha.), medium (2.01 to 4.00 ha.) and large size farms (4.01 ha & above.). Thus in all, 70 gram growers from 16 clusters were selected for the study. The data pertaining to 2011-2012 were collected.

The study revealed that Gross cropped area of sample cultivators was 4.64 ha. Out of which 35.31 and 50.34 per cent area was occupied by *kharif* and rabi crops, respectively at overall level. The area allotted for Gram was about 9.62 per cent, at overall level. The cropping intensity had decreased trend with the level of adoption.

The total cost of cultivation increased with increase in the level of adoption among the different adoption groups. That means higher the adoption of new and improved technologies, there is ultimate increase in the costs of cultivation.

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Mechanism for Reducing Drudgery of Farm Women

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After harvesting Roselle from the plant, the calyses are separated/ detached manually , these Roselle calyses are then used for preparing different value added products e.g. sharbat, Jam, syrup, pickle, Roselle supari etc. the manual method is laborious and time consuming. With the increasing demand of calyces for preparing various value added products there was an urgent need to develop a detacher for calyces separation/ detaching from Roselle fruit and hence Roselle calyces detacher (RCD) was developed. The developed detacher consist of cutting blade, cutting blade holder, spring and rivet arrangement. The Detacher is a manual hand operated tool with wt. of 125 g and overall dimensions of 225 mm x 105mm x 20mm .

The average percentage of calyces and seed capsule were found to be 50.64 (±2.726) and 49.36 (±2.726). The manual calyces detaching efficiency was observed to be 68.9 ± 4.51 % and by Roselle Calyces detacher (RCD) was observed to be 96.8 ± 1.23%. According to the the ergonomical observations it was observed that detaching of Roselle calyces falls under LIGHT WORKLOAD. It is recommended to use Roselle calyces detacher (RCD) for detaching calyces from Roselle fruit as the capacity of RCD is 5.62± 0.918 kg/h.

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Economics of Farm Machinery in Agriculture: An Overview

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The use of advanced machines in the farm operation has great importance to reduce the cost of operation and to enhance the yield of crop. Present paper emphasis on the economics of farm machines in the farming operations. The two machines viz, BBF planter cum inter row cultivator and the turmeric harvester have been considered to evaluate the economics of sowing and harvesting operation. The cost of operation of BBF planter based sown crop is minimum as compared to the other method of sowing. The planting of crops by the BBF planter have shown the higher yield (10 to 15 %). Another machine i.e., turmeric harvester has been evaluated in the farm for its economic feasibility. The harvesting of turmeric crops by the machines saves more than 30 per cent cost as compared to the traditional method of operation. This paper also put the SWAT analysis of agricultural mechanization in the state of Maharashtra. An overview of challenges and possible solution of farm mechanization in the Vidarbha region has been narrated in this paper.

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Impact of Improved Vegetable Production Technology in Maharashtra

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The new production technologies through intensive research may result in increased real income to the consumers through decline in prices, relative of crops as a result of reduction in unit cost. The decline in food prices as a result of technological change would redistribute income in favour of consumers. The paper envisages the detailed analysis of assessment of improved vegetable production technologies on production, resource use economic surplus estimates of vegetable growers in Maharashtra. Among the adopters, maximum share of total cropped area was observed under cereals crops (34.15 %) followed by vegetable crops (25.61 %). Among the non adopters, cereals crops contributed maximum area (38.25 %) followed by vegetable crops (28.85 %). The adoption rate of improved variety above 75 per cent level was found in case of 79.80, 99.17, 59.36, 47.37 and 50.54 per cent for onion, tomato, chilli, brinjal and okra, respectively and the adoption level of remaining vegetable growers was below 25 per cent. As regards the seed rate used the adoption rate was above 75 per cent. The level of adoption above 75 per cent in case

of FYM use was found in case of 24.28, 46.28, 31.96, 27.20 and 17.20 per cent of onion, tomato, chilli, brinjal and okra growers. The maximum number of vegetable growers level of adoption of fertilizer application was in the range of 50 to 75 per cent.

The monetary benefits accrued for both to the producers and consumers of vegetables in Maharashtra due to adoption of recommended vegetable production technology were estimated in respect of major vegetables viz. chilli, okra, brinjal, onion and tomato. The net present value of cultivation of major vegetables was estimated to Rs. 4849 crores and in case of chilli, okra, brinjal, onion and tomato it was Rs. 1521, Rs. 672, Rs. 46, Rs. 1134 and Rs. 1476 crores respectively. The benefit –cost ratio of an investment made in vegetable research was observed 1:89 for major vegetables in Maharashtra. Among the vegetables, the highest (Rs. 873 crores) consumers surplus was recorded in case of tomato and it was followed by chilli (Rs.621 crores), onion (Rs. 524 crores), okra (Rs. 299 crores) and brinjal (Rs.26 crores). The total surplus in vegetable cultivation especially of five major vegetables due to adoption of improved vegetable production technology was to the tune of Rs. 3168.48 crores and it was Rs. 988.57, Rs. 961.42, Rs. 741.53, Rs. 439.68 and Rs. 37.28 crores in case of chilli, tomato, onion, okra and brinjal respectively.

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Economic Analysis and Impact Assessment of Dry Land Technologies for Rabi Sorghum in Western Maharashtra

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The adoption of dry land technology is a production syndrome encompassing the use of pre-tillage operations for soil and water conservation, improved varieties, seed rate, manures, fertilizer, plant protection measures and interculturing practices. The study, therefore, was undertaken to assess the adoption level of dry land technologies and cost effectiveness in rabi sorghum and estimate the impact of dry land technologies of rabi sorghum on income, employment and gender. The factors influencing adoption level and constraints in adoption are also studied.

The study was undertaken in three districts viz; Ahmednagar, Pune and Solapur of the state as the area under rabi sorghum is more concentrated in these districts. The topic is selected under HOPE (Harnessing Opportunities for Productivity Enhancement) project. Three clusters were selected viz; Hiwarebazar (Ahmednagar District), Borkarwadi (Pune District), and Aurad (Solapur District).

Two villages from each cluster were selected on the basis of area under rabi sorghum. 90 farmers were randomly selected including 30 small, 30 medium and 30 large

farmers. 10 farmers from each size group from each district were selected for the year 2011-12. Thus, the total sample comprised of 90 sample farm. The classification of farmers on the basis of size of land holding as less than 5 acre, 5.01 to 10 acre and above 10 acre were considered as small, medium and large farmers.

According to Technology Adoption Index (TAI), below 39.53 per cent TAI (Mean-SD) were grouped as low adopter farmers, between 39.53 and 64.36 per cent TAI (Mean-SD to Mean+SD) were grouped as medium adopter farmers and above 64.36 per cent TAI (Mean+SD) were grouped as high adopter farmers.

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Economic Analysis of Aonla Processing Units in Maharashtra

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Investigation was carried out during the year 2011-12 in Marathwada region of Maharashtra. In all ten aonla processing business units were selected for the study. Cost concept of variable cost and fixed cost was used to determine profitability of different product enterprises and ultimately the profitability of the processing unit as whole. The results revealed that age old, educated, experienced and trained persons engaged in aonla processing business in the region. The unit as whole consisted with eight aonla product enterprises in which raw aonla was processed about 60 quintals in 75 days per annum.Net profit of the unit as whole was Rs.226020.05 in which aonla-murraba and aonla-candy enterprises were dominant. Cost of production of aonla-murraba was Rs.30.02 /kg which was the lowest among all the aonla products.

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Economic Impact of Summer Groundnut Technologies developed by MPKV, Rahuri

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The oilseed crops are important in human diet because they provide high oil percentage i.e. 42-52%, fatty acids and nutritive value. In Maharashtra, the area under total oilseeds is 3.88 million ha with production of 2.80 million tonnes and having average productivity of 725 kg/ha. In Western Maharashtra, area under summer groundnut was

41,700 ha, with the production of 6.75 lakh tonnes and having average productivity of 538.6 kg/ha (2010-11).

This study has been undertaken for research on adoption of recommended technologies, input gap, yield gap and the economics of production at different levels of technology of summer groundnut in the Western Maharashtra.

Ahmednagar and Jalgaon, the largest summer groundnut growing district of Western Maharashtra were selected purposively. The primary data collection for the year 2010-11 was carried out by survey method with specially designed schedules.

The selected sample cultivators were grouped as low, medium and high adopters on the basis estimated mean and standard deviation of Technology Adoption Index. The investment in agriculture of sample adopter groups increases from low group (₹ 394835) to high group (₹ 601814) and it was ₹ 476324.67 at the overall level. The area under summer groundnut crop was maximum (9.20 per cent) in low adopters followed by medium (8.03 per cent) and high adopter group (7.27 per cent).

Among the low, medium and high adopters the use of seed has varied from 58.60 to 85.39 kg/ha. The wide difference in the use of seed was attributed due to various factors like variety, method of planting, spacing, etc. A very negligible quantity of manure was used by the low adopters (0.09 tonn), while it was 2.59 and 2.95 tonn in medium and high adopters.

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Impact of Tillage Practices on Engineering Parameters under Cotton Cropping System

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The study was undertaken during the kharif season of 2010-11 at Agronomy Farm of Dr. PDKV, Akola. The five tillage treatments were Conservation tillage (CnT), Conventional tillage (CvT), Conventional tillage + Sub soiling (CvT+SS), Shallow tillage by tractor (STT) and Shallow tillage by bullock drawn plough (STB). The tillage treatments were evaluated for clay soil with split plot design under cotton cropping system [cotton + black gram (CB)] & [cotton+ pigeon pea (CP)]. The engineering parameters such as soil moisture content, bulk density, porosity, infiltration rate, hydraulic conductivity and penetration resistance (cone index) were considered for the study.

The treatment of conventional tillage with subsoiling recorded superior results in terms of moisture content(27.26%), bulk density (1.22 g/cm^3), porosity (53.52%), infiltration rate (3.33 cm/hr), hydraulic conductivity (38.6 mm/hr) and cone index (299.12 kPa). Improvement in the soil parameters was observed in a very deep

tillage treatment with subsoiler while the treatment of conservation tillage did not influenced the engineering parameters to an appreciable extent. The seed cotton equivalent yield under both the cotton based cropping systems were found highest in the treatement of 'CvT+SS' followed by the treatments 'CvT', 'STT' and 'STB' and lowest in the treatment 'CnT'.The interaction of very deep tillage practices with subsoiler alongwith cotton+pigeon pea cropping system was found to be most remunerative in terms of GMR, NMR and BC ratio.

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Economics of Processing of Mango in Gadchiroli district of Maharashtra

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The study entitled "Economics of processing of mango in Gadchiroli district", was conducted in one processing unit in the vicinity of Gadchiroli District during year 2010-2011. The data revealed that, the processing unit had a capital investment of Rs. 6.42 lakh. Quantity of mango processed products prepared by the unit was 460 kg/year. Mango pickle (78.26 per cent) and amchur (21.74 per cent), were the major mango products prepared by the unit. Major items of variable costs were in the packaging cost.

Net returns from mango pickle and amchur were Rs. 19,746.71 and Rs. 9,265.23 respectively. Input-output ratio for mango pickle was 1:2.72 and for amchur it was 1:2.35. Break-Even quantity was observed for Mango pickle and amchur was 6.00 kgs and 7.37 kgs respectively.

High packaging cost and spoilage due to shut down of electricity and hot climatic conditions were the major aspects affecting the profitability of mango processed products and major problems faced by processing units. Redressal of these aspects through alternative measures can certainly review the profitability of processing units. However, processing of mango products is a profitable business.

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Investigation on Energy and Techno- Economics of Solar Tunnel Drying System for Turmeric (*Curcuma longa L.*)

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A solar tunnel dryer (STD) was designed and fabricated for drying of turmeric in the Department of Unconventional Energy Sources, Dr. PDKV, Akola. Experiments for drying of Turmeric were conducted to test the performance of the dryer and its techno economic feasibility was tested. The results indicated that drying in solar tunnel dryer was faster as compared to open sun drying. The quantitative analysis showed that the traditional drying i.e., open sun drying took 4 to 15 days to dry the rhizomes while solar tunnel drier took only 1.5 to 4 days for the samples having different treatments and produced better quality produce. The maximum efficiency of solar tunnel dryer obtained were found to be 79.79 and 14.00 per cen. On the basis of economic analysis it is revealed that drying of 0.5 cm processed and fresh slice, 3 cm cut and whole processed turmeric seems to be economical in solar tunnel dryer. It was found that the system could maintain an adequate temperature in the range of 50 to 60^0 C required for drying. Energy economics for drying of 1000 kg of turmeric slices under solar tunnel dryer, and tray dryer were accomplished in 7930.75 and 14394.40 MJ as compared to 7213.06 MJ in existing open sun drying method. It is revealed that the saving of energy in STD over tray drying system were 44.90 per cent. Techno economics and energy analysis suggested that the solar tunnel drying system was found feasible in present energy scenario.

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Effect of Environmental Parameters on Leafy Vegetables in Shadenet House

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Environmental parameter temperature, relative humidity and light intensity concentration are the major factor for plant growth and they should within comfortable zone of plant for satisfactory results. Shadenet house are the framed or inflated structures, covered with different percent of shade net large enough to grow crops under partial or fully controlled environmental conditions to get optimum growth and productivity. Due to climate change farmers are facing a lot of problems in their traditional farming so for diversification ,cultivation of high value short duration crops in shadenet house is the best

solution for small farmers. They will get more returns and they can increase their economical status. Adoption of shadenet house technologies in this region will be helpful for the judicious use of water and gaining the economic advantages. The leafy vegetables like spinach, fenugreek and coriander were selected in white and green shadenet house for this study. The environmental parameters such as temperature, relative humidity, CO_2 concentration and light intensity at 8, 12 and 4 pm and biometric characteristic like height were measured daily in shadenet house. Very limited information is available regarding the cultivation of leafy vegetable in shadenet house, So this study will be taken with the objectives to study the effect of environmental parameters like temperature, relative humidity, Co_2 concentration and light intensity on the growth of spinach, fenugreek and coriander in shadenet house. The temperature in shadenet house is 2-3 ^{0}C less and Rh is 5 - 6 % more than the open field. The CO_2 concentration is in the range of 600 – 900 ppm in shadenet house.

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Impact Assessment: A Case Study of Bengal gram (Deshi) Pre-harvest Price Forecast Released by NAIP, AMIC, Dr. PDKV, Akola

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The present study was undertaken to analyze and capture the impact of price forecast of Bengal gram (Deshi) released by the NAIP, AMIC during February 2012. Monthly time series data on average prices of Bengal gram (Deshi) for the period from 2000 to 2012 were collected from APMC Akola. Various univariate time series models were tried to analyze the data and forecasted prices were calculated. Finally a market advisory was prepared and released through different mass media like news papers, voice SMS and university website. To study the impact assessment of price forecast out of 52 farmers who attended the training programme conducted by AMIC, Dr. PDKV, Akola at village Talegaon, taluka Telhara, District Akola about 39 farmers who adopted the advice were selected and interviewed.

It was found that Winters Multiplicative model was the best fit model with lowest MAPE. The price forecasted for the months from February to June 2012 was Rs.3000-3300 per quintal and higher prices could be received during April to May. Based on the above price levels farmers are recommended to store and sell from April to May. On an average 1.46 ha area was operated under Bengal gram (Deshi) crop by the selected farmers. Average price realized by the farmers during March-2012 was Rs.2800 per quintal, whereas those who retained Bengal gram (Deshi) according to advice given by AMIC, Dr. PDKV,

Akola realized Rs.3800 per quintal during May to June 2012. Thus, an incremental income realized to the extent of Rs.22374 per hectare by the farmers who sold their produce during May-June 2012.

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Technology Adoption in Gram Production

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The present investigation aims in studying the Technology adoption in Gram production. The present study based on secondary data procured from Agricultural Prices and Costs Scheme (APC) functioning in the Department of Agricultural Economics and Statistics, Dr. PDKV, Akola for the year 2012-13. The yield gap is considered as a function of level of adoption and the contribution of each technology in yield gap were worked out by fitting linear regression between the level of adoption of each technologies and yield gap. The analysis showed that out of 9 technologies, five technologies viz., preparatory tillage, sowing time, spacing, seed rate and N application have explained 82 percent contribution in Gram productivity. The technology adoption composite indices has resulted 58 cultivators in low level of adoption group and 32 in medium adoption group out of 90 gram cultivators. Not a single cultivator found in high adoption category. The technology adoption parameters like application N fertilizer, inter-culturing, preparatory tillage and seed rate are the major contributors for the gram production.

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Effect of Production Technology on Onion Productivity

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An investigation was carried out to study the effect of FYM, as source of N, on the growth and yield of onion (*Allium cepa* L.) cv. Nasik Red under irrigated condition at Horticultural Research Station Hidkal Dam during *kharif*2011.The maximum diameter of bulb (6.43 cm), higher fresh bulb weight of 98.13 g per plant and significantly highest bulb yield of 221.62 q per hectare was recorded in T_3 (75% N through FYM + 25% N through chemical fertilizer). However, T_1 (198.69 q/ha), T_2 (217.38 q/ha), and T_5 (218.71 q/ha) were found on par with T_3. The lowest bulb yield (163.46 q/ha) was recorded in T_6 (Control). The highest expenditure (Rs. 70,120 /ha) was made in T_4 (100% N through

FYM). Significantly higher gross return of Rs. 1, 32, 968 per hectare obtained through application of 75% N through FYM + 25% N through chemical fertilizer (T_3). While application of RDF (125:50:125 NPK kg/ha + 30 ton FYM/ha) (T_5)recorded significantly higher net profit of Rs. 77,790 per hectare and higher B: C ratio (2.48), followed by T_1 (2.15) and T_2 (2.16) and T_3 (2.04) were found on par with each other.

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Comparative Economics of Different Organic Treatments on Onion Production

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An investigation was carried out to study the effect of FYM, as source of N, on the growth and yield of onion (*Allium cepa* L.) cv. Nasik Red under irrigated condition at Horticultural Research Station Hidkal Dam during *kharif*2011.Significantlyhighest bulb yield (195.39 q/ha), as well as bulb diameter (5.88 cm), fresh bulb weight (86.48 g/plant) was recorded in T_4 (poultry manure equivalent to 100% RDN). Highest gross returns (Rs. 1, 17, 240 /ha) was also recorded in T_4(poultry manure equivalent to 100% RDN).On other hand application RDF (T_5) recorded significantly highest net returns of Rs. 54, 243 per hectare and also significantly higher B: C ratio (2.03) followed by the application of poultry manure (equivalent to 100% RDN) (1.78).However, T_4 (Rs. 51, 452 /ha) was on par with T_5in respect of net return. Among the different organic manures applied, as a source of N, poultry manure application was found good in increasing the yield and profitability in onion.

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Impact of Genetically Modified Crops on Productivity and Profitability: An Economic Analysis of Bt Cotton Cultivation

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Cotton production in India is at cross roads for the past few years**.** Till recently cotton was the hybrid that was at the focus but the era of genetically modified cotton has arrived. The impacts of genetically modified cotton on productivity and profitability have been assessed in cotton growing area of Western Maharashtra. The study is based mainly on primary data collected for the year 2008-09 and processed using Cobb Douglas production function. On an average, per farm area under Bt cotton was 2.27 ha, accounting for 69 per cent of the total land holding. With a yield of 24.50 qtl/ha, Bt cotton

has registered 32 per cent higher yield and 219 per cent higher net return over non Bt cotton, net additional benefit being Rs. 20418 /ha. The non Bt cotton farmers use chemical fertilizer, pesticides and bullock labour excessively which result in a lower net returns. Genetically modified technology has been found major contributor to the total productivity and profitability difference between Bt and non Bt cottons.

Non availability of quality seeds and in required quantity was the major constraint in adoption of technology in cotton cultivation. Higher productivity and higher profitability and lower pest problem have been quoted as the important factors behind preference for Bt cotton. However, high cost of seeds and incidence of pests and diseases other than bollworm have been observed as the major bottlenecks in cultivation of Bt cotton. The study has concluded that Bt cotton cultivation is technically more efficient than non Bt cotton. To foster adoption, availability of quality and quantity of Bt cotton seed to farmers needs greater attention of Govt. agencies.

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Post Harvest Losses in Tomato in Latur District of Maharashtra State-An Economic Evaluation

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Investigation was carried out during the year 2011-12 in Latur district of Maharashtra. In all sixty farmers were selected for the study on tomato production, marketing practices and losses incurred by farmers at the farm level and during transportation to markets. To study the post harvest losses in the marketing channels of tomato two varieties was selected for the present study. The results revealed that the respondents were in the group of middle age, education level was in primary level and the majority of respondents were medium farmers. At the farm level, the post harvest losses occurred during collection, sorting, packing and transportation. These losses occurred at farm level due to lack of storage facilities and improper handling. Storage of tomato was practiced neither at farm level nor at the trader level over a period of time. The overall post harvest losses were estimated to 35 kg per quintal of tomato. The post harvest losses in the market network were observed in each and every stages of handling. Plastic crates were used for long distant transportation and the packing losses were found minimum in the packing materials like plastic crates.

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To study the Prospects of Milk Sweet Makers and Constraints Faced by Milk Sweet Makers (*Halwai*) in Western Maharashtra.

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The present research work was undertaken in six district of Western Maharashtra viz; Jalgaon, Nasik, Ahmednagar, Pune, Satara and Kolhapur. Three hundred sixty respondents (milk sweet makers), sixty from each district were randomly selected for present study. The respondents were personally interviewed with the help of structured and pretested interview schedule. Disproportionate random sampling method was used to ensure a random selection of 60 milk sweet shop. The collected data was analyzed by appropriate statistical tools like frequency and percentage. In conclusion prospectus point of view sweet maker urge to (i) establishment of regulating authority/apex body for technical guidance and policy support for unorganized sector, (ii) maintain standards of basic nutrition and food requirement, (iii) increase benefit-cost (B:C) ratio and capacity building of labour through training for improving quality of milk products is the main prospects for milk sweet makers. In respect to constraint the raw material price inflation is the major constraint faced by them. It was followed by electricity problem, fluctuation and demand of milk product, increase in market competitor, availability of quality raw material and lack of availability of skilled labour, lack of guidance etc should be overcome by creating awareness among them.

THEME III - AGRICULTURAL FINANCE

Role of District Central Co-operative Banks in Rural Development of Maharashtra

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Agricultural credit is very important instrument in facilitating the process of agricultural development and thereby initiating the growth of rural economy. The role of agricultural credit and credit institutions in the developing countries like India is very important due to the pressing needs for increasing agricultural production and productivity to meet the needs of increasing population. Today, credit no more remained the "hunger mans rope supports the hanged" but it is an elevator specially in underdeveloped countries where agriculture is managed by poor farmers, inputs are borrowed from outside farm and the period of production is long, there the role of agricultural finance is very much emphasized..

Extension of area under irrigation facilitates cultivation of high value cash crops and horticultural crops require more capital. Credit still continues to be one of the limiting factors in the rural weak irrespective of being small and agricultural labourers. The farmers have very low capital base and are mainly depend on credit. Due to unavailability of credit, it would be difficult for them to adopt advanced technologies and also leads to compulsory marketing of their produce with lower prices.

The DCCBs in Maharashtra are largely responsible for the success of dairy and sugar industry in Western Maharashtra, cotton pockets in Marathwada and Vidarbha, fruit and rice processing in Konkan region and also small scale processing industry in rural areas, This situation attracted the attention of State Govt. towards the strengthening of the co-operative credit structure and because of this; the co-operative banking system has reached to almost each village in the State. The need was felt to examine the financial performance of DCCBs in Maharashtra.. The paper aims at examining the role of DCCBs in terms of their contribution to the rural development. and performance of DCCBs in Maharashtra.

Methodology:

The study is based on secondary data obtained from the annual reports of 30 DCCBs in Maharashtra for the period of past 27 years i.e. from 1985-86 to 2011-12. The periodwise performance in respect of growth in performance indicator was studied with the help of compound growth rates (CGRs) The annual rates of compound growth were

estimated for three different periods viz; Period I i.e. 1985-86 to 1993-94, Period II i.e. 1994-95 to 2011-12 and Period III covered the entire study period (1985-86 to 2011-12). The loans advanced by per DCCB and their compositions were estimated for the base year (1985-86) and the terminal year (2011-12) with the help of ratios, averages and percentages. Ranking of DCCBs for the purpose of performance index has been done. The average performance index was estimated and ranking was done in the descending order of performance index.

The ranking of districts was based on performance index (PI) of DCCBs, which was obtained as under,

$$PI = \frac{Lo - Ld}{Lod} X \frac{MB}{MBs}$$

Where,

Lo - Loan outstanding (Rs.)
Ld - Loan demand (Rs.)
Lod – Overdues (Rs.)
MB - Number of borrowing members.
MBs - Membership at the state level .

Role of DCCBs in rural development

The co-operative credit is the only agency suitable for agricultural credit. It has local participation democratic management and responsive to local needs of village. The co-operative credit system can mobilize funds from urban area through DCCBs and lend them in rural areas. The intermediate level unit that is DCCBs has been playing a crucial role in promoting agriculture and allied activities by purveying credit to the needy through primary agricultural credit societies. They provide a strong linkage between rural based credit societies, which do not have a close contact with money market and the urban biased apex co-operative bank, which does have a healthy connection with money market.

1. Average total loan distributed and its composition

It was revealed that (Table 1) the average total amount of loan distributed per DCCB to its members in Maharashtra state had increased from Rs. 74.84 crores in 1985-86 to Rs. 1056.63 crores in 2011-12.

Table 1 Average loans and advances distributed by DCCBs in Maharashtra

(Rs. in crores)

Period	Short Term loans			Medium Term loans			Other loans and advances	Total loans and advances
	Agricul-tural	Non Agricul-tural	Total Short Term	Agricul-tural	Non Agricul-tural	Total Medium Term		
1985-86	11.79 (15.75)	51.14 (68.34)	62.93 (84.09)	3.11 (4.16)	1.00 (1.33)	4.11 (5.49)	7.80 (10.42)	74.84 (100.00)
2011-12	378.95 (35.86)	381.18 (36.07)	760.13 (71.93)	43.63 (4.14)	52.97 (5.01)	96.60 (09.15)	199.90 (18.92)	1056.63 (100.00)

(Figures in the parentheses are the percentages to the totals)

Over 80 per cent of total loans and advances issued were in the form of short term loans and remaining being medium term and other loans and advances during the base year, but in the terminal year it was declined up to 71.93 per cent which indicates focused emphasis on short term loans by the DCCBs in Maharashtra. The percentage shares of medium term loan and other loan were 5.49 and 10.42 per cent in 1985-86, which had increased to 9.15 and 18.92 per cent in 2011-12, respectively. The proportion of total agricultural loans (both ST and MT) in the total loans was above 20 per cent in the base year, which increased to about 40 per cent during the terminal year. The proportion of non-agricultural loans (both ST & MT) in the total loans was 69.67 per cent in the base year which declined to 41.08 per cent in the terminal year.

2. The District Central Co-operative Banks in Maharashtra

The highlights of the co-operative movement in the Maharashtra State were its quantitative growth, its reach in providing services for all aspects of human life, its achievement in accomplishing co-operative economy base and above all, its acceptance by people as a powerful medium of economic progress and social development. The co-operative movement in Maharashtra has played a significant role in the social and economic development of the State. Maharashtra has witnessed successful development as compared to other states in co-operative sector during the last six decades.

After formation of the Maharashtra State, if we summarize last six decades, there is a significant growth in supply of loans but the growth in the number of borrowers is not satisfactory. No doubt, the volume of total loans and advances had increased from Rs.61 crores to Rs 31699 crores during the period of 1961 to 2011-12.. The lending policies of DCCBs underwent many changes due to the implementation of various agricultural

development schemes viz.; Rural Infrastructure Development Fund, Kisan Credit Cards, involvement of NGOs, etc. Table 2 gives the business growth of District Central Co-operative Banks in Maharashtra from 1960-61 to 2011-12

Table 2 Decade wise business growth of DCCBs in Maharashtra

(Members (000) and Rs. crores)

Sr. No	Particulars	1961	1971	1981	1991	2001	2011
1.	No. of Banks	35	35	26	30	30	30
2	Branches	NA	867	1,703	3,147	3,722	3787
3.	Total Membership	57	55	62	84	107	126
4.	Share capital	7	25	46	189	655	1873
5.	Owned funds	8	35	102	376	2232	8,457
6.	Deposits	26.47	113.23	588.14	3,199	19,519	48,674
7.	Borrowings	24.65	80.55	93.55	911.07	2.242	4,599
8.	Working Capital	61	236	835	4,835	23,736	65,084
9.	Loan advanced	51	121	279	1,192	15,458	31,698
10.	Demand	NA	133	364	1,625	8,249	22,383
11.	Recovery	NA	88	218	1,107	5,701	14,682
12.	Percentage of recovery to demand	NA	66.5	60.0	67.7	69.12	65.59
13.	Loans overdue	4.60	44.52	144.52	561.51	2,546.87	709
14.	overdue (%)	10.00	25.0	29.4	18.2	30.88	34.41
15.	Banks in profit	-	-	-	-	19	26
16.	Amount of profit	0.50	1.4	3.76	17.14	242.10	153
17.	No of banks in loss	-	-	-	-	11	04
18.	Amount of loss	-	-	-	---	170.29	170.29

Source: Co-operative movement at a glance in Maharashtra, 2001.

National Federation of State Co-operative Banks Report, 2011-12.

The number of banks decreased from 35 in 1960-61 to 26 in 1980-81 due to policy of one DCCB for one district, by All India Rural Credit Review Committee (1966). Further, the number of DCCBs has increased to 30 in 1991 due to the formation of four new districts in the state in 1982.The owned funds of the DCCBs have increased from Rs. 8

crores in 1960-61 to Rs. 8,457 crores in 2011-12 due to the branch expansion, Governments participation and increased membership of PACS. The deposits showed an increase from Rs. 26.47 crores in 1960-61 to Rs. 48674 crores in 2011-12 indicating tremendous growth in deposits. There was a significant growth in deposits due to the compulsory deposit mobilization by DCCBs and minimum involvement policy.

The working capital of DCCBs in Maharashtra has increased from Rs.60.93. crores in 1960-61 to Rs. 65084 crores in 2011-12, indicating a growth by more than thousand times. The borrowings also showed an increase from Rs.24.65 crores in 1960-61 to 4599 crores in 2011-12.

The overdues of the DCCBs in Maharashtra have increased from Rs.4.6 crores in 1960-61 to Rs. 7701 crores in 2011-12, indicating a tremendous increase of overdues over the last six decades. No serious efforts have been taken to curb the overdues .In the year 2011-12, 26 DCCBs were running in profit and their amount of profit was Rs.709 crores, whereas, 04 DCCBs were in loss which was to the extent of Rs.153 crores. In this world of competition, DCCBs without profit may not be able to have strong financial base and thereby would not be able to withstand competition from the external opposing and counteracting forces. Hence, the necessary efforts in respect of increasing owned funds, deposits and recovery of loans, decreasing level of overdues and total expenditure are needed. Removal of dual control on co-operatives, recapitalization support by Government was the measures required to emerge the co-operatives as strong efficient viable institutions.

3. Performance of DCCBs in Maharashtra

The growth and progress of DCCBs is presented in Table 3.

It was revealed that there was significant increase in total number of branches (2.22 per cent) and membership (2.41 per cent) of DCCBs in the state depicting the satisfactory performance of DCCBs in respect of expansion and coverage. The total owned funds of DCCBs in the state had significantly increased by 21.48 per cent per annum.. This was possible mainly due to the increased growth in share capital (26.33 per cent) and reserve fund (16.33 per cent) of the DCCBs in Maharashtra. The deposits of DCCBs in the Maharashtra.state had recorded an impressive growth 18.92 per cent per annum indicating the movement of DCCBs towards self reliance. The PACs and individuals were the major sources of deposits in DCCBs.

Table 3 Growth and progress of DCCBs in Maharashtra (Rs in Crorers)

Indicator	Period		Per cent Change	Compound Growth Rate (per cent)		
	1985-86	2011-12		Period I (1985-86 to1993-94)	Period II (1994-95 to 2011-12)	Entire Period (1985-86 to 2011-12
Number of branches	2438	3787	55.33	4.83***	0.71***	2.22***
Membership	70599	126312	78.91	3.34***	1.25*	2.41 ***
Share capital	82	1873	2184	15.60***	19.38***	16.33***
Reserve fund	92	6586	7059	15.52***	34.85***	26.33***
Own fund	174	8457	4768	15.55***	29.14***	21.48***
Deposits	1437	48,674	3287	17.06***	19.63***	18.92***
Borrowings	225	4,599	1944	21.30***	12.75***	14.44***
Working capital	1981	65,084	3185	18.66***	24.26***	19.62***
Investment	452	22813	4747	18.86***	21.84***	24.52***
Loan issued	2245	31,698	1312	19.28***	15.05***	13.65***
Loan collection	416	14,682	3429	25.95***	19.65***	15.74***
Recovery percentage	63.85	65.59	2.12	1.77*	1.09NS	0.65NS
Overdues	235	7701	2700	20.18***	27.62***	21.40***
Overdue as % to demand	36.15	34.41	- 4.81	-3.43NS	0.19 NS	-0.91 NS
Cost of management	61	1365	2137	16.17***	11.32***	13.10***
Proportion of COM to working capital	3.08	2.10	- 9.93	-0.17 NS	-0.35 NS	-0.21 NS--
Profit	10.17 (30)	709 (26)	6871	18.98***	26.32***	24.93***
Loss	--	153 (04)	--	-	-	-

(Figures in parentheses are the number of DCCBs in profit or loss)

National Federation of State Co-operative Banks Report, 2011-12.

The annual growth rate of borrowings of DCCBs indicated a declining trend .in second period (12.75 per cent)as compare to first period (21.30 per cent) indicating movement of DCCBs towards self reliance.. The total working capital of DCCBs in the state had recorded an impressive growth of 19.62 per cent and this was mainly due to increased growth in reserve funds and deposits. The growth in total loan issued by the DCCBs witnessed a significantly positive trend (13.65 per cent) of the State. It was mainly due to the increasing area under commercial crops and horticultural crops, which necessarily call for more investments in input use and plant protection and therefore, increase in demand for loans.

The poor performance in recovery by DCCBs was quite comprehendible from an increase in total overdues of DCCBs in the state. As the improvement in recovery percentage, the quantum of overdue remain on same position. The total cost of management in DCCBs of Maharashtra had significantly increased during the entire periods under study The proportion of cost of management to working capital had declined from 3.08 per cent to 2.10 per cent during period under study.. The profits of DCCBs in the state showed a significant growth by 24.93 per cent per annum during he period under study. The period wise performance indicates that better growth in period I were noticed in respect of number of branches, membership loan issued and recovery. The satisfactory performance in respect of share capital, reserve fund, owned funds, working capital, borrowins, cosr of management and total profits was more in period II as compared to period I in the DCCBs at the state level.

4. Performance Index

It can be revealed that based on DCCBwise average performance index, Mumbai (17.31), Satara (15.67), Pune (14.96), Solapur (11.68), Ahmednagar (11.31), Thane (10.95), Nashik (10.66), Kolhapur(10.08) Jalgaon (9.64) and Raigad (8.85) DCCBs were the strong units among the 30 DCCBs. The DCCBs having very low average performance index were Osmanabad (0.95), Jalana (0.70), Gadchiroli (0.52), Beed (0.31)and Dhule (0.24) which call for suitable economic measures, so that these DCCBs will improve their performance in future. The performance evaluation being quantitative analysis, provides a better format for comparison of DCCBs than the recovery related eligibility criteria, from an objective point of view.

Conclusion

Maharashtra has the largest network of co-operatives in India. Now, the DCCBs occupy an important place in rural economy in terms of their membership, business turnover and contribution to the social economic welfare of their members, and hence rural development. The DCCBs in the State have performed well in some sectors in some places and badly in many other places. But the fact remains that most of them have survived, albeit with a rather heavy dose of oxygen in many cases. The satisfactory performance of DCCBs in Maharashtra before banking reform period i.e. 1985-86 to 1993-94 was noticed in

the number of branches, membership, loans and advances, recovery, while better performance after banking reform period (1994-95 to 2011-12) was observed in respect of reserve funds, own funds, deposits, investment, profit and importantly, reduction in overdue and cost of management.

The DCCBs having better average performance index suvh as, Mumbai, Satara, Pune, Solapur, Ahmednagar, Thane, Nashik, Kolhapur, Jalgaon and Raigad DCCBs were the strong units among the 30 DCCBs. The DCCBs having very low average performance index were Osmanabad, Jalana, Gadchiroli, Beed and Dhule which call for suitable economic measures, so that these DCCBs will improve their performance in future.

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Performance of NABARD With Reference To Liabilities and Assets

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ABSTRACT

NABARD is set up as an apex Development Bank with a mandate to provide focused and undivided attention to the development of rural India by facilitating credit flow for promotion of agriculture and rural non farm sector. Emphasizing this in no uncertain terms, its mission statement underscores NABARD's goal to "promote sustainable and equitable agriculture and rural prosperity through effective credit support, related services, institution development and other innovative initiatives".

The performance of NABARD revealed that, the available capital with NABARD increased over the period with increase in reserves, NRC (LTO) fund, and open market borrowings which helped NABARD to create more assets through refinancing and conversion of funds. The significant growth seen in performance of capital, reserves, NRC (LTO) Fund, Open Market Borrowings and total liabilities in comparison to advance towards capital and borrowings from RBI under ARDR scheme 1990. The extent of variability was observed more in case of advance towards capital and borrowings from RBI under ARDR Scheme 1990, followed by open market borrowings, total liabilities, reserves, capital and NRC (LTO) fund. Also, maximum credit demand funds contributed/utilized through open market borrowings while, minimum credit funds contributed through borrowings from RBI under ARDR Scheme 1990. The direct relationship observed between capital with reserves, NRC (LTO) fund, open market borrowings, total liabilities, and total assets. Whereas, inverse relationship seen between capital, reserves and NRC (LTO) fund with borrowings from RBI under ARDR Scheme 1990.

INTRODUCTION

NABARD completed 32 years of its eventful and trailblazing existence on 12 July 2013. Established in 1982, by an Act of Parliament, NABARD's mandate was to provide focused and undivided attention to the development of rural India by facilitating credit flow for promotion of agriculture and rural non farm sector. Emphasizing this in no uncertain terms, its mission statement underscores NABARD's goal to "promote sustainable and equitable agriculture and rural prosperity through effective credit support, related services, institution development and other innovative initiatives".

NABARD's functions can be classified into 4 major categories viz. Credit Planning, Financial Services, Promotion and Development, and Supervision. Under Credit Planning NABARD prepares Potential Linked Credit Plan (PLP) annually for each district of the country by assessing potential available in agriculture and rural sector. This serves as a guide for banks and Government agencies to prepare their own investment and credit plans in the district and state. Under its financial services, it refinances commercial, co-operative and regional rural banks for lending to on farm and non-farm activities. This includes farm activities like minor irrigation, animal husbandry, farm mechanization, forestry, fisheries, land development, horticulture plantation and medicinal crops and non-farm like rural industries, artisan's handicrafts, handlooms, rural housing, rural tourism and agro processing. Refinance is provided by NABARD for both long term investment credit as well as short term production credit for crop loans and working capital for non-farm activities. A nationwide network of 28 regional offices at the state capitals, a suboffice at Port Blair and 391 district development offices are at hand to cater to this awesome task.

NABARD is set up as an apex Development Bank with a mandate for facilitating credit flow for promotion and development of agriculture, small-scale industries, cottage and village industries, handicrafts and other rural crafts. It also has the mandate to support all other allied economic activities in rural areas, promote integrated and sustainable rural development and secure prosperity of rural areas. In discharging its role as a facilitator for rural prosperity NABARD is entrusted with

- Providing refinance to lending institutions in rural areas.
- Bringing about or promoting institutional development and
- Evaluating, monitoring and inspecting the client banks

Besides this pivotal role, NABARD also:

- Acts as a coordinator in the operations of rural credit institutions
- Extends assistance to the government, the Reserve Bank of India and other organizations in matters relating to rural development
- Offers training and research facilities for banks, cooperatives and organizations working in the field of rural development
- Helps the state governments in reaching their targets of providing assistance to eligible institutions in agriculture and rural development
- Acts as regulator for cooperative banks and RRBs

Major Activities

- Preparing of Potential Linked Credit Plans for identification of exploitable potentials under agriculture and other activities available for development through bank credit.
- Refinancing banks for extending loans for investment and production purpose in rural areas. Providing loans to State Government/Non Government Organizations (NGOs)/ Panchayati Raj Institutions (PRIs) for developing rural infrastructure.

- Supporting credit innovations of Non Government Organizations (NGOs) and other non-formal agencies.
- Extending formal banking services to the unreached rural poor by evolving a supplementary credit delivery strategy in a cost effective manner by promoting Self Help Groups (SHGs)
- Promoting participatory watershed development for enhancing productivity and profitability of rainfed agriculture in a sustainable manner.
- On-site inspection of cooperative banks and Regional Rural Banks (RRBs) and off-site surveillance over health of cooperatives and RRBs. (www.nabard.org)

Credit Facilities Offered by NABARD

NABARD also offers various credit facilities like:

- Short-term/ Medium term/ Long-term refinance
- Investment Credit
- Rural Infrastructure Development Fund (RIDF)
- Refinance for Rural Housing Facilities scheme (RRHFS)
- Micro Credit Innovation scheme (MCIS)
- Loans to State Governments
- A Research and Development Fund
- Swarojgar Credit Card Scheme
- Farmers' Club Programme
- NABARD Consultancy Services (NABCONS)
- Crafts Mart
- Rural Innovation Fund (RIF)
- Co-Financing
- Rural Marketing
- Water Harvesting Scheme

Over the last three decades, NABARD has grown and evolved from a uni-dimensional apex financing agency into a multi-dimensional institution for shaping and implementing the country's overall rural credit policy. NABARD has been a leader in promoting microfinance through the SHG-Bank linkage programme. By investing huge energies and manpower into this programme and drawing upon its myriad roles, NABARD has reached nearly 97 million households, making India's microfinance programme the fastest, if not also the largest, in the world. All of you – management and staff of NABARD – including those who have retired can be proud of this very credible record of achievement of NABARD.

NABARD's Roles and Functions are summarized below :

- Credit Functions
- Developmental and Promotional Functions
- Supervisory Functions
- Institutional and Capacity building

Credit functions

NABARD's credit functions cover planning, dispensation and monitoring of credit.
This activity involves:

- Framing policy and guidelines for rural financial institutions
- Providing credit facilities to issuing organizations
- Preparation of potential-linked credit plans annually for all districts for identification of credit potential
- Monitoring the flow of ground level rural credit

Developmental and Promotional Functions

Credit is a critical factor in development of agriculture and rural sector as it enables investment in capital formation and technological up-gradation. Hence, strengthening of rural financial institutions, which deliver credit to the sector, has been identified by NABARD as a thrust area. Various initiatives have been taken to strengthen the cooperative credit structure and the regional rural banks, so that adequate and timely credit is made available to the needy.

In order to reinforce the credit functions and to make credit more productive, NABARD has been undertaking a number of developmental and promotional activities such as:-

- Help cooperative banks and Regional Rural Banks to prepare development action plans for themselves
- Enter into MoU with state governments and cooperative banks specifying their respective obligations to improve the affairs of the banks in a stipulated timeframe
- Help Regional Rural Banks and the sponsor banks to enter into MoUs specifying their respective obligations to improve the affairs of the Regional Rural Banks in a stipulated timeframe
- Monitor implementation of development action plans of banks and fulfillment of obligations under MoUs
- Provide financial assistance to cooperatives and Regional Rural Banks for establishment of technical, monitoring and evaluations cells
- Provide organisation development intervention (ODI) through reputed training institutes like Bankers Institute of Rural Development (BIRD), Lucknow www.birdlucknow.in, National Bank Staff College, Lucknow www.nbsc.in and College of Agriculture Banking, Pune, etc.
- Provide financial support for the training institutes of cooperative banks
- Provide training for senior and middle level executives of commercial banks, Regional Rural Banks and cooperative banks
- Create awareness among the borrowers on ethics of repayment through Vikas Volunteer Vahini and Farmer's clubs

- Provide financial assistance to cooperative banks for building improved management information system, computerization of operations and development of human resources

Supervisory Functions

As an apex bank involved in refinancing credit needs of major financial institutions in the country engaged in offering financial assistance to agriculture and rural development operations and programmes, NABARD has been sharing with the Reserve Bank of India certain supervisory functions in respect of cooperative banks and Regional Rural Banks (RRBs).

As part of these functions, it

- Undertakes inspection of Regional Rural Banks (RRBs) and Cooperative Banks (Other than urban/primary cooperative banks) under the provisions of Banking Regulation Act, 1949.
- Undertakes inspection of State Cooperative Agriculture and Rural Development
- Banks (SCARDBs) and apex non-credit cooperative societies on a voluntary basis
- Undertakes portfolio inspections, systems study, besides off-site surveillance of Cooperative Banks and Regional Rural Banks (RRBs)
- Provides recommendations to Reserve Bank of India on issue of licenses to Cooperative Banks, opening of new branches by State Cooperative Banks and Regional Rural Banks (RRBs)
- Administering Credit Monitoring Arrangements (CMA) in SCBs and CCBs.

Core Functions

NABARD has been entrusted with the statutory responsibility of conducting inspections of State Cooperative Banks (SCBs), District Central Cooperative Banks (DCCBs) and Regional Rural Banks (RRBs) under the provisions of Section 35(6) of the Banking Regulation Act (BR Act), 1949. In addition, NABARD has also been conducting periodic inspections of state level cooperative institutions such as State Cooperative Agriculture and Rural Development Banks (SCARDBs), Apex Weavers Societies, Marketing Federations, etc., on a voluntary basis.

Institutional Building

- Help cooperative banks and RRBs to prepare development actions plans for themselves
- Enter into MoU with state governments and cooperative banks specifying their respective obligations to improve the affairs of the banks in a stipulated timeframe
- Help RRBs and the sponsor banks to enter into MoUs specifying their respective obligations to improve the affairs of the RRBs in a stipulated timeframe
- Monitor implementation of development action plans of banks and fulfillment of obligations under MoUs.
- Provide financial assistance to cooperatives and RRBs for establishment of technical, monitoring and evaluations cells.

- Provide organisation development intervention (ODI) through reputed training institutes like Bankers Institute of Rural Development (BIRD), Lucknow, National Bank Staff College, Lucknow, College of Agriculture Banking, Pune, etc.
- Provide financial support for the training institutes of cooperative banks
- Provide training for senior and middle level executives of commercial banks, RRBs and cooperative banks
- Create awareness among the borrowers on ethics of repayment through Vikas Volunteer Vahini/farmer's clubs
- Provide financial assistance to cooperative banks for building improved management information system, computerisation of operations, development of human resources, etc.

The falling annual growth rate of profit and a higher proportion of costs incurred to total assets of NABARD may have some serious consequences. NABARD may probably, then, further cut down on its loans and refinance facilities to the cooperative and RRBs for rural credits and invest in other forms of assets that have a more assured and higher level of returns. This is mainly to earn a higher level of interest income, and it might lead to an increase in its profitability through higher revenue. But the associated cost in such a process will be a further reduction in loans and advances to the rural sector. This point has some empirical basis. The NABARD has increased its investments in government securities from Rs 2,747 crore in 2001-02 to Rs 6,256 crore in 2005-06, a growth rate of around 127.1% (*Handbook of Statistics on Indian Economy*, RBI 2006-07). This pattern of investment may seriously hamper the cooperative banks and the RRBs, which are heavily dependent on the loans and advances from NABARD. Thus, the loan portfolio changes to accommodate for this higher cost of funds.

As discussed, the cooperative banks and the RRBs heavily depend on NABARD for loans and refinance facilities from the latter (Sen 2005; RBI 2004). The NABARD, in turn, is depended upon the RBI for loans and advances and refinance facilities. The annual growth rate of loans and advances of NABARD is falling, especially from the period of 1998-99 to 2005-06, which in turn, has affected the growth rates of loans and advances of the cooperative banks and the RRBs. NABARD, on being denied such loans from the RBI, has had to resort to open market borrowings to meet the demand for rural credit. This operation of open market borrowing was able to meet the loans and advances and refinance facilities to some extent. But, this open market borrowing was not enough to meet the huge requirements of credit in the rural areas.

Keeping this in view, the following objectives are selected for the study.

Objectives:

1. To study the role of NABARD in providing funds to rural banks.
2. To study the performance of various financial resources of liabilities of NABARD.
3. To study the relationship between capital investment, borrowings and assets.

METHODOLOGY:

Data for the study were collected from the secondary sources for the period 1990 to 2013.The secondary data on liabilities and assets of NABARD were collected from the Handbook of statistics on Indian economy, (2012-13), Reserve Bank of India, Bombay. The analytical tools used for study are,

a. Compound growth rate:

To study the growth performance of liabilities of NABARD, the Compound Growth Rate (CGR) was worked out. An exponential form of the function was used.

$$Y=ab^x$$

Taking logarithms on both sides

$$\log Y= \log a+ x \log b$$

Where,

Y= Liabilities of NABARD

a= intercept

b= regression coefficient

x= time period

Then compound growth rate were worked out by using following formula,

$$CGR = [\text{Antilog}(\log b) - 1] * 100$$

Also degree of instability in liabilities of NABARD was measured using co-efficient of variation with minimum value and maximum value.

The relationship between capital, borrowings and assets of NABARD established with the help of correlation coefficient.

RESULT AND DISCUSSION:

The unscientific and ad-hoc pricing of deposits in the context of competition and alternative avenues for the borrower, results in inefficient deployment of resources. Asset-Liability management systems can address the issue related to liquidity, interest rate and currency risks.

Table 1: Maturity Pattern of Liabilities and Assets of NABARD (Rupees Billion)

Year (End-March)	Liabilities							Assets
	Capital	Advance Towards Capital	Reserves	NRC (LTO) FUND	Borrowings From RBI Under ARDR Scheme 1990	Open Market Borrowings	Total Liabilities	Total Assets
1990	1.00	0.00	4.08	49.12	0.00	5.43	118.46	118.46
1991	1.00	0.00	4.71	56.87	6.92	6.33	127.51	127.51
1992	1.00	0.00	5.76	66.02	7.23	7.32	145.72	145.72
1993	1.00	0.00	6.54	71.27	7.81	8.32	157.87	157.87
1994	1.20	0.00	7.67	76.83	2.49	9.10	156.94	156.94
1995	3.30	0.00	12.32	79.34	3.18	10.00	179.91	179.91
1996	5.00	0.00	17.38	81.85	2.04	10.45	196.08	196.08
1997	5.00	5.00	22.80	86.36	1.10	12.45	225.71	225.71
1998	5.00	10.00	27.31	91.87	0.45	13.70	252.07	252.07
1999	5.00	15.00	28.20	100.20	0.00	16.33	289.86	289.86
2000	5.00	15.00	28.12	110.41	0.00	21.41	333.67	333.67
2001	5.00	15.00	29.71	121.92	0.00	36.14	388.16	388.16
2002	20.00	0.00	36.26	127.23	0.00	60.78	450.98	450.98
2003	20.00	0.00	43.19	129.45	0.00	87.02	500.71	500.71
2004	20.00	0.00	52.91	130.70	0.00	143.83	558.89	558.89
2005	20.00	0.00	61.99	131.52	0.00	215.04	607.79	607.79
2006	20.00	0.00	69.74	131.83	0.00	233.13	676.05	676.05
2007	20.00	0.00	78.02	132.14	0.00	313.92	812.20	812.20
2008	20.00	0.00	86.03	136.15	0.00	326.22	987.06	987.06
2009	20.00	0.00	95.35	140.16	0.00	264.45	1181.76	1181.76
2010	20.00	0.00	106.75	144.17	0.00	245.40	1362.92	1362.92
2011	20.00	0.00	118.63	144.68	0.00	338.42	1588.72	1588.72
2012	30.00	0.00	134.08	144.79	0.00	423.24	1820.75	1820.75
2013	40.00	0.00	151.00	144.80	0.00	502.69	2132.55	2132.55

NABARD, like any other financial institution has put in place a sound resource management system. The financial resources of NABARD increased from Rs.1820.75 billion as on 31

March 2012 to 2132.55 as on 31 March 2013 registering an increase of 17 per cent over the previous period.

It is revealed from Table 1, that there was a continuous increase in the total liabilities of NABARD. The total liabilities in 1990 was Rs.118.46 billion, while in the year 2013, it was stood at Rs. 2132.55 billion. The available paid up capital to NABARD in 1990 was Rs. 1 billion, which was continuously increased to Rs.40 billion in 2013. The advances towards capital were initially zero and further contributed from year 1997 to 2001 i.e. from Rs. 5 billion to Rs. 15 billion, respectively. The amounts of reserves with NABARD were increased from 4.08 billion in 1990 to 151.00 billion in 2013. The National Rural Credit (NRC) for long term operations fund are utilized for investment operations was increased from 49.12 billion in 1990 to 144.80 billion in 2013. The borrowings from RBI under ARDR scheme 1990 initially was zero and further started borrowings up to the year 1998 which was Rs. 0.45 billion and there was no fresh borrowings from RBI loans from 1999 to 2013. In order to meet the increasing credit demand, NABARD has been augmenting its resources from market borrowings by way of Corporate Bonds, Commercial Papers, Certificates of Deposits, Term Money Borrowings, etc. The open market borrowings of NABARD steadily increased over the entire period i.e. from 1990 to 2013, which was stood at Rs.5.43 billion to 502.69 billion, respectively.

Table 2: Compound Growth Rates of Liabilities of NABARD

(Period-1990 to 2013)

Sr.No.	Type Of Liabilities	CGR %
1	Capital	17.95***
2	Advance Towards Capital	-29.73
3	Reserves	16.86***
4	NRC (LTO) FUND	4.48***
5	Borrowings From RBI Under ARDR Scheme 1990	-31.94
6	Open Market Borrowings	25.22***
7	Total Liabilities	13.59***

*** denotes significance at 1 %

The growth in the performance of liabilities of NABARD is determined by using exponential growth function. The compound growth rate was presented in Table 2, it is observed from above table that there was significant growth in total liabilities at 1 per cent level of significance with CGR of 13.59 per cent .The growth in Capital, Reserves, NRC (LTO) fund and open market borrowings was also found to be significant at 1 per cent level of

significance with CGR of 17.95, 16.86, 4.48 and 25.22 per cent, respectively. Whereas, the growth in advance towards capital and borrowings from RBI under ARDR scheme 1990 was negative. Because in 2001-02 by a notification of GOI, advance towards capital amounts were credited to capital account of NABARD, while borrowings from RBI under ARDR Scheme 1990 has been stopped after 1998.

Table 3: Coefficient of Variation (CV %) in Liabilities of NABARD

(Period- from 1990 to 2013)

Particulars	Capital	Advance Towards Capital	Reserves	NRC (LTO) FUND	Borrowings From RBI Under ARDR Scheme 1990	Open Market Borrowings	Total Liabilities
CV (%)	84.30	212.64	86.40	28.76	191.30	113.11	91.68
Min.	1.00	5.00	4.08	49.12	0.45	5.43	118.46
Max.	40.00	15.00	151.00	144.80	7.81	502.69	2132.55

In order to examine the extent of variability in performance of liabilities of NABARD, the coefficient of variation which measures the absolute variation was worked out. The higher the co-efficient of variation the greater is the variability and *vice versa*. It is revealed from table 3 that, advance towards capital and borrowings from RBI under ARDR Scheme 1990 witnesses a high variability in performance of liabilities as indicated by high co-efficient of variation value of 212.64 and 191.30 per cent ,respectively. This indicated the unstable nature of performance of liabilities of NABARD. Also, coefficient of variation was observed more in case of open market borrowings with CV 113.11 per cent, followed by total liabilities, reserves, capital and NRC(LTO) fund with CV of 91.68,86.40,84.30 and 28.76 per cent , respectively.

The maximum credit demand funds contributed/utilized through open market borrowings, reserves and NRC (LTO) fund towards total liabilities. While, minimum credit funds contributed through borrowings from RBI under ARDR Scheme 1990, available capital, reserves and advance towards capital towards total liabilities.

Table 4: Correlation of Advance towards Capital with Borrowings from RBI under ARDR Scheme 1990 and Open Market Borrowings

Particulars	**Advance Towards Capital**
Borrowings From RBI Under ARDR Scheme 1990	-0.22
Open Market Borrowings	-0.36

Table 4, presents the correlation of Advance towards Capital with Borrowings from RBI under ARDR Scheme 1990 and Open Market Borrowings, it was observed that correlation between Borrowings From RBI Under ARDR Scheme 1990 with Advance Towards Capital is negative i.e. -0.22, because advance towards capital in 2001-02 by a notification of GOI, were credited to capital account of NABARD and borrowings from RBI Under ARDR Scheme 1990 has been stopped after 1998 and imposed no significant contribution to total liabilities . As a result NABARD, starved of funds from the RBI, had to resort open market borrowings, to meet the demand for loans and refinance facilities. Whereas, correlation of Open Market Borrowings with Advance towards Capital is also found to be negative i.e. -0.36. The negative correlation observed due to increase in open market borrowings over the entire period, while advance towards capital has been credited to capital account of NABARD after 2001. The rate at which NABARD borrows from the open market is much higher than the rate at which it borrows from the RBI. The increased proportion of borrowings from the open market at a higher rate of interest, when denied loans by the RBI, has caused a potential loss in income of NABARD in the form of an increased cost in borrowing.

Table 5: Correlation Matrix between Capital Investment, Liabilities and Assets of NABARD

Particulars	Capital	Advance Towards Capital	Reserves	NRC (LTO) FUND	Borrowings From RBI Under ARDR Scheme 1990	Open Market Borrowings	Total Liabilities	Total Assets
Capital	1.00							
Advance Towards Capital	-0.36	1.00						
Reserves	0.92***	-0.26	1.00					
NRC (LTO) Fund	0.87***	-0.06	0.86***	1.00				
Borrowings From RBI Under ARDR Scheme 1990	-0.56**	-0.22	-0.53*	-0.69**	1.00			
Open Market Borrowings	0.91***	-0.37	0.97***	0.80***	-0.45	1.00		
Total Liabilities	0.88***	-0.27	0.98***	0.78***	-0.45	0.95***	1.00	
Total Assets	0.88***	-0.27	0.98***	0.78***	-0.45	0.95***	1.00	1.00

***, **, and * denotes significance at 1 %, 5 % and 10 % ,respectively.

Table 5, represents the correlation between available capital, liabilities and assets. It can be seen from table 5 that, correlation of available capital investment with reserves, NRC (LTO) fund, open market borrowings, total liabilities and total assets is positively significant at 1 % level of significance, implying a direct relationship between the variables. Because reserves created through business profits by different sources increased with increasing reserves through profitable operations over the period than the capital invested, therefore reserves are frequently considered as funds saved for the future. Also, contribution to National Rural Credit (Long Term Operations) which has been out of the surpluses of NABARD itself, increased with increase in capital investment over the period. To meet credit demands for loans and refinance facilities NABARD has been resorted to hugely open market borrowings with increase in capital over the period. Due to increase in available capital, total liabilities also increased over the period, which helps NABARD to create assets and contribute to total assets through refinance, conversion of fund, etc. Whereas, the inverse relationship observed between capital investment with advance towards capital and borrowings from RBI under ARDR Scheme 1990 is significant at 5 % level, because advance towards capital in 2001-02 by a notification of GOI, were credited to capital account of NABARD and borrowings from RBI under ARDR Scheme 1990 was provided to NABARD but after 1998 borrowings has been stopped while the capital invested has been increased.

The correlation between reserves with NRC (LTO) fund, open market borrowings, total liabilities and total assets shows direct relationship with each other, which is positively significant at 1 % level of significance. This is due to, reserves which are the business profits of NABARD ,while NRC(LTO) fund after 1992 which has been surpluses of NABARD itself, both are increasing steadily over the period with increase in open market borrowings of NABARD to meet the credit demands. Whereas, the inverse relationship observed between reserves and borrowings from RBI under ARDR Scheme 1990, which is significant at 10 per cent level of significance due to increased in amount of reserves over the year and completely ceasing of borrowings from RBI under ARDR scheme after 1998.

The direct relationship observed between NRC (LTO) fund with open market borrowings, total liabilities and total assets which are significant at 1 per cent level of significance. Because both NRC (LTO) fund and open market borrowings steadily increased over the period and both contributes significantly to increase in total liabilities. As a result, increased in total liabilities, total assets also increased through refinance, conversion of fund, etc. Whereas, inverse relationship i.e. -0.69, which is significant at 5 per cent level of significance is seen between NRC (LTO) fund and borrowings from RBI under ARDR Scheme 1990 due to increase in amount of reserves and completely ceasing of borrowings from RBI under ARDR scheme 1990 over the period.

The correlation between open market borrowings with total liabilities and total assets shows direct relationship with each other, which is significant at 1 per cent level of significance .Because to meet credit demands, NABARD has raised funds through open

market borrowings which has contributed significantly to total liabilities of NABARD over the period. As a result, increased in total liabilities, helps NABARD to increase total assets through refinance, conversion of fund, etc.

CONCLUSIONS:

- The available capital with NABARD increased over the period with increase in reserves, NRC (LTO) fund, and open market borrowings which helped NABARD to create assets through refinancing and conversion of funds.
- Significant growth in performance seen in capital, reserves, NRC (LTO) Fund, Open Market Borrowings and total liabilities in comparison to advance towards capital and borrowings from RBI under ARDR scheme.
- In performance of liabilities, the extent of variability seen more in case of advance towards capital and borrowings from RBI under ARDR Scheme 1990, followed by open market borrowings, total liabilities, reserves, capital and NRC (LTO) fund. Also, maximum credit demand funds contributed/utilized through open market borrowings while, minimum credit funds contributed through borrowings from RBI under ARDR Scheme 1990.
- There is direct relationship seen between capital with reserves, NRC (LTO) fund, open market borrowings, total liabilities, and total assets. Whereas, inverse relationship seen between capital, reserves and NRC (LTO) fund with borrowings from RBI under ARDR Scheme 1990.

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Appraisal of District Central Co-operative Banks in Konkan Region

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The district central co-operative banks (DCCBs) in Konkan region of Maharashtra have played significant role in providing crop loans and term loans to farmers. The study is based on secondary data obtained from four DCCBs in Konkan region,who provided the agricultural loans for the period of last 20 years from 1990-91 to 2009-10. DCCB wise and period wise compound growth rates of various performance indicators were estimated and average performance index was computed. Satisfactory performance was observed in all indicators except borrowing, loan recovery and overdues. The study revealed that, special attention of borrower's banks is needed to increase in the share capital and loan disbursement for agricultural purposes by the DCCBs. Loan disbursement should be made strictly after assessing repaying capacity of the borrowers and economic soundness of the PACS. There is a need to enhance investment of funds in Government securities and fixed deposits for transparency in financial management of the banks. The average performance index analysis showed that Thane and Raigad DCCB were the strong financial institutions among the four DCCBs and remaining two DCCB required to improve their performance in future.

Credit is very important instrument in facilitating the process of development and there by initiating the growth of rural economy. Credit flows through co-operatives in rural India and their sustainability, viability and operational efficiency have become the major focus of attention of various policymakers in the era of financial sector reforms. Although reforms in the banking sector were initiated in commercial banks much earlier i.e. beginning of 1991-92. The reform process in the co-operatives has taken a longer time to get started.

The co-operatives have been playing a crucial role in the economic upliftment of the people, particularly of the weaker sections in rural areas. The co-operative credit system in India is comprised of short term (ST) and the long term (LT) credit structure. The ST structure has its base with the primary agricultural credit societies (PACS), which are affiliated to District central co-operative Banks (DCCBs) at the district level and these banks are affiliated to state co-operative Banks (SCB) at the state level.

The DCCBs in Maharashtra played a pivotal role in the development of agriculture by providing a regular flow of short term and medium term credit to the farmers through the PACS in rural areas. Maharashtra state was divided into four regions viz. Western Maharashtra, Konkan, Marathwada and Vidarbha on the basis of different agroclimatic conditions and administrative considerations. To assess the performance of DCCBs, Konkan

region was purposely selected for this study. The sickness of DCCBs is mainly due to low recovery and increasing overdues. Improvement in recovery and thereby reducing the burden of overdues in the DCCBs is the most important challenge for the policy makers. In this contest present study was carried out to evaluate the performance of DCCBs in Konkan region of Maharashtra with the help of different performance indicators after banking reform period. Growths for different performance indicators were also studied.

Methodology

The study is based on secondary data obtained form 4 DCCBs in Konkan region for the period of last 20 years i.e. from 1990-91 to 2009-10. Data were obtained from publications of NAFSCOB, annual reports of DCCBs, progress reports and other records of the banks. The compound growth rates for different performance indicators were estimated for three periods viz.

I) Period I : 1990-91 to 1999-00 (1^{st} decade period – post economic reform decade)

II) Period II: 2000-01 to 2009-10 (II^{nd} decade period.)

III) Period III : 1990-91 to 2009-10 (entire period)

The district wise and period wise compound growth rates of various performance indicators were estimated. In all four DCCBs were purposively selected for this study. The performance index for beginning, mid and terminal years were estimated. With this three points, the average performance index ranking for each DCCBs were computed.

The ranking of districts were made based on the performance Index (PI) of DCCBs, which was obtained as under:

$$PI = \frac{Lo - LD}{Lod} \times \frac{MB}{MBs}$$

Where, Lo = Loan outstanding

Lo = Loan demand

Lod = Overdues

MB = Number of borrowing members

MBs = Membership at region level.

Results and Discussion

Growth in different performance indicators of DCCBs in Konkan region during 1990-91 to 2009-10 is given in Table 1.

The study showed an overall significant increase in total number of branches and membership of all DCCBs and thus region as a whole, depicted the satisfactory performance of DCCBs in respect of expansion and coverage. The total owned funds of all DCCBs and at regional level had significantly increased. These were possible mainly due to the increased growth in share capital and reserve fund of the DCCBs in Konkan region. The deposits of DCCBs in Konkan region recorded an impressive growth (14.38% per annum) indicated the self reliance of DCCBs. The PACS and individuals were the major sources of deposits in DCCBs. The annual growth rate of borrowings of DCCBs indicated an increasing trend in borrowings.

Table 1. Growth in different performance indicators of DCCBs in Konkan region during 1990-91 to 2009-10

(Rs. In lakhs)

Performance indicator	Period		Per cent change Over 1990-91	Compound growth rate (per cent)		
	1990-91	2009-10		Period 1990-91to 1999-00 (I^{st} decade)	Period II 2000-01 to 2009-10 (II^{nd} decade)	Entire period 1990-91 to 2009-10 (overall)
No. of branches	207	303	46.38	2.05*	1.38*	1.83*
Membership (Numbers)	5471	10136	85.27	4.45*	2.88*	3.33*
Share capital	653	6540	901.53	14.78*	10.27*	13.38*
Reserve funds	2627	56052	2033.69	25.85*	9.02*	18.78*
Owned funds	3280	62592	1808.29	24.04*	9.15*	17.99*
Deposits	34341	496525	1345.87	17.57*	11.78*	14.38*
Borrowings	1080	11143	931.76	12.91^{NS}	3.62^{NS}	13.12*
Working capital	41826	590721	1312.33	18.09*	11.10*	14.64*
Investment	13506	311858	2209.03	21.78*	11.65*	16.59*
Total loan advances	37238	266835	616.57	15.22*	8.55*	11.39*
Loan outstanding	16804	234213	1293.79	19.10*	10.82*	15.59*
Loan recovery	6015	78406	1203.67	19.11*	4.80***	15.25*
Loan over dues	2608	17361	665.68	12.23*	7.16***	13.04*
Cost of management	1515	11947	688.58	13.05*	15.69*	13.65*
Profit	171(4)	8222(4)	4711.70	26.58*	16.05*	18.96*

(Figures in parentheses indicate the number of DCCBs in profit)

* Significant at 1 per cent level of significance.

** Significant at 5 per cent level of significance.

*** Significant at 10 per cent level of significance.

The total working capital of DCCBs and at the regional level recorded an impressive growth (14.64 %) because of increased growth in reserve funds and deposits i.e. 18.78 per cent and 14.38 per cent per annum, respectively. The total loans issued were relatively more in Sindhudurg DCCB than the other DCCBs in the region during the period under study (details is given in Table 2).

Table 2. DCCB wise and period wise growth in loan issued in Konkan Region.
(Per cent)

DCCB and period	Short Term			Medium Term			Other loan Advances	Total Loan Advances
	Agril.	N. Agril.	Total S.T.	Agril.	N. Agril.	Total M.T.		
Thane								
I	15.50*	11.15*	11.25**	18.37*	-7.40^{NS}	-0.22^{NS}	10.19**	10.45**
II	12.97*	-11.51*	-9.03**	11.60^{NS}	-6.78^{NS}	12.85^{NS}	19.57**	3.77^{NS}
III	18.08*	1.04^{NS}	2.25^{NS}	25.15*	14.34**	22.14*	8.27*	5.90*
Raigad								
I	15.69*	11.42^{NS}	5.28^{NS}	1.46^{NS}	26.88*	27.20*	18.78*	16.86*
II	24.61*	0.67^{NS}	0.89^{NS}	8.27^{NS}	10.04^{NS}	9.95^{NS}	18.95^{NS}	3.20^{NS}
III	9.31*	24.87***	18.64*	-2.53^{NS}	15.70*	13.86*	-6.94^{NS}	11.39*
Ratnagiri								
I	25.05*	30.66*	29.81*	17.19^{NS}	23.31*	21.55*	57.28^{NS}	21.40*
II	1.93^{NS}	-69.05*	-32.93*	-25.61*	-27.30*	-27.09*	87.98**	11.85*
III	16.93*	-26.61*	-1.44^{NS}	5.76^{NS}	1.45^{NS}	2.14^{NS}	55.06*	14.39*
Sindhudurg								
I	17.68*	22.21**	21.48*	3.77^{NS}	30.80***	22.52***	249.07***	19.33*
II	15.43*	19.32*	19.03*	7.88^{NS}	17.62**	15.87**	55.87***	18.57*
III	18.68*	21.02*	20.49*	8.26*	33.67*	24.86*	69.07*	18.81*
Konkan								
I	19.05*	15.40*	15.52*	14.69^{NS}	18.02**	18.07**	14.31*	15.22*
II	12.24*	0.03^{NS}	0.75^{NS}	5.88^{NS}	10.17^{NS}	9.45^{NS}	35.93*	8.55*
III	17.54*	10.17*	10.58*	14.27*	16.23*	15.33*	10.37*	11.39*

* = Significant at 1 per cent level of significance.
** = Significant at 5 per cent level of significance
*** = Significant at 10 per cent level of significance.
NS = Non Significant.

Near about 50 per cent of the total loans and advances issued were in the form of short term loans and remaining 50 per cent being medium term and other loans, indicated focussed emphasis on both short term and medium term loans by the DCCBs in the region. The proportion of total agricultural loan (both ST and MT) in the total loans showed minute increase at the regional level. The recovery of short term and medium term loans sanctioned for agricultural purposes showed satisfactory performance in period I and for the region as a whole. The poor performance in recovery by DCCBs was quite comprehendible from an increase in overdues in period I as compared to period II of the DCCBs in the Konkan region. The highest growth in total overdues was noticed in Raigad DCCB i.e. 20.42 fold.

The total cost of management in DCCBs of Konkan region significantly increased during the entire period of the study. The profits of DCCBs in the Konkan region showed a

significant growth of 18.96 per cent per annum during period under study. The growth in total profits was more in IInd period as compared to period Ist at regional level.

Performance Index

Average ranking of DCCBs was worked out by considering performance Index during 1990-91, 1999-2000 and 2009-10 in Konkan region and depicted in in Table 3. Based on DCCB wise performance Index, Thane (4.23) and Raigad (2.37) were the strong banks among the four DCCBs covered under study. Ratnagiri (0.55) and Sindhudurg (0.35) having very low average performance index, which call for suitable economic measures, so that these two DCCBs would improve their performance in future.

Table 3: Ranking of DCCBs according to performance Index in Konkan region.

Rank No.	Name of DCCBs	Performance Index
1	Thane	4.23
2	Raigad	2.37
3	Ratnagiri	0.55
4	Sindhudurg	0.35

Conclusions

The study advocated the need of paying attention to borrower members, which will lead to increase in the share capital and loan disbursement for agricultural purposes. Loan disbursement should be made strictly upon repaying capacity of borrowers, technical efficiency and economic soundness of the PACS. There is a need to enhance investment of funds in Government securities and fixed deposits for transparency in financial management.

The average performance index and overall performance indices analysis showed that Thane and Raigad DCCB were the strong financial co-operative institutions among the four DCCBs covered by the study as compared to other two DCCBs in the konkan region.

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Repayment Performance of Satara District Central Co-operative Credit Society

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An attempt has been made to study the repayment and overduesof co-operative credit in Satara district of Maharashtra. The sampling method used in the present investigation was two stage random sampling with villages as primary sampling unit and cultivators as secondary sampling unit. In all, from six villages a cross sectional sample comprising of 30 farmers from each village was selected randomly. Thus, the total sample comprised of 90 farmers. The data were collected by survey method for the year 2005-06.

The study concluded that the mounting of overdues, low income was reported as main reason by about 85.56 per cent farmers. More than 85 per cent farmers reported that they accrued additional income due to better use of credit but did not repay the loan. To overcome the problem of the indebtedness, the willful defaulters will have to be taken to the task and forced to repay the loans through appropriate legal action. There is a need of optimum scale of financing on the basis of timely assessment of prevailing prices. For efficient recovery of loans, special recovery unit may be created at the district or tahsil level.

Introduction

As the agriculture in India is getting modernized, the subsistence farming is shifting to the commercial farming requiring intensive capital. The techniques of production are changing and modern inputs are made available to increase the production and the modern inputs are fairly costly. However, small size of business unit which leaves hardly any surplus for reinvestment and appealing indebtedness of persons engaged in farming business make the case of agriculture deserving for outside finance.

In the earlier days, non-institutional agencies like relatives and money-lenders dominated the field of agricultural credit. Then the institutional agencies came forward to finance the farmers. The co-operatives were playing the major role before the nationalization of some of the commercial banks. After the nationalization of banks, they are now assuming a significant role in the field of agricultural finance.

It has been observed that the overdues are increasing by leaps and bounds. Their mounting overdues lead to high indebtedness and the stagnation of credit channel. From the point of view of the borrowers, accumulation of overdues results in the non-availability of further loans. The mounting overdues of a co-operative society may even bring the society on the verge of liquidation.

The overdues of the co-operative credit societies in Satara district for the year 2004-05 were to the tune of Rs. 1178.95 lakhs. The figure of the overdues for the Sataratahsil of Satara district for the year 2004-05 was Rs. 36.88 lakhs. The picture of the overdues of nationalized banks in the district may not be different from that of the co-operatives.Thepresent investigation is an attempt to study the extent of amount borrowed by the farmers from different institutions and the repayment position of the loans borrowed as well as the problems faced by the farmers in repayment of loan and suggest corrective measures.

Methodology

The study was undertaken in the Sataratahsil of Satara district. The sampling method used in the present investigation was two stage random sampling with villages as primary sampling unit and cultivators as secondary sampling unit. In all, six villages were selected. From each selected village, 5 farmers each from small, medium and large size groups comprising of 30 farmers from each group were selected randomly. Thus, the total sample comprised of 90 farmers. The data were collected by survey method for the year 2005-06.

Tabulation method with simple averages, means and percentages was used for analysis of data. The factors affecting the amount of overdues was analysed statistically by using multiple regression analysis and other statistical tools. The significance of the results obtained was tested by using 't' test. The amount of overdues is largely influenced by the factors like net income from crop production, net income from the sources other than crop production, size of farm irrigation area amount of loan used for the purpose for which the loan was taken and the amount of family expenditure. An attempt was made to study the functional relationship between the amount of overdues as an dependent variable and the above mentioned factors as independent variables.

Therefore, the following specific model of multiple regression was used >

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + u$$

The specification of the selected variables is as under

Y = Total amount of overdues in rupees
X_1 = Net income from crop production in rupees
X_2 = Net income from sources other than crop production in rupees
X_3 = Total land holdings in hectares
X_4 = Area under irrigation in hectares
X_5 = Amount of total loan borrowed in rupees
X_6 = Amount of loan used for the purpose for which it was taken in rupees
X_7 = Amount of family expenditure in rupees
b_1 to b_7 = Regression coefficients associated with the independent variables
a = Constant
u = Random term.

Results

1) Extent of the amount borrowed by the selected farmers

The information on the extent of amount borrowed by the selected farmers is presented in Table1.

As regards the borrowing at the overall level, the average per family borrowing worked out to Rs. 11775.04. The number of borrowers was as high as 129 (143.33 per cent) of the total number of families selected. This percentage is more than the selected sample, because, one person has borrowed from more than one agency or more than one type of loan. Out of the total amount of borrowings, the amount of short term, medium term and long term loan was Rs. 6301.57 (53.52 per cent), Rs. 1196.68 (10.16 per cent) and Rs. 4276.79 (36.32 per cent), respectively.

2) Repayment pattern of loans

Credit means an ability to command the capital of others in terms of promise to repay it at some specified time in future. This would imply that the overdues and bad debts ought to be negligible. The magnitude of overdues should therefore, be considered as an important criterion for assessing the performance of any financing agency.

2.1Repayment position of short term credit

The details regarding repayment position of short term credit are presented in Table 2.

It is revealed from the table that at the overall level, the average per family amount borrowed was Rs. 6301.57. The average per family repayment of principal amount of loan worked out to Rs. 4847.78 (76.93 per cent of the principal amount borrowed). The principal amount outstanding was Rs. 1453.79 (23.07 per cent of the total amount borrowed). The percentage of the repayment to the total amount borrowed was the highest (81.28 per cent) in the large size group and it was the lowest (68.90 per cent) in the medium size group. The small farmers repaid 77.99 per cent of the total loan borrowed. The average per family amount of outstanding loan increased with the increase in the size of holdings. The average per family amount of the outstanding loan with interest was Rs. 861.39, Rs. 1945.17 and Rs. 1988.04 in small, medium and large size groups, respectively.

2.2 Repayment position of the medium term credit

The repayment position of the medium term loans is presented in Table 3.

At the overall level, the average per farm amount borrowed was Rs. 1196.68. Out of this amount Rs. 767.56 (64.14 per cent) amount was repaid, leaving 35.86 per cent of the amount as an outstanding. The proportion of repayment was the highest in medium size group (65.28 per cent of the amount borrowed) followed by large (63.30 per cent) and small (62.33 per cent) groups of holding. The average amount of outstanding per family was the highest (37.67 per cent) in small size group followed by large (36.70 per cent) and medium (34.72 per cent) groups of holding. The average per family amount of outstanding loan with the interest was Rs. 441.29, Rs. 780.40 and Rs. 191.88 in small, medium and large size groups, respectively. Out of the total outstanding loan amount, the proportion of overdues was to the tune of 51.22 per cent. The average per family amount

of overdues was Rs. 265.70, Rs. 354.69 and Rs. 99.87 in the case of small, medium and large size groups of holding, respectively. The percentage of overdues to total outstanding loans was 60.21 per cent, 45.45 per cent and 52.05 per cent in case of small, medium and large size groups of holdings.

2.3Repayment of long term credit

The repayment information of long term credit is presented in Table 4

At the overall level, the average per family amount borrowed was Rs. 4276.79, out of which Rs. 3094.29 (72.35 per cent of total amount borrowed) was repaid, leaving Rs. 1182.50 (27.65 per cent of the amount borrowed) as an outstanding amount. The proportion of repayment was the highest in large size group (78.15 per cent of total amount borrowed) followed by medium (63.07 per cent) and small (58.34 per cent) size groups of holding, respectively. The average amount of outstanding per family was increased with increase in the size groups. The average amount of outstanding was Rs. 391.92, Rs. 1567.36 and Rs. 1948.98 in case of small, medium and large size groups of holding, respectively. Out of the total outstanding loan amount, the proportion of overdues was to the tune of 54.33 per cent. The average per family amount of overdues was increased with increase in the size groups, similar to that of the outstanding amount. The average per family amount of overdues was Rs. 184.55 (47.09 per cent of total outstanding amount), Rs. 917. 85 (58.56 per cent of outstanding amount) and Rs. 1026.72 (52.68 per cent of outstanding amount) in case of small, medium and large size groups of holding, respectively.

3) Groupwise level ofoverdues

The information on average per family overdues is presented in Table 5.

Table 5 Average per family overdues

(Rupees)

Sr. No.	Size group	Short term	Medium term	Long term	Total overdues
1	Small	535.53 (54.33)	265.70 (26.95)	184.55 (18.72)	985.78 (100.00)
2	Medium	914.81 (41.82)	354.69 (16.22)	917.85 (41.96)	2187.35 (100.00)
3	Large	1077.72 (48.89)	99.87 (4.53)	1026.72 (46.58)	2204.31 (100.00)
	Overall	842.69 (47.01)	240.09 (13.39)	709.71 (39.60)	1792.49 (100.00)

(Figures in the parentheses indicates percentage to the total)

It can be seen from the table that, at the overall level, the average per family amount of overdues worked out to Rs. 1792.49. The contribution of overdues of long term loan, medium term loan and short term loan to the total amount of overdueswas 47.01, 13.39 and 39.60 per cent, respectively. The highest amount of overdues was

observed in the large size group (Rs. 2204.31), followed by Rs. 2187.35 in the medium size group and Rs. 985.78 in the small size group.

4) Suggestions by the farmers to minimize the overdues.

The selected farmers were asked to give their suggestions to overcome the situation of mounting overdues. These suggestions were compiled in a tabular form and the percentages were worked out. The suggestions are summarized in Table 6.

It can be seen from the table that, at overall level, as many as 59 farmers (65.56 per cent) suggested that intimation of due amount should be given well in advance. About 47 farmers (52.22 per cent) applied for concession in the repayment of the event of natural calamities. About 48 farmers(53.33 per cent) reported that expenditure for obtained loan should be low. About 57 farmers (63.33 per cent) suggested to lower the interest rate to minimize the mounting overdues.

65.56 per cent suggested that the finance should be made adequately and in time. More than 57 per cent of the farmers suggested that the prices of farm inputs should be stable. According to 48 farmers (53.33 per cent) the sundry expenses are required to be incurred to obtain the loan, such expenses should be minimized.

5) Factors influencing amount of overdues

The results of multiple linear regression analysis are presented in Table 7

Table 7 Results of multiple linear regression analysis, regression coefficient and tests of significance

Sr. No.	Independent variable	Regression coefficients	Standard error
1	Net income from crop production in Rs. (X_1)	-0.03070*	0.01537
2	Net income from sources other than crop production in Rs. (X_2)	-0.00154 N.S.	0.01182
3	Total land holding in hectares (X_3)	273.26030**	101.2056
4	Total irrigated area in hectares (X_4)	-104.4782 N.S.	214.4925
5	Total amount borrowed in Rs. (X_5)	0.50081**	0.08232
6	Amount used for productive purpose in Rs. (X_6)	0.48575**	0.09586
7	Family expenditure in Rs. (X_7)	0.05375*	0.02419

N = 90 R^2 = 0.840984273 N.S. = Non significant

* Significant at 5 % level of probability

** Significant at 1 %level of probability

The estimated equation obtained through regression analysis is as follows.

$$Y = 220.2432-0.03070X_1 -0.00154X_2 + 273.26030X_3 -104.4782X_4 + 0.50081X_5 -0.48575X_6+ 0.05375 X_7+u$$

The value of the coefficient of multiple determination (R^2) was 0.8410. It indicates the fact that the variation in the dependent variable viz., the amount of overdues is explained jointly by the selected seven independent variables to the extent of 84.10 per cent. The regression coefficient for the net income from crop production (X_1) worked out to -0.0307 which was significant at 5 per cent level.

The value of regression coefficient for total land holding (X_3) worked out to 273.26. This coefficient was significant at 1 per cent level. The positive sign indicates the positive relationship between the total land holding and the amount of overdues. This means that with an increase of 1 hectare total land holding and all other factors constant, there will be increase in the amount of overdues by Rs. 273.26.

The regression coefficient for total irrigated area (X_4) was non-significant indicating no relationship with the amount of overdues. However, the sign of the regression coefficient of this variable was negative which means that with the increase in the total irrigated area the amount of overdues will decrease.

The regression coefficient of the amount used for productive purpose (X_6) was significant at 1 per cent level of significance. The sign of the regression coefficient was negative indicating negative relationship with the amount of overdues, that is with the increase in the amount used for productive purposes, the amount of overdues will decrease. The value of regression coefficient worked out to -0.49, indicating that with one rupee increase in the amount used for productive purpose, there will be decrease in the amount of overdues by Rs. 0.49.

Conclusions

At the overall level, the repayment percentage of short term loans was 76.93

per cent. As far as the repayments of medium term and long term loans are concerned, it was observed that 64.14 per cent and 72.35 per cent of the total principal amount was repaid, respectively. At the overall level, the average per family amount of overdues was Rs. 1792.49. The overdues of short term loans contributed 47.01 per cent to the total amount of overdues. Medium term and long term loans contributed to the extent of 13.39 per cent and 39.60 per cent, respectively.

As regards the mounting of overdues, low income was reported as main reason by about 85.56 per cent farmers. More than 85 per cent farmers reported that they accrued additional income due to better use of credit but did not repay the loan. Low prices for farm produce was another reason reported by more number of farmers (71.11 per cent). More than 61 per cent of farmers reported crop failure due to natural calamities as the reason for non-repayment of loan. Other reasons reported were political patronage, under

impression that government will write off the loan, spent on relatively costly items and recovery officer granted unofficial permission to postpone the repayment.

To overcome the problem of the indebtedness, the willful defaulters will have to be taken to the task and forced to repay the loans through appropriate legal action. The optimum scale of financing on the basis of timely assessment of prevailing prices. For efficient recovery of loans, special recovery unit may be created at the district or tahsil level. Incentives for the repayment and linking of credit with the crop insurance scheme are necessary for reducing the overdues and the borrowers who repay the loan in time should be advanced sufficient loan for next time.

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Performance of Sangli District Central Co-operative Banks in Western Maharashtra.

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The performance of SDCCB has been undertaken since the year 1995-96 which is considered as base year, ending the year 2009-10. This period of 15 years has been divided into two periods i.e. period-I (1995-96 to 2004-05), period-II (2005-06 to2009-10) and the overall period (1995-96 to 2009-10). During the year 1995-96 the number of members of the SDCCB were 366 which were declined to 363 during the year 2004-05 thereby indicating a decline by 0.81 per cent over the base year. The another important indicator share capital of the SDCCB during the year 1995-96 was amounting to Rs.1494.31 lakh and the same increased to height of Rs. 4569.98 lakh during the year 2004-05. Thus, an increase of 205.82 per cent was witnessed over the base year. The loan advanced by the SDCCB during the base year were Rs.44122.02 lakh and the same were Rs. 93039.92 lakh during the year 2004-05, thereby exhibiting a rise of 158.85 per cent over the base year.

The performance of SDCCB was also tested for the period-II (2005-06 to 2009-10). During this period the membership seen to be stagnant in the case of share capital a moderate increase (19.98 per cent) was seen, and the total amount of loans advanced thus, meagre increase of 5.45 per cent.

In general during the years under study the performance of SDCCB for the indicators under consideration observed to be satisfactory. However, the compound growth rate of loan advanced were found non significant.

Introduction:

The growth of modern movement of co-operatives is 100 years old, beginning with the enactment of Co-operative Credit Societies Act on 25th March, 1904. The co-operative sector in India has made its humble beginning prior to independence as an effective weapon to fight against the clutches of moneylenders. After independence, the cooperative sector received its due role in the process of economic development.

The co-operative credit system in India is comprised of the short-term (ST) credit structure and long-term (LT) credit structure. The ST structure has at its base with the Primary Agricultural Credit Societies (PACS), which are affiliated to District Central Co-operative Banks (DCCBs) at the district level which in turn, are affiliated to State Co-operative Bank (SCB) at the state level. The LT structure consists of State Co-operative Agricultural and Rural Development Bank (SCARDB), Federal and Primary Agricultural and Rural Development Bank (PCARDB) at base level.

In Maharashtra, upto March, 2008, there were 31 DCCBs amongst which Sangli District Central Co-operative Bank is one of the important bank. In past, the rural credit was well dominated by the private agencies, which generally have exploited the borrowers by charging high rates of interest. Now a days, the co-operatives have been the main source of institutional finance to farmers in Maharashtra state. The DCCBS are most important in the entire co-operative credit structure. The success of co-operative credit structure depends to a very large extent on the working of the DCCBS. These banks not only safeguard the interest of the PACS but also various other types of credit and non-credit societies in the district.

The findings of the study would be advantageous to help the planners and decision makers to adopt effective strategies for development and expansion of branches in other regions having similar conditions. In view of this the present investigation is undertaken to assess the performance of the Sangli District Central Co-operative Bank in Western Maharashtra.

Methodology:

The study was undertaken in Sangli district. The Sangli District Central Co-operative Bank Ltd., Sangli was selected purposively for the study. The SDCCB covers the whole Sangli district. Performance indicators viz; membership, share capital, reserve funds, deposits, borrowings, working capital, investment, loan advances were collected from the SDCCB's records for the period of 15 years i.e. from the year 1995-96 to the year 2009-10.

To accomplish the objective set for the study, simple tabular analysis was carried out to evaluate performance of SDCCB. The growth rates of various cooperative performance indicators were worked out for the period of 15 years i.e. from the year 1995-96 to the year 2009-10. The compound growth rates for different indicators for SDCCB were calculated using the following type of exponential model.

$$Y = abt$$

Where,
Y = Dependent variable (indicator)
a = Intercept
b = Trend value
t = Time period in years
The percentage compound growth rates were estimated by using the formula CGR = (Antilog b-1) x 100. The significance of the estimated compound growth rates were tested with the help of student 't' test.

Results:

1. Financial highlights of Sangli District Central Co-operative Bank.

The information regarding financial aspects of SDCCB are presented in the Table 1. given below.

Table 1. Financial highlights of SDCCB in Western Maharashtra

(Rs.in lakhs)

Sr. No	Particulars	2005-06	2006-07	2007-08	2008-09	2009-10
1.	Number of branches	220	220	218	218	218
2.	Share capital	4706.31	4868.91	5131.41	5346.49	5647.10
3.	Reserved funds	10322.86	11064.99	12656.36	14743.67	16712.23
4	Deposits	123206.89	114448.38	123937.15	143778.46	187664.67
5	Borrowings	17935.21	21603.08	19664.34	15455.89	4462.44
6	Investment	57563.30	43141.24	54156.84	81837.96	97959.68
7.	Working capital	172040.2	164923.81	173881.41	196963.55	228172.28
8	Loan advanced	100372.60	108886.62	104753.93	94142.72	105852.88

Source : Annual Report, 2010-11 of SDCCB

The number of branches decreased from 220 from the year 2005-06 to 218 during the year 2009-10. The share capital of SDCCB increased from Rs. 4706.31 lakh to Rs. 5647.10 lakh in the year 2009-10. The reserved funds increased from Rs. 10322.86 lakh from the year 2005-06 to Rs.16712.23 lakh. Deposits increased from Rs.123206.89 lakh to Rs. 187664.67 lakh during the same period. While Borrowings decreased from Rs. 21603.08 lakh in 2006-07 to Rs. 4462.44 lakh in 2009-10. Investment increased from Rs.43141.24 in 2006-07 to Rs. 97959.68 lakh and working capital increased from Rs.164923.82 lakh to Rs. 228172.28 lakh and loan advance by SDCCB in year 2009-10 was Rs.105852.88 lakh.

2. Performance of SDCCB in Western Maharashtra

The performance of Sangli District Central Cooperative Bank during 1995-96 to 2009-10 was studied for different indicators are presented in Table 2.

The performance of SDCCB has been undertaken since the year 1995-96 which is considered as base year, ending the year 2009-10. This period of 15 years has been divided into two periods i.e. period-I (1995-96 to 2004-05), period-II (2005-06 to2009-10) and the overall period (1995-96 to 2009-10). During the year 1995-96 the number of members of the SDCCB were 366 which however, declined to 363 during the year 2004-05 thereby indicating a decline by 0.81 per cent over the base year. The another important indicator share capital of the SDCCB during the year 1995-96 was amounting to Rs.1494.31 lakh and the same increase to height of Rs. 4569.98 lakh during the year 2004-05. Thus an increase of 205.82 per cent was witnessed over the base year. The loan advanced by the SDCCB during the base year were Rs. 44122.02 lakh and the same were Rs. 93039.92 lakh during the year 2004-05, thereby exhibiting a rise of 158.85 per cent over the base year.

Table 2. Performance of SDCCB in Western Maharashtra

(Rs. In lakhs)

Sr.No	Year	Members		Share Capital	Reserved Funds	Deposits	Borrowings	Working Capital	Investment	Loan Advances
	Period-I	**Persons**	**PACS**							
1.	1995-96	366	2723	1494.31	1857.12	39573.67	13696.95	59701.94	10837.32	44122.02
2.	1996-97	365	2865	1696.26	2379.82	48721.77	6637.94	62729.31	15036.61	43087.46
3.	1997-98	364	2945	1908.69	2839.04	53499.27	8019.34	70135.66	20503.32	44712.45
4.	1998-99	364	3027	2182.76	3168.31	60576.63	7527.97	78793.13	21194.5	52170.12
5.	1999-00	364	3087	2575.96	3731.01	68649.01	7277.13	88443.21	18851.03	63726.96
6.	2000-01	364	3264	3024.61	4406.06	76532.61	12851.05	105798.22	19925.93	78512.31
7.	2001-02	364	3402	3586.8	5189.52	84138.88	25993.33	128161.54	24376.54	96306.54
8.	2002-03	363	3523	4153.86	6080.7	94747.81	24891.1	140817.62	26071.55	106041.79
9.	2003-04	363	3625	4406.87	7293.41	100455.1	17938.22	143020.9	26385.1	106268.59
10.	2004-05	363	3699	4569.98	8618.47	111636.2	15021.9	154539.02	49554.73	93039.92
	% Change	-0.81	35.84	205.82	364.07	182.09	9.67	110.86	357.26	158.85
	CGR	-0.08***	3.52***	14.46***	17.86***	17.76***	11.35**	12.40***	12.51***	12.48***
	Period-II									
11.	2005-06	363	3770	4706.31	10322.86	123206.9	17935.21	172040.22	57563.3	100372.6
12.	2006-07	363	3813	4868.91	11064.99	114448.4	21603.08	164923.81	43141.24	108886.62
13.	2007-08	363	3831	5131.41	12656.36	123937.2	19664.34	173881.41	54156.84	104753.93
14.	2008-09	363	3848	5346.49	14743.67	143778.5	15455.89	196963.55	81837.96	94142.72
15.	2009-10	363	3881	5647.1	16712.23	187664.7	4462.44	228172.28	97959.68	105852.88
	% Change	0	2.94	19.98	61.89	52.31	-75.11	32.62	70.17	5.45
	CGR	-	0.67***	4.69***	13.32***	11.29*	-26.78N.S.	7.71**	18.57*	-0.39N.S.
	Overall period									
	% Change	-0.81	42.52	277.90	799.90	374.21	-67.42	282.18	803.91	139.90
	CGR	-0.05***	2.68***	10.20***	16.82***	10.05***	3.11N.S.	9.97***	14.75***	7.33***

(Period-I : 1995-96 to 2004-05; Period-II : 2005-06 to 2009-10 and Overall period : 1995-96 to 2009-10)

The compound growth rates of these various indicators were also estimated to know the performance of SDCCB during this period. The compound growth rates of almost all indictors turned out to be highly significant except of the members.

The performance of SDCCB was also tested for the period-II under study (2005-06 to 2009-10). During this period the membership seen to be stagnant, i.e. no change since 2004- 05 till the end of the year 2009-10. In the case of share capital a moderate increase (19.98 per cent) was seen during this period over the base year i.e. 2005-06. During the year 2005-06 the total amount of loans advanced amounted to Rs.100372.60 lakh and by the end of year 2009-10 it was Rs.105852.88 lakh thus, meagre increase of 5.45 per cent was noticed over the base year 2005-06.

The compound growth rates estimated for the indicators PACS, share capital, reserve funds and working capital observed to be highly significant. However, the compound growth rate of loan advanced were found non significant

Table 3. Per cent change over the base year

(Per cent)

Sr. No.	Particulars	Period-I (1995-96 to 2004-05) Base year- (1995-96)	Period-II (2005-06 to 2009-10) Base year- (2005-06)	Overall period (1995-96 to 2009-10) Base year (1995-96)
1	Persons	-0.81	--	-0.81
2	PACS	35.84	2.94	45.52
3	Share capital	205.82	19.98	277.90
4	Reserved funds	364.07	61.89	799.90
5	Deposits	182.09	52.31	374.21
6	Borrowings	9.67	-75.11	-67.42
7	Working capital	158.85	32.62	282.18
8	Investment	357.26	70.17	803.91
9	Loan advances	110.86	5.45	139.90

The performance of SDCCB for the overall period under study (1995-96 to 2009-10) was also tested. The similar kinds of trends in the case of per cent changes and compound growth rates were estimated as that of period-I except for the indicator 'borrowings'.

Table 4. Compound growth rates

(Per cent)

Sr. No.	Particulars	Period-I (1995-96 to 2004-05)	Period-II (2005-06 to 2009-10)	Overall period (1995-96 to 2009-10)
1	Persons	-0.08***	- -	0.05***
2	PACS	3.52***	0.67***	2.68***
3	Share capital	14.46***	4.69***	10.20***
4	Reserved funds	17.86***	13.32***	16.82***
5	Deposits	17.76***	11.29*	10.05***
6	Borrowings	11.35**	-26.78 n.s	3.11 n.s
7	Working capital	12.51***	7.71**	9.97***
8	Investment	12.40***	18.57*	14.75***
9	Loan advances	12.48***.	-0.39 n.s	7.33***

'***' '**'&'*': Indicates significance at 1, 5 &10%level

Thus, in general during the years under study the performance of SDCCB for the indicators under consideration observed to be satisfactory. The performance of SDCCB has analysed with the help of tools viz., per cent changes and compound growth rates is also depicted in the Tables 3. and 4. for easy understanding and assessment.

Conclusions:

The following conclusions could be emerged from the present study. The performance of SDCCB in terms of network and coverage was satisfactory as the number of membership had increased substantially during the study period. The compound growth rates of various indicators were also estimated to know the performance of SDCCB during study period. The compound growth rates of almost all indictors turned out to be highly significant except of the members.

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Performance and Challenges before the DCCBs in Vidarbha region of Maharashtra

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The present study was carried to study the Performance and Challenges before the DCCBs in Vidarbha region of Maharashtra.in respect of various performance indicators. The study is based on secondary data of District Central Co-operative Banks (DCCBs) in vidarbha covering the period of 27 years i.e. from 1985-86 to 2011-12. The profile of DCCBs in the Vidarbha region were studied for the year 2011-12,, periodwise average loan disbursement per DCCB and its composition were estimated for the base year (1985-86) and the terminal year (2011-12) with the help of ratios, averages and percentages. The periodwise performance in respect of important indicators was estimated with the help of compound growth rates (CGRs). The ranking of districts was based on performance index (PI) of DCCBs.

coverall comparison of DCCBs in Vidarbha region to DCCBs at state level indicates that the DCCBs in Vidarbha region were far behind in every performance indicator than at state level except in cost of management where the per DCCB cost of management to working capital was low which is good sign. The proportion of total agricultural loans (both ST and MT) in the total loans was increased this indicates that the per cent share of agricultural loans showed an increase at Vidarbha and state level, It seems that the DCCBs had concentrated on agriculture during the terminal year. However, there is need to enhance the adequate crop loans to needy farmer.

The period wise analysis of performance of DCCBs in Vidharbha region showed that the satisfactory performance of DCCBs before banking reform period i.e. 1985-86 to 1993-94 was noticed in the number of branches, borrowing, recovery, overdues, while after banking reform period (1994-95 to 2011-12) satisfactory performance of DCCBs was observed in respect of membership, loans and advances, share capital, reserve funds, own funds, deposits, investment, working capital and importantly profit and cost of management. The Akola, Yeotmal, Bhandara and Chandrapur DCCBs were the better units among the 10 DCCBs in the region. The DCCBs having very low average performance index were Wardha, Gondia and Gadchiroli which resulted into poor record of performance, which call for suitable economic measures, so that these DCCBs will improve their performance in future.. So the concerted efforts are required to enhance the recovery status in some of these DCCBs.

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Performance of Co-operative Credit for Agriculture in Thane District

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The present study was conducted in Thane district. Six villages having Agriculture Co-operative Credit Society were selected randomly. From each co-operative credit society 15 borrowers were selected randomly. The sample consisted of 45non-defaulter and 45 defaulters.

The proportion of non-liquidating loan in total borrowing was the tune of 57.21 per cent whereas, self-liquidating credit accounted for 42.79 per cent. Among the different institutions share of co-operatives in total loan component was the highest (70.76 per cent) and that of commercial banks 29.24 per cent. In case of non-defaulter group the extent of co-operative credit utilized for productive purpose was 74.83 per cent, while 25.17 per cent of credit was diverted to unproductive purposes. The defaulters utilized 63.98 and 36.02 per cent of co-operative credit for productive and unproductive purpose respectively.

The credit requirement and credit gap was estimated only for rice crop. For estimating the credit requirements, three criteria were adopted. The overall production credit requirement for first, second and third criteria were Rs.22389.61, Rs.16792.21and Rs.17403.14, respectively. The foregoing analysis of credit gap revealed that among the three criteria considered for the estimating production credit requirements, it was found that the present policy of keeping 25 per cent as margin will result in the lowest amount as compared to other two criterion. Hence, either of the remaining two (100% variable cost and excluding family labour cost) criteria should be adopted while advancing credit for rice crop.

The result of logit regression model revealed that the variables working members, non working members, consumption expenditure, use of loan for unproductive purpose, proportion of overdue to total loan and proportion of overdue to total income has significant influence on probability of being non-defaulter.

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Impact of Microfinance on SHG members in Latur district of Maharashtra state-An Economic Analysis

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The present investigation was conducted in villages of Latur district of Marthwada region of Maharashtra state to know the socio economic profile self help groups members.The findings revealed that the average size of SHGs was consisted of 10.83 members. Majority of the groups have undertaken buffalo keeping. Average per year per SHGs saving was to the extent of Rs. 10492.25. The loan received through bank was to the extent of Rs. 1251497.5 and through SHG they formed was Rs. 77942.00. The average subsidy component was Rs. 609995.00 received by banks. The recovery of loan was about 74 per cent for the bank and it was about 62 per cent in SHG. Amount of saving per member per year was Rs. 970.43. As far as individual members are concerned average size of family was 5.03 persons.Majority of the respondents took the loan for maintenance of house and education purposes. The reasons of non repayment of loan were low price of milk, low sale price of goat, not availability of market for goat and non availability of veterinary aid.

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Status of Credit Gap in Cultivation of Commercial Crops- A Study of Solapur District Co-Operative Credit Bank of Western Maharashtra

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Agricultural credit is very important instrument in facilitating the process of agricultural development and thereby initiating the growth of rural economy. The role of agricultural credit and credit institutions in the developing countries like India is very important due to the pressing needs for increasing agricultural production and productivity to meet the needs of increasing population. However, it is a problem when it cannot be obtained and it is also a problem when it is not properly utilized.

For the crops under study, i.e. banana and maintenance of grapes garden, the scale of finance decided or provided by the SDCCB is low or scanty at different costs levels (i.e. cost 'A', 'B' and 'C') and also at different criteria taken into account (i.e. at working capital level and at gross returns level). It is therefore, necessary to raise the

scale of finance for these crops by the SDCCB, in particular and other financing agencies, in general for such types of crops and also for other common crops cultivated in the state. The per hectare credit gap for banana and grapes (maintenance) at Cost 'C' was Rs.101981/- and Rs.232603/-, respectively. It is thus, imperative to raise credit/crop loans for banana and maintenance of grapes orchards by 67.10, and 65.04 per cent, respectively by the agricultural financing agencies/institutions if, to adopt the recent technologies developed to be adopted for cultivating such crops.

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Impact of Prof. Vaidyanathan Committee Report in Co-operative Sector with Special Reference to Primary Agriculture Credit Society (PACS)

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PACS are playing an important role in providing agricultural credits in rural areas. However, it faces several problems. The committee was appointed for revitalisation of the cooperative credit structure under the chairmanship of Prof. Vaidyanathan. The study was based on the primary and secondary data collected from 10 PACS each from Satara and Jalgaon district. The data pertains to the year from 2005-06 to 2008-09. It is observed that there is a positive effect of revitalisation. The PACS were in loss prior to revival package. While, they have turned out into profit after the revival package. Prof. Vaidyanathan Committee Report has provided a real tonic for the sustainance of the PACS in rural India. The study suggested that there is a need for increased contribution of female in agriculture operational work.

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Institutional Financing and Credit Disbursement in Agriculture: A review

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The co-operative credit structure needs revamping to improve efficiency of the credit delivery system in rural areas. State Governments' performance in bringing about the reforms in co-operative banks should form one of the yardsticks for sanctioning assistance/grants by the Central Government. The share of institutional credit was increased and remarkable decline in the share of non-institutional credit during the same

period. The share of commercial banks was hardly 0.90 per cent in 1950, it increased to 25.10 per cent in 2010. Up to the end of March, 2010, total KCCs issued in India were 1009.18 lakh, which were 7.84 lakh in the year 1998-99. Out of the total KCCs issued, the Co-operative banks were issued 40.32 per cent whereas, the RRBs and Commercial banks issued 15.06 per cent and 44.62 per cent of them. In the case of RRBs, for a period of 26 year, the compound growth rates (CGRs) of working capital, deposits, loan advanced and share capital were found satisfactory. All the public sector banks (PSBs) have been advised to reduce their lending rates for agriculture to a single digit rate of not more than 9 per cent per annum on crop loans upto a ceiling of Rs.50,000. There is need to promote micro finance more vigorously on a widespread basis in the rural areas of the country and bring more and more small and marginal farm families under the umbrella of rural banking. The Government of India announced number of measures in 2004 to double the flow of agricultural credit during the period of 2004-05 to 2006-07 by all the financial institutions. The Reserve Bank has also announced several policies/ measures in accordance with the objectives set for doubling of credit flow to agriculture. To prevent and save the farmers from the clutches of private money lenders, several measures were taken and are being taken by the state governments and also by the Government of India in this regard.

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Agricultural Price Policy

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The government has formulated a price policy for agricultural produce that aims at securing remunerative prices to farmers to encourage to invest more in agricultural production. Keeping this in mind, the government announces minimum support prices for major agricultural products every year. The minimum support prices for different agricultural crops were worked out by using the simple tabular analysis method. The results of the study revealed that increase in minimum support price for the year 2011-12 was observed over 2010-2011.The increase in the minimum support prices over the crops ranges between 6.67 in tur and 17.39 ground nut. The price received by the farmers for the selected crops was higher during 2008-2009 and 2009-2010, decline in the price received over the MSP was observed in cotton and kharif jowar while substantial increases in the prices of Tur and Soybean was recorded.

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Regional inequality in loan disbursement by District Central Cooperative Banks and Factors influencing loan disbursement

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Maharashtra is one of the most heterogeneous states in India. The four regions in the state viz; Western Maharashtra, Marathwada, Vidarbha and Konkan could not make much and equal progress in modernizing agriculture because of their excessively dependence on availability of capital resources and difficulties in adoption of advances in crop production technologies. An attempt has been made to study regional inequality in loan disbursement by DCCBs and factors influencing loan disbursement. The study was based on secondary data for the period of 26 years, i.e. from the year 1985-86 to 2010-11. The data related to the institutional agencies of Maharashtra were collected from Annual Reports of NABARD, RBI Bulletins, Reports, Economic Survey of Maharashtra and India and other public surveys. In order to examine whether or not the DCCBs disbursed the loan uniformly across the regions and state the Coefficients of Variations were computed for each year (from 1985 to 2010), similarly, the Theil's entropy was worked out.

The study pointed out that : (i) there were wide imbalances in disbursement of loan among the various regions. The percentage of loan recovery wasn't uniform in the state, (ii) The Western Maharashtra region enjoyed greatest benefit in disbursement of loan in the year 1990, 1995 and 2005, (iii) the coefficients of variation for per hectare loan disbursement by the DCCBs for Konkan and Marathwada region were observed to be non- significant indicating thereby an inequality in loan disbursement for the period under study, (iv) the trend analysis of Theil's. entropy coefficient showed that regression coefficients of trend equations were negative and significant for Konkan, Marathwada , Vidarbha and for the state as a whole which indicated a inequality in loan disbursement during the period under study, (v) the results of Gini ratio showed an increase in the regional inequality in the average year and subsequently reduction in the inequality for the terminal year of the study, and (vi) the GCA, average rainfall and recovery of loan were observed to be most important factors influencing the regional inequality in the disbursement of per hectare loan in all the regions during the period under study. Thus, the conclusions drawn are focusing light on the inequality in the case of loans disbursements by the DCCBs and also on the loan recovery in the state.

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