AERC, Jabalpur - Research Study No. 121

PROBLEMS AND PROSPECTS OF PRODUCTION OF SMALL MILLETS AND THEIR VALUE ADDED PRODUCTS IN MADHYA PRADESH

Study Sponsored by
Ministry of Agriculture and Farmers Welfare
(Govt. of India)

Agro Economic Research Centre
Jawaharlal Nehru Krishi Vishwa Vidyalaya
Jabalpur (M.P.) 482 004

MARCH, 2017

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AGRO- ECONOMIC RESEARCH CENTRE FOR MADHYA PRADESH AND CHHATTISGARH
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.)

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PREFACE

The present study entitled "Problems and Prospects of Production of Small Millets and their Value Added Products in Madhya Pradesh" was sponsored by the Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare Government of India, New Delhi.

The study comprises 60 Kodo and 60 Kutki growers of Mandla & Dindori and Dindori & Chindwara districts respectively. The primary data were collected from selected respondents in the reference year 2015-16 by survey method. Low productivity of Kodo/Kutki was observed in farmers' fields as compared to Recommended Packages of Practices (RPP), as these crops were found to predominantly grown in shallow soils with low water holding capacity and under rain-fed conditions. The farmers were not found to adopt improved crop production practices due to lack of knowledge about RPP in cultivation of these crops. Their poor socio economic conditions and non availability of HYVs seed also hampered the production of small millets. Lack of suitable extension and development support for production and research on genetic improvement in small millets was not given utmost importance as compared to other food crops troubled the production of small millet. Huge price spread (minimum of 200%) and absence of Minimum Support Price (MSP) forced famers to distress sell of their products at un-remunerative price.

The present study was conducted by Dr. H.O. Sharma and Dr. Deepak Rathi of this Centre. The field investigation, tabulation, analysis, interpretation and drafting of the report was performed by them. I wish to express my deep sense of gratitude to team members namely; Mr. S.K. Upadhye, Mr. C.K. Mishra, Mr. S.C. Meena, Mr. H.K. Niranjan, S.S. Thakur, Mr. Rajendra Singh Bareliya and Mr. Ravi Singh Chouhan for their untiring efforts in bringing this innovative study to its perfect shape.

On behalf of the Centre, I express deep sense of gratitude to Dr. V.S. Tomar, Hon'ble Vice-Chancellor and Chairman Advisory Body of AERC, Jabalpur, Shri P.C. Bodh, Adviser, AER Division, Ministry of Agriculture & Farmers Welfare, Govt. of India, New Delhi. Dr. S.K. Rao, Director Research Services, Dr. P.K. Mishra, Dean, Faculty of Agriculture, and Dr. D. Khare, Director Instruction, Dr. P.K. Bisen, Director of Extension, Dr. N.K. Raghuwanshi, Prof. & Head (Dept. of Agril. Econ. & F.M.), Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur for providing the valuable guidance and all facilities during various stages in successful completion of this study of high importance.

I express sincere thanks to Shri K.S. Netam, Joint Director Agriculture, (Jabalpur Division) Shri R.B. Sahu, K.P. Bhagat, and Shri Shaleel Dhagat, Deputy Director, Agriculture of Mandla, Chhindwara & Dindori, districts respectively and their field staff for providing not only secondary data but also extending great assistance in collection of field data from the selected respondents .

I hope the findings and suggestions made in the study would be useful to policy makers of the State and Govt. of India.

Date : 10.04.2017
Place: Jabalpur

(Hari Om Sharma)
Prof. & Director

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CHAPTER-I

INTRODUCTION

Millet crops comprises of pearl millets, sorghum, finger millets and small millets namely fox millets (Kangni), Kodo millets (kodo), Proso Millets (Cheena), barnyard millets (Sawan) and little millets (Kutki). The term "millet" is used to represent many small-grained cereals. Millets are one of the oldest cultivated food-grains known to humans and have been a staple food in Northern Africa for thousand years, and was a staple food in China and India prior to the popularity of fine cereals like rice and wheat (Hariprasanna and Rao, 2016). These crops have a long history of cultivation of more than 5000 years and grown in many States.

Millets are drought tolerant, climate resilient and hardy crops and quite adoptable to poor soil fertility and limited precipitation. They are drought hardy, ecologically sound and esuriently. Wide adaptability, early maturity, easy cultivation and assured harvests of these crops by and large have ensured regional food and feed security in the country (Michaelraj 2013). The millet grains are well known for their superior quality, nutritional security and human health. They are quite important in areas of their production as dry land crops, especially increase of argental and hill agriculture, providing staple food for the people of the region. Millets are also unique due to their short growing season. They can be developed from planted seeds to mature, ready to harvest plants in as little as 65 days. When, properly stored, whole millets can be kept for two or more years.

Millets are highly nutritious, non-glutinous and not acid forming foods, and easy to digest. They are considered to be the least allergenic and most digestible grains. Compared to rice, especially polished rice, millets release lesser percentage of glucose and over a longer period, this lowers the risk of diabetes. Millets are particularly high in minerals like iron, magnesium, phosphorous and potassium. Finger millet (Ragi) is the richest in calcium content, about 10 times that of rice or wheat. Millets, like Kodo (Paspalum scrobiculatum) and Kutki (Panicum sumatrense) are high on fiber and low on calorie. Kodo/Kutki are Indian origin minor millets, short duration Kharif crop grown well in warm climate, divers soil, varying rain fall and in areas widely differing in thermo and photo periods. All these have made millet crops quite indispensable to rain fed, tribal and hilly agriculrure where crop substitution is difficult. That is why it has become imperative to enhance the production and productivity of these crops to ensure food and nutritional security not only to people living in harsh and difficult terrains but also in other area with exploring the possibility of export as they can be a good choice for diabetes patients, cooked just like rice and can be a good substitute of rice. Its fiber content is five times that of rice and contains low calorie content. Mixed with wheat Kodo is a good diet for diabetes patients. Protein-rich Kutki too is a good grain substitute for diabetics. It has 20 per cent less carbohydrate than rice and wheat (Table 1.1).

Table 1.1: Nutrient composition of kodo/kutki as compared to other cereals

Crop / Nutrient	Protein (g)	Fat (g)	Fiber (g)	Minerals (g)	Iron (mg)	Calcium (mg)	Calories (kcal)
Pearl Millet	10.6	4.8	1.3	2.3	16.9	38	378
Finger Millet	7.3	1.5	3.6	2.7	3.9	344	336
Foxtail Millet	12.3	4	8	3.3	2.8	31	473
Kodo Millet	8.3	3.6	9	2.6	0.5	27	309
Little Millet	7.7	5.2	7.6	1.5	9.3	17	207
Barnyard Millet	11.2	3.9	10.1	4.4	15.2	11	342
Sorghum	10.4	3.1	2	1.6	5.4	25	329
Proso Millet	12.5	2.9	2.2	1.9	0.8	14	356
Rice	6.8	2.7	0.2	0.6	0.7	10	362
Wheat	11.8	2	1.2	1.5	5.3	41	348

Kodo is not only drought resistant but also grows on poor soil. It can be stored for 20 years without being spoiled by pests. Tribal communities eat Kodo millet when the paddy crop fails. Madhya Pradesh covers 33.4 per cent of area and contributes 26.6 per cent of production of small millets in the country. Kodo (70 %) and Kutki (24 %) account together 94 per cent of area of small millets in Madhya Pradesh. Looking to the importance of the small millets particularly Kodo and kutki in Madhya Pradesh, the present study was undertaken with the following specific objectives;

1.1 Objectives of the Study

1. To examine the trend of area, production and productivity of small millets and other Kharif crops
2. To analyze profitability of small millets over other Kharif crops.
3. To identify different value added products of small millets and analyze their economics in the area under study.
4. To identify the problems in production of small millets and their value added products.

1.2 Review of Literature

Tekam (1989) worked out economics of kodo-Kutki production and examined constrains in adoption of improved technology in a study at Rewa (M.P.) and concluded the defective package of practices applicable to respective Agro-Climatic conditions, imbalanced and improper use of fertilizer, lack of plant protection measures inadequate irrigation facilities, low price of farm produce, lack of technical know-how and lack of motivation to follow the recommended technology of kodo Kutki was also estimated to be 33 per cent.

Baghel et al. (1991) conducted field trials at Rewa, Kodo millets was intercropped with Green gram, Soybean and Til. The highest Kodo

millet equivalent yield was obtained when it was intercropped with Soybean in alternate rows.

Seetaram (1998) derived in his research that area of Finger, Foxtail, Kodo, Little, Proso and Banyard millet in India during the last 50 years was found to be decreased by 4 million hectare without reduction in their overall production. Among minor millets, Finger millet accounts for about 50% of area and contributes 65% Production.

Beohar and Agrawal (1999) reported that the productivity of small millets (kodo Kutaki, Ragi and Sawan) in Mandla district (M.P.) is very low thus there is a great opportunity for increasing yields. The Regional Agriculture Research Station (Mandla) got very good result in applied and adoption trails of mixed intercropping with smaller cereals. Kodo grown alone gave the maximum yield (1270 kg/ha) but when Kodo was sown with arhar or Soybean, net profit was found to be increased and was highest with 2:1 (Kodo : Arhar) ratio.

Arora and Shrivastava (2002) studied the suitability of millet-based food products for diabatics. The food products like; khichdi, laddu and batti were prepared by them taking Finger millet/ Barnyard millet as a base separately with legumes and fenugreek seed. These food products showed hypoglycemic effect in human volunteers. The glycemic index of Finger millet based food products were 25.53, 34.62 and 36.12 and of Barnyard millet based food products were 27.24, 34.68, and 36.71 for khichdi, laddu and batti respectively.

Singh and Shrivatava (2004) conducted 25 FLDs on small millets at Sidhi district. Yield gap was calculated between demonstration and farmer's field and found that the maximum yield gap was estimated to be 48.3 % in case of large followed by small (36.3%) and medium (34.9%) farmers. It maybe concluded that the yield gap was lowest among medium farmers which indicate that medium farmers used comparatively more input to reap the good harvest efficiently from their limited land. Average grain yield of improved and traditional variety of kodo millet was 7.33 and 5.55 q/ha, respectively. It indicated that productivity of Kodo millet could be increased around 32% by adopting the improved varieties by the farmers.

Thus it can be concluded that the ignorance of recommended package of practices is the major constraints of Kodo production. The improved and recommended technology/ package gave a higher yield per acre than farmer's practices for all the crops under study. kodo gave maximum returns or profit when it was intercropped with other crops. Capital was the most important constraint contributing about 50 per cent gap in potential gross return. The main constraints for the wide gap were unbalanced and very low quantity of fertilizer application, high cost of inputs, and untimely supply of inputs, poor capital base and lack of adoption of modern technology.

Kodo grown alone gave the maximum yield (1270 kg/ha) but when kodo was sown with Arhar or Soybean, net profit increase. Net profit was highest with 2:1 (Kodo:Arhar) intercropping.

1.3 Data and Methodology

The study is confined to Madhya Pradesh keeping in view the maximum share of small millets (Table 1.2) and importance of these particular crops in view of the global perspectives. The study attempted to cover Kodo and Kutki with other crops during kharif season for in depth analysis as the major area was found to be occupied under these crops.

The study is based on primary as well as secondary data. The primary data were collected from the small millets growers.

Table 1.2: Contribution of area, production & productivity of small millets of different States in India

States	Area		Production		Yield Kg/ha
	000' ha	% to total	000' t	% to total	
Andhra Pradesh	28.0	4.1	22.0	5.1	786
Arunachal Pradesh	22.7	3.3	23.8	5.5	1050
Assam	5.4	0.8	3.3	0.8	614
Bihar	2.8	0.4	2.1	0.5	755
Chattisgarh	112.8	16.5	25.1	5.8	223
Gujarat	38.0	5.6	41.0	9.5	1079
Himachal Pradesh	4.6	0.7	3.2	0.7	685
Jammu & Kashmir	5.1	0.7	2.4	0.6	473
Karnataka	24.0	3.5	13.0	3.0	542
Kerala	0.0	0.0	0.0	0.0	875
Madhya Pradesh	227.7	33.4	114.5	26.6	503
Maharashtra	57.0	8.4	29.0	6.7	509
Meghalaya	2.8	0.4	2.5	0.6	872
Nagaland	8.7	1.3	9.8	2.3	1125
Orissa	19.3	2.8	9.7	2.3	502
Rajasthan	13.7	2.0	4.5	1.0	330
Sikkim	3.0	0.4	3.0	0.7	1003
Tamil Nadu	32.4	4.8	35.2	8.2	1085
Uttar Pradesh	8.0	1.2	6.0	1.4	750
Uttarakhand	64.5	9.5	78.1	18.2	1211
West Bengal	1.5	0.2	1.5	0.4	975
D & N Haveli	0.2	0.0	0.2	0.1	957
All India	682.3	100.0	429.9	100.0	630

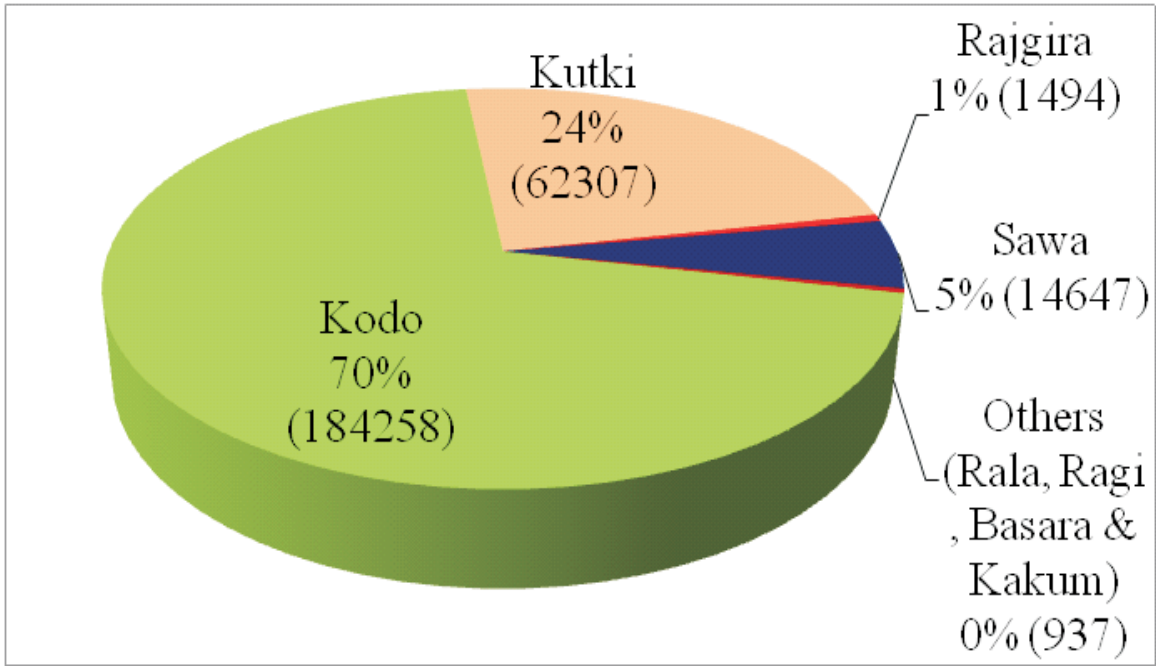

Fig 1.1: Share of different Small Millets in Madhya Pradesh

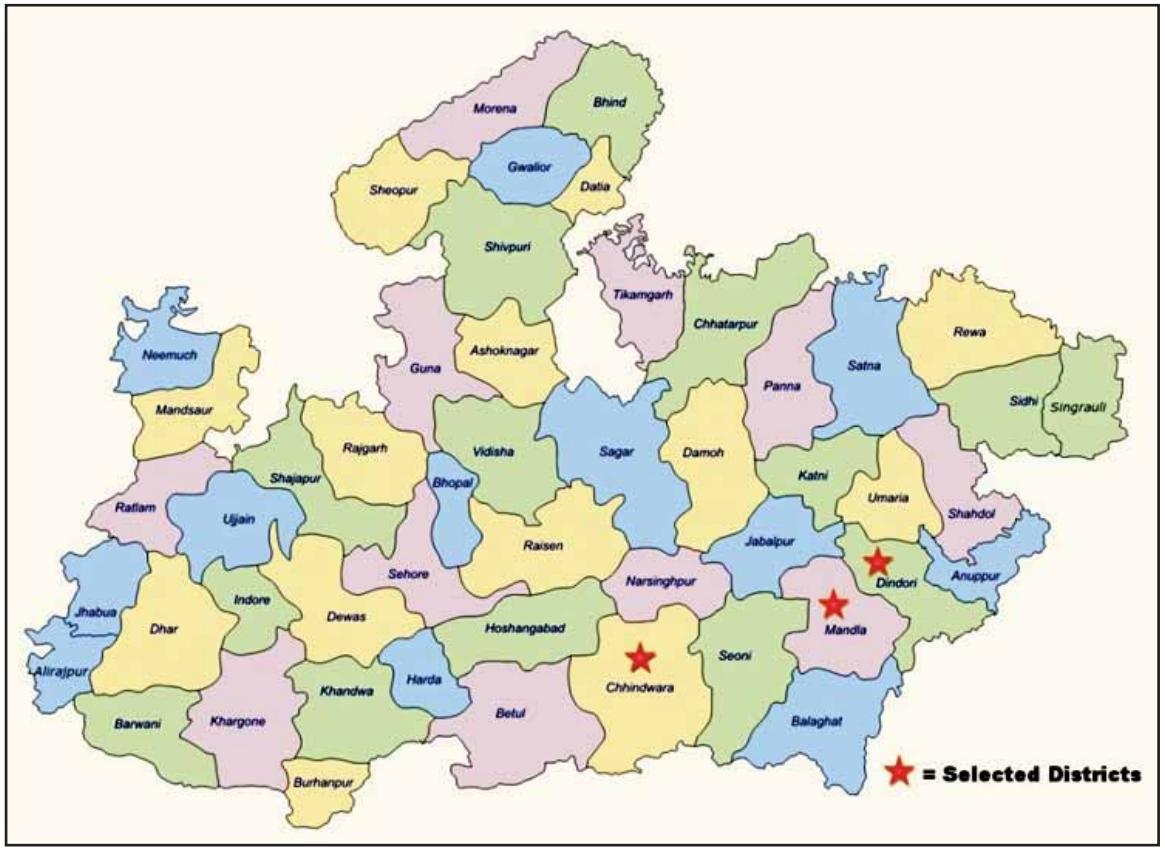

Fig 1.2 Selected Districts under the Study in Madhya Pradesh

Table 1.3: District wise area of kodo and kutki in Madhya Pradesh (ha)

Districts	Kodo		Districts	Kutki	
	Area	% to total		Area	% to total
Dindori	28542	15.49	Chhindwara	15413	24.74
Mandla	22756	12.35	Dindori	12051	19.34
Singroli	17690	9.6	Mandla	9517	15.27
Damoh	15829	8.59	Balaghat	4636	7.44
Shahdol	13212	7.17	Seoni	4559	7.32
Umariya	12918	7.01	Anuppur	3677	5.9
Sidhi	12543	6.81	Singroli	3668	5.89
Anuppur	11398	6.19	Betul	2822	4.53
Jabalpur	11151	6.05	Jabalpur	1432	2.3
Chhindwara	8502	4.61	Shahdol	1102	1.77
Seoni	6762	3.67	Umaria	1054	1.69
Balaghat	5530	3	Khandwa	873	1.4
Katni	2704	1.47			
Rewa	1869	1.01			
Others	12852	6.98	Others	1503	2.41
Madhya Pradesh	184258	100	Madhya Pradesh	62307	100

Two districts having the highest area under the selected crops in the State i.e. Dindori & Madla for kodo and Chhindwara & Dindori for Kutki were selected for the study. (Table 1.3) One block from each selected districts and 30 farmers from each block viz. Ghughari & Shapura from Mandla & Dindori, for kodo and Tamiya & Shapura from Chhindwara & Dindori for kutki (Table 1.4) were selected for the study. on the basis of maximum area under these crops. . A list of all the villages in these selected blocks where concentration of area was found to be more under these crops was prepared and one village was chosen randomly. Further, more number of villages nearby selected village were considered for collection of primary data to fulfill the requirement of desired sample size (Table 1.4).

Thus, the study covered 120 tribal farmers comprises of 60 kodo and 60 kutki growers in the area under study. The primary data were collected by pretested interview schedule by survey method for the reference year 2015-16.

Table 1.4: Number of respondents in selected crops for the study

Name of Crops	Districts	Blocks	Villages	No. of respondents
Kodo	Mandla	Ghughari	Choba, Baniya, Tilabade Deorikalan, Patpara,	30
	Dindori	Shahpura	Dubaraiyat, Kahamariya, Rampurimal, Dubamal, Duba, Tendudi	30
Total	2	2	11	60
Kutki	Chhindwara	Shahpura	Tinga, Dhulaniya, Batakidhana Deorikalan, Deori,	30
	Dindori	Tamiya	Dubaraiyat, Dubamal, Duba, Deorimal, Chhapara, Pataparamal	30
Total	2	2	11	60
Grand Total	4	4	22	120

The secondary data on area production and productivity of selected crops and other kharif crops of last fifteen years (2001-2014) were collected from the various sources viz. Agriculture statistics of Madhya Pradesh published by Directorate of Agriculture, various online information available at government websites like;- http://eands.dacnet.nic.in,www.mpkrishi.org etc. www.landrecordcommissioner.in,

1.4 Limitation of the Study

The present study is purely based on primary data. The study pertains to the primary data collected for the study in the year 2015-16. Moreover, farmers provided information based on their recall memory. Thus, there is a possibility of certain memory bias to enter in the presentation of the data. Therefore considerable care should be taken while generalizing the acceptability of the results of this study. The study related to Agro Climatic Condition representing the study area of the State. Therefore result of present investigation may not be generalized in broad sense because of small sample and coverage of the study area.

1.5 Organization of the Report

The study is organised into 6 chapters. Chapter I covers the introductory part of the study followed by trend of area, production and productivity of small millets and other major

kharif crops (Chapter II), Socio economic characterises of the sample household in Chapter –III, Profi+tability of small millets over other major kharif crops covered under chapter IV. Chapter V deals with the value added products of small millets while, Summary and conclusion are given in chapter VI.

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Box-1.1: Kodo Millet Characters and Uses

Kodo millet Paspalum scrobiculatum (L.) is widely distributed in damp habitats across the tropics and subtropics of the world. This cereal is also known as varagu, haraka and arakalu. It forms the main stay of the dietary nutritional requirements. It has high protein content (11%), low fat (4.2%) and very high fiber content (14.3%).

Kodo millet is very easy to digest; it contains a high amount of lecithin and is excellent for strengthening the nervous system. Kodo millets are rich in B vitamins, especially niacin, B6 and folic acid, as well as the minerals such as calcium, iron, potassium, magnesium and zinc. Kodo millets contain no gluten and is good for people who are gluten intolerant. Regular consumption of kodo millet is very beneficial for postmenopausal women suffering from signs of cardiovascular disease, high blood pressure and high cholesterol levels.

Kodo millet is a monocot and an annual grass that grows to heights of approximately four feet. It has an inflorescence that produces 4-6 racemes that are 4-9 cm long. Its slender, light green leaves grow to be 20 to 40 centimetres in length.

The seeds it produces are very small and ellipsoidal, being approximately 1.5 mm in width and 2 mm in length; they vary in colour from being light brown to a dark grey. Kodo millet has a shallow root system which may be ideal for intercropping.

Kodo millet is propagated from seed, ideally in row planting instead of broadcast sowing. Its preferred soil type is a very fertile, clay-based soil. Kodo is better suited to dried conditions than its wild counterpart, which requires approximately 800-1200 mm of water annually and is well suited to sub-humid aridity condition. With very low competition from other plants or weeds for nutrients, it can grow well in poor-nutrient soils. However, it does best in soils supplemented with a general fertilizer. .

Kodo millet prefers full light for optimal growth, but can tolerate some partial shading. Its ideal temperature for growth is 25-27 °C. It requires four months until maturity and harvesting.

Box-1.2 Kutki Characters and Uses

Kutki (Pichrohiza Kurroa Royle ex. Benth) belong to family Scrophulariaceae-Tikta Kula is a small herb with spoon-shaped and powerful Ayurvedic herb used in treating mainly chronic fever, skin disorders and diabetes.

It is also used in purgation (Virechana Panchakarma) procedure. Leaves 5 to 15 cm long almost all at the base, often withered, leaves are oval in shape coarsely toothed, and narrowed to a winged stalk. Flowers small, pale or purplish blue in colour, about 8 mm, 5 lobed in the middle and with much longer stamens. Fruits 1.3 cm long Rhizomes 15 to 25 cm long. It is a well-known herb in the Ayurveda and has been used to treat disorders of the liver and upper respiratory tract, chronic diarrhea, and scorpion sting. Kutkin, D-mannitol, Vanillic Acid two C-9 iridoid glycosides-Picroside I and Kutakoside, Apocynin, Picroside II and some steroids are present. Kutki root contains a Kutki, a bitter glycosidal principle Also isolated D-mannitol, vanillic acid and some steroids are present in the plant. Kutki was later shown to be a stable mixed crystal of two C-9 iridoid glycosides- Picroside I and Kutakosid. Apocynin has been isolated from the plant. Picroside II has been isolated and shown to have hepatoprotective activity. With the help of preparative HPLC, larger Quantities of picrosides have been isolated, permitting precise structure identification and biological experiments.

Kutki is grown throughout India up to altitudes of 2100 m. Plants vary from 60 to 170 cm in height. The inflorescence is 14 to 20 cm long, erect, open, and highly branched. These branches sometimes droop at maturity. It matures between 2.5 to 5 months. The yields are generally less than 0.5 Tones/ ha, but under favorable conditions, may reach close to 1 t / ha. Little millet tends be confused with common millet, but it is generally shorter, and has smaller panicles and seeds than common millets.

The plant varies in height between 30 and 90 cm and its oblong panicle varies in length between 14 and 40 cm. It is mostly mix cropped with other millets, pulses and oilseeds. The seeds of little millet are smaller than those of common millet. It is generally consumed as rice and any recipe that demands staple rice can be prepared using little millet.

CHAPTER-II

TREND OF AREA, PRODUCTION AND PRODUCTIVITY OF SMALL MILLETS

This chapter deals with the trend along with relative change, coefficient of variance, compound growth of area, production, and productivity of small millets in Madhya Pradesh and India for the period from 2001-15. These were also analysed for the selected small cereals i.e. kodo & kutki and other/competing major cereal crops grown in Madhya Pradesh.

2.1 Trend of Small Cereals in Madhya Pradesh and India

The trend (b) along with relative change, co-efficient of variance, and growth of area, production and productivity of small millets have been analysed for Madhya Pradesh and India for the period from 2001-2015 and presented in table 2.1.

Table 2.1: Growth of area, production and yield of small millets in Madhya Pradesh and India during the period 2001-15

Particulars	The Base year (TE 2003)	The Current year (TE 2015)	Absolute Change	Relative Change	Standard Deviation	Coefficient of Variance	Regression Coefficient	Annual Compound Growth Rate
Area (000' ha)								
Madhya Pradesh	453.13	194.57	-258.57	-57.06	100.13	30.43	-21.48*	-7.05
India	1311.77	675.33	-636.44	-48.52	246.90	24.67	-53.18*	-5.41
Production (000' t)								
Madhya Pradesh	94.90	90.48	-4.42	-4.66	14.85	15.96	-1.25	-1.35
India	540.97	417.14	-123.82	-22.89	65.05	13.55	-11.34*	-2.32
Yield (kg/ha)								
Madhya Pradesh	210.09	484.24	274.14	130.49	105.85	34.28	19.74*	6.13
India	411.57	620.76	209.19	50.83	80.84	16.31	16.38*	3.27

* Significant at 1% of Probability level

It is observed from the data that the area of small millets in Madhya Pradesh was found to be decreased by 57.06 per cent in the current year (194.57 thousand ha) over the base year (453.13 thousand ha) with the fluctuation of 30.43 per cent with highly significant compound growth of -7.05 per cent and magnitude of -21.48 thousand ha (b) per year during the period from 2001-15. The area of small millets in India was found to be decreased by 48.52 per cent in the current year (675.33 thousand ha) over the base year (1311.77 thousand ha) with the fluctuation of 24.67 per cent with highly significant compound growth of -5.41 per cent and magnitude of -53.18 thousand ha (b) per year during the period under study.

The production of small millets in Madhya Pradesh was found to be decreased by 4.68 per cent in the current year (90.48 thousand t) over the base year (94.90 thousand t) with the fluctuation of 15.96 per cent and compound growth of -1.35 per cent and magnitude of 1.25 thousand ha (b) per year. The production of small millets in India was found to be decreased by 2.32

per cent in the current year (417.14 thousand t) over the base year (540.97 thousand t) with the fluctuation of 13.55 per cent with highly significantly compound growth of -2.32 per cent and magnitude of -11.34 thousand t (b) per year.

The yield of small millets in Madhya Pradesh was found to be increased by 130.49 per cent in the current year (484.24 kg/ha) over the base year (210.09 kg/ ha) with the fluctuation of 34.28 per cent with highly significantly compound growth of 6.13 per cent and magnitude of 34.28 thousand ha (b) per year. The yield of small millets in India was also found to be increased by 3.27 per cent in the current year (620.76 kg/ha) over the base year (411.57 kg/ ha) with the fluctuation of 16.31 per cent with highly significantly compound growth of 3.27 per cent and magnitude of 16.38 kg/ ha (b) per year.

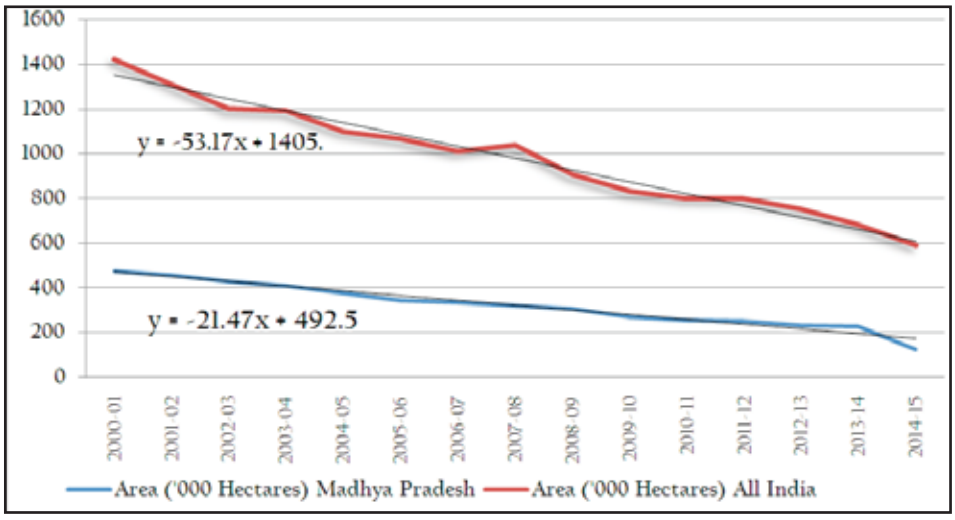

Fig. 2.1: Trend of Area of Small Millets in Madhya Pradesh and India

The trend of area of small millets in Madhya Pradesh and India was found to be decreased with a highly significant rate (Fig.2.1)

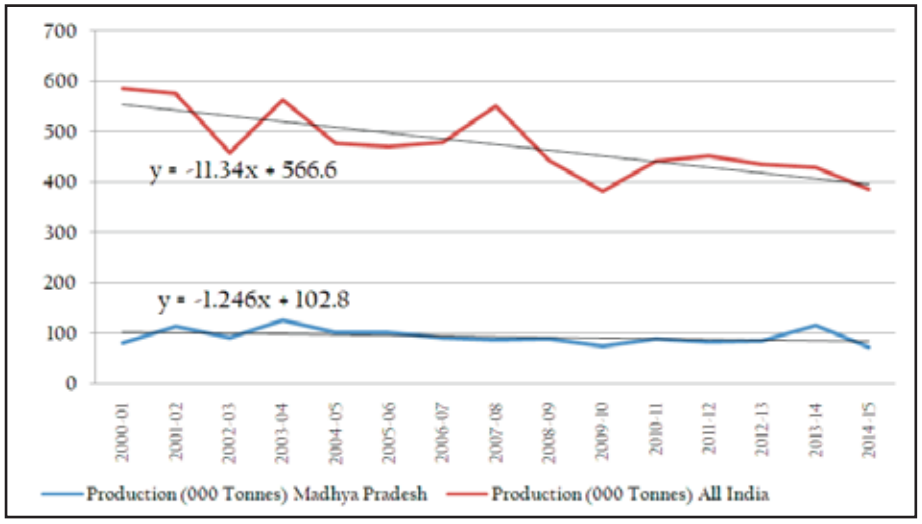

Fig. 2.2: Trend of Production of Small Millets in Madhya Pradesh and India

The production of small millets was found to be decreased at highly significant rate in the country but it was found non significant in Madhya Pradesh (Fig.2.2), while the yield of small millets was found to be increased at highly significant rate both in the State and in the country (Fig.2.3) .

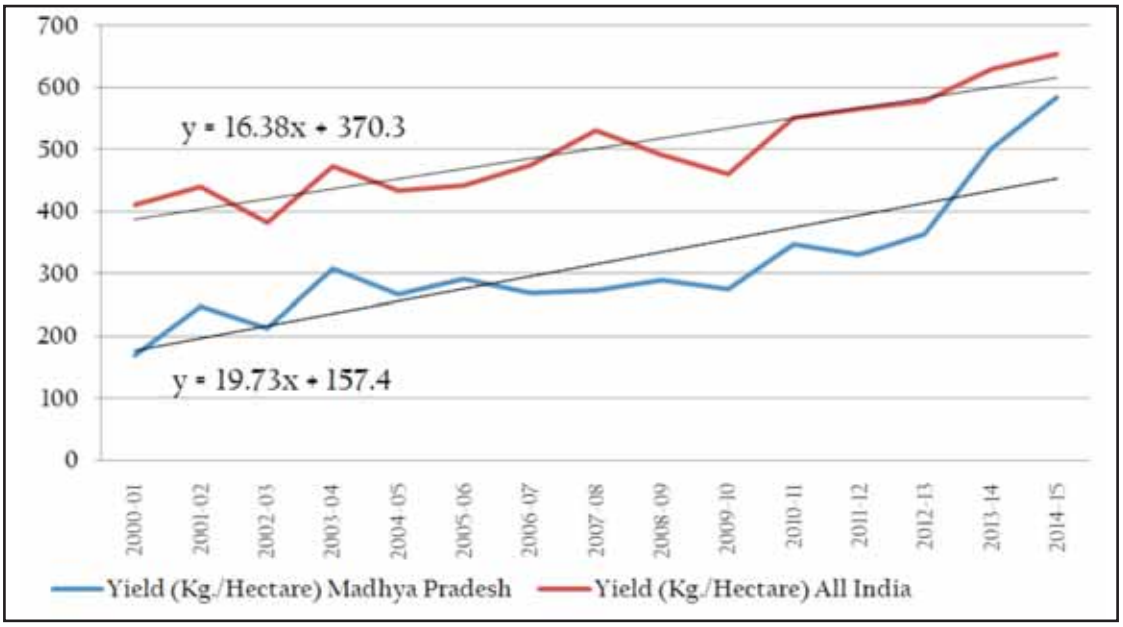

Fig. 2.3: Trend of Yield of Small Millets in Madhya Pradesh and India

2.2 Trend of Area, Production and Productivity of Kodo/Kutki and other Major Kharif Crops

The trend of area, production and productivity of Kodo/Kutki & other kharif crops for the period from 2000-14 in Madhya Pradesh was analysed and presented in table 2.2. The data related to area, production and productivity exclusively for kodo and kutki was not available separately. Hence pooled available data of kodo and kutki was considered for the study.

It is observed from the data that the area of kodo & kutki in Madhya Pradesh was found to be decreased by -49.36 per cent in the current year (216.57 thousand ha) over the base year (427.63 thousand ha) with the fluctuation of 25.41 per cent and highly significant compound growth of -5.56 per cent with magnitude of -17.62 thousand ha (b) per year during the period from 2001-15. While the area under other kharif crops i.e. paddy, maize and soybean was found to be increased by 3.30, 3.70, and 35.71 per cent respectively in the current year over the base year with compound growth of 0.13, 0.07 and 2.87 per cent per year. the compound growth rate of area under soybean was found to be highly significant.

Table 2.2: Trend of area (000' ha), production (000' t) and productivity (kg/ha) of kodo/kutki and other major kharif crops in Madhya Pradesh (2001-15)

Particulars	The Base year (TE 2003)	The Current year (TE 2015)	Absolute Change	Relative Change	Standard Deviation	Coefficient of Variance	Regression Coefficient	Growth
Kodo/Kutki								
Area	427.63	216.57	-211.07	-49.36	79.58	25.41	-17.62*	-5.56
Production	95.73	81.53	-14.20	-14.83	15.99	18.86	-1.53	-1.45
Yield	220.33	475.33	255.00	115.73	126.32	42.16	19.18*	5.78
Paddy								
Area	1741.40	1798.80	57.40	3.30	79.90	4.69	2.49	0.13
Production	1425.04	2889.67	1464.62	102.78	688.41	39.29	103.71*	5.56
Yield	840.63	1666.67	826.04	98.26	363.27	34.64	61.40*	5.58
Maize								
Area	831.80	862.57	30.77	3.70	28.24	3.30	0.55	0.07
Production	1389.63	1735.60	345.97	24.90	375.50	27.19	11.84	0.52
Yield	1676.33	2010.80	334.47	19.95	421.69	26.10	11.84	0.41
Soybean								
Area	4454.97	6045.70	1590.73	35.71	692.06	13.81	144.37*	2.87
Production	3969.67	6472.30	2502.63	63.04	1481.61	29.05	246.88*	5.00
Yield	891.33	1078.38	187.05	20.99	198.18	19.67	21.08*	2.12

* Significant at 1% of Probability level

The production of kodo & kutki in Madhya Pradesh was also found to be decreased by 14.83 per cent in the current year (81.53 thousand t) over the base year (95.73 thousand t) with the fluctuation of 18.86 per cent and compound growth of -1.45 per cent with the magnitude of -1.53 thousand ha (b) per year. While the production of other kharif crops i.e. paddy, maize and soybean was found to be increased by 102.78, 24.90, 63.04 per cent respectively in the current year over the base year with highly significant compound growth of 5.56 and 5.00 per cent per year in case of paddy and soybean respectively, while the compound growth rate of maize production was found to be 0.52 per cent per year and non-significant.

The yield of kodo & kutki in Madhya Pradesh was also found to be increased by 115.73 per cent in the current year (475.33 kh/ha) over the base year (220.33 kg/ha) with the fluctuation of 42.16 per cent and highly significant compound growth of 5.78 per cent with magnitude of 19.18 thousand ha (b) per year during the period under study. The yield of other kharif crops i.e. paddy, maize and soybean was found to be increased by 98.26, 19.95, 20.99 per cent respectively in the current year over the base year with highly significant compound growth of 5.58and 2.12 per cent per year in case of paddy and soybean respectively, while the compound growth rate of maize yieldwas found to be 0.41 per cent per year and non-significant.

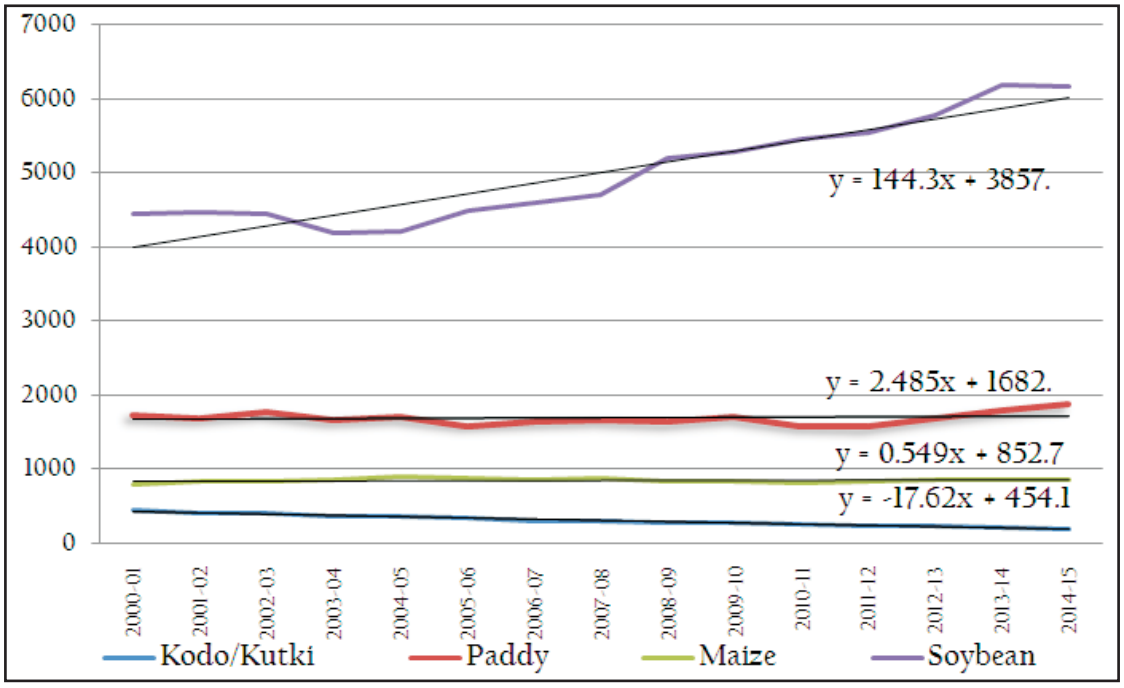

Fig. 2.4: Trend of Area of Kodo/Kutki, Paddy, Maize and Soybean in Madhya Pradesh

The trend of area of kodo-kutki was found to be decreased while increased in case of paddy, maize and soybean during the period under study. (Fig.2.4). The trend of production of kodo-kutki was found to be decreased, while increased in case of paddy, maize and soybean during period under study. (Fig.2.5). As far as the trend of productivity is concerned it was found to be increased across all the crops considered during the period under study in Madhya Pradesh. (Fig.2.6)

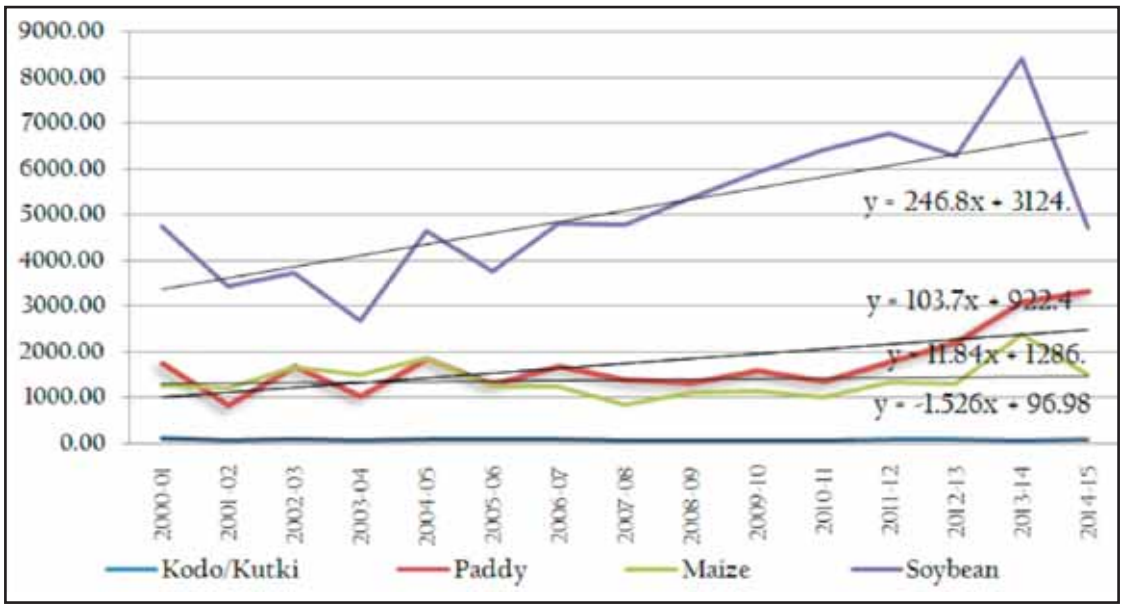

Fig. 2.5: Trend of Production of Kodo/Kutki, Paddy, Maize and Soybean in Madhya Pradesh

Thus, it can be concluded from the above findings that area and production of small millets was found to be decreased while the productivity was increased with highly significant rate in Madhya Pradesh and Country as well except production in Madhya Pradesh.

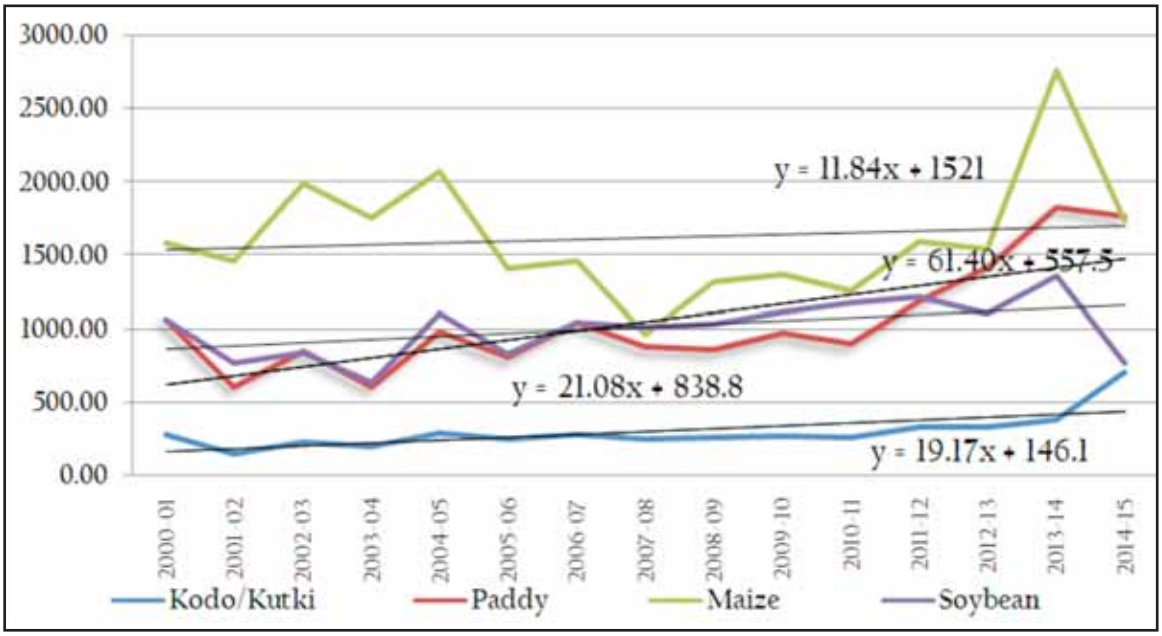

Fig. 2.6: Trend of Yield of Kodo/Kutki, Paddy, Maize and Soybean in Madhya Pradesh

The area and production of other major kharif crops viz. paddy, maize and soybean were found to be increased at highly significant rte except area of paddy & maize and production in case of maize during the period from 2001-15 in Madhya Pradesh. Looking to the above discussion it is clear that in Madhya Pradesh the area under kodo/kutki was found to be decreasing significantly while the productivity was increasing significantly. The area, production and productivity of other major kharif crops such as paddy, maize and soybean grown in the state during the period under study were found to be increased and replacing the area of kodo/kutki significantly as these crops were found to be more profitable than the kodo/kutki. The government is also popularizing and motivating farmers to grow other major kharif crops by replacing kodo/kutki for their economic betterment.

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CHAPTER-III

SOCIO-ECONOMIC CHARATERISTICS OF THE SAMPLE HOUSEHOLDS

This chapter deals with the socio-economic profile of the respondents related to small millets i.e. kodo and kutki their land utilization pattern, cropping pattern and value of their farm assets.

3.1 Socio-Economic Profile of the Respondents

Socio economic profile of the respondents is presented in table 3.1. It is observed from the data that majority of farmers were found to be scheduled tribe (95%) followed by Other Backward Classes (5.0 %) farmers. Their average age was found to be 48 years and had 3 male, 2 females and 3 children in family. The majority of them were found to be illiterate (50%) followed by primary (38.3%), high school (7.5%) and higher secondary (4.2%) educated.

Table 3.1: Socio-Economic profile of respondents (%)

S.No	Particulars	Respondents related to		Overall
		Kodo Millets	Kutki(Little) Millets	
1	Total Numbers of Respondents	60	60	120
2	Caste			
a.	Schedule Caste	0.0	0.0	0.0
b.	Schedule Tribe	95.3	96.7	96.0
c.	Other Backward Classes	4.7	3.3.	4.0
d.	General	0.0	0.0	0.0
3	Average age (Years)	47.0	48.0	48.0
4	Average No. of Family Members			
a.	Male	2.0	3.0	3.0
b.	Female	2.0	2.0	2.0
c.	Children	2.0	3.0	3.0
	Total	6.0	8.0	8.0
5	Educational Status			
a.	Illiterate	43.3	56.7	50.0
b.	Primary	38.3	38.3	38.3
c.	High School	11.7	3.3	7.5
d.	Higher Secondary	6.7	1.7	4.2
6	Occupation			
a.	Main: Agriculture & Allied	100.0	100.0	100.0
b.	Subsidiary: Agricultural Labour	76.6	83.3	80.0

All the respondents were found to engage in agriculture and allied activities for their livelihood. The 80 per cent of them engaged themselves as agricultural labourers. The majority of kodo growers were also found to be scheduled tribe (95.3%) followed by Other Backward Classes (4.7 %). Their average age was found to be 47 years and had 2 male, 2 females and 2 children in family. The majority of them were found to be illiterate (43.3%) followed by primary (38.3%) high school (11.7%) and higher secondary (6.7%)educated. All the respondents were found to be engaged in agriculture and allied activities for their livelihood. The 76.6 per cent of them engaged themselves as agricultural labourers.

The majority of kutki growers were found to be scheduled tribe (96.7%) followed by Other Backward Classes (3.3 %). Their average age was found to be 48 years and had 3 male, 2 females and 3 children in family. The majority of them were found to be illiterate (56.7%) followed by primary (38.3%) high school (3.3%) and higher secondary (1.7%) educated. All the respondents were found to be engaged in agriculture and allied activities for their livelihood. The 83.3 per cent of them engaged themselves as agricultural labourers.

3.2 Land Utilization Pattern

The land utilization of the respondents is presented in table 3.2. It is observed from the data that at overall level the average size of holding of the respondents was found to be 11.23 acres, out of which only 5.57 per cent was found under irrigation and the rest i.e. 94.42 per cent was un-irrigated solely depends on rains. The 74.68 per cent of total land was found under cultivation and rest 18.43, 1.08 and 6.75 per cent under non agricultural uses, current and old fellow respectively. Leased in and leased out practice was not so common in the area under study and only 0.97 and 0.37 per cent land comes under these categories, respectively.

Table 3.2: Land utilization pattern

S.No	Particulars	Respondents related to		Overall
		Kodo Millets	Kutki(Little) Millets	
1	Total Land	9.96 (100.00)	12.47 (100.00)	11.23 (100.00)
2	Irrigated	0.125 (1.25)	1.13 (9.03)	0.63 (5.57)
3	UnIrrigated	9.83(98.75)	11.34 (90.96)	10.59 (94.42)
4	Cultivated Land	6.52 (65.47)	10.23 (82.03)	8.38 (74.68)
5	Non Agri. & Grazing	2.64 (26.53)	1.49 (11.96)	2.07 (18.43)
6	Current Fellow	0.21 (2.09))	0.03 (0.27)	0.12 (1.08)
7	Old Fellow	0.80 (8.00)	0.72 (5.47)	0.76 (6.75)
8	Leased In	0.03 (0.33)	0.18 (1.47)	0.11 (0.97)
9	Leased Out	0.08 (0.84)	0 (0.00)	0.04 (0.37)

The average size of holding of the respondents related to kodo was found to be 9.96 acres, out of which only 1.25 per cent was found under irrigation and the rest i.e. 98.75 per cent was rain-fed. The 65.47 per cent of total land was found under cultivation and rest i.e. 26.53, 2.09 and 8.00 per cent under non agricultural uses, current and old fellow respectively. Leased in and leased out practice was not so common in the area under study and only 0.33 and 0.84 per cent land comes under these categories, respectively.

The average size of holding of the respondents belongs to kutki was found to be 12.47 acres, out of which only 1.13 per cent was found under irrigation, the rest i.e. 90.96 per cent was un irrigated solely depends on rains. The 82.03 per cent of total land was found under cultivation and rest 11.96, 0.27 and 5.47 per cent under non agricultural uses, current and old fellow respectively. Leased in and leased out practice was not so common in the area under study and only 1.47 per cent was found under leased in categories, while none of the farmers leased out their land to other farmers.

3.3 Cropping Pattern

Cropping pattern of an average farmer is presented in table 3.3. It is observed from the data that at overall level an average farmer found to devote his maximum area in Kharif (76.45%) as compared to Rabi season (23.55%).

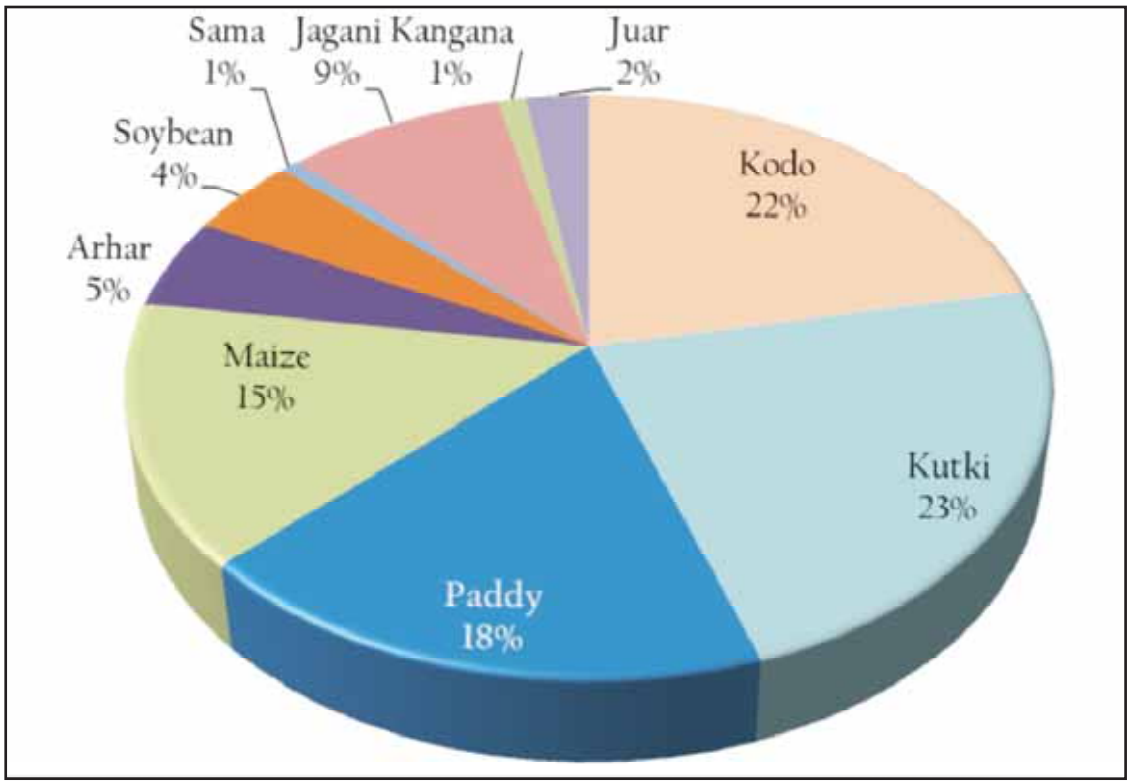

Fig. 3.1 : Share of different Crops in Kharif Season (7.92 acres)

Table 3.3: Cropping pattern of selected crop under the study

S.No	Particulars	Respondents related to		Overall
		Kodo Millets	Kutki(Little) Millets	
		Kharif Crops		
1	Kodo	2.06(33.28)	1.40 (14.53)	1.73 (21.88)
2	Kutki	1.08 (17.45)	2.54 (26.34)	1.81 (22.86)
3	Paddy	1.76 (28.43)	1.10 (11.42)	1.43 (18.08)
4	Maize	0.63 (10.17)	1.68 (17.43)	1.15 (14.59)
5	Arhar	0.18 (2.98)	0.61 (6.36)	0.40 (5.04)
6	soybean	0.00 (0.00)	0.70 (7.27)	0.35(4.42)
7	Sama	0.03 (0.54)	0.08 (0.91)	0.06 (0.76)
8	Jagani	0.43 (6.87)	0.94 (9.82)	0.69 (8.66)
9	Kangana	0.02 (0.27)	0.17 (1.77)	0.09 (1.18)
10	Juar	0.00 (0.00)	0.40(4.15)	0.20 (2.53)
Total Kharif		6.20 (100.00)/76.60/	9.63 (100.00)/76.35/	7.92 (100.00)/76.45/
		Rabi Crops		
1	Wheat	0.58 (30.67)	1.62 (54.31)	(45.13)
2	Gram	0.13 (6.68)	0.69 (23.29)	0.41 (16.84)
3	Field Pea	0.57 (29.92)	0.38 (12.82)	0.47 (19.46)
4	Lentil	0.33 (17.51)	0.09 (3.16)	0.21 (8.73)
5	Mustard	0.29 (15.22)	0.19 (6.42)	0.24 (9.84)
Total Rabi		1.89 (100.00)/23.40/	2.98 (100.00) /23.65/	2.43 (100.00) /23.55/
Net Area Sown		6.52	10.23	8.38
Gross Cropped Area		8.10	12.62	10.36
Cropping Intensity (%)		124.20	123.30	123.65

Figures in Parenthesis show percentage to total, while in slashes show percentage to gross cropped area

In Kharif Kutki (22.85%) and Kodo (21.88%) followed by paddy (18.08%), maize (14.59%) were found to be major crops grown by the respondents in the area under study . An average farmer was found to devote his 8.66, 5.04, 4.42, 2.53,1.18 and 0.76 per cent Kharif area in Jagni, Arhar, Soybean, Juar, Kangna, and Sama (Fig 2.1). It is clear from the data presented in table 3.3 that tribal farmers used to follow diversified farming in their fields during Kharif season.

In Rabi season Wheat (45.13%) followed by field Pea (19.46%) Gram (16.84%), Mustard (9.84%) and Lentil (8.73%) were found to be major kharif crops grown by the farmers in the area under study (Fig 2.2). The selected respondents Kodo and Kutki were found to grow the above mentioned crops with little variation in area occupied .

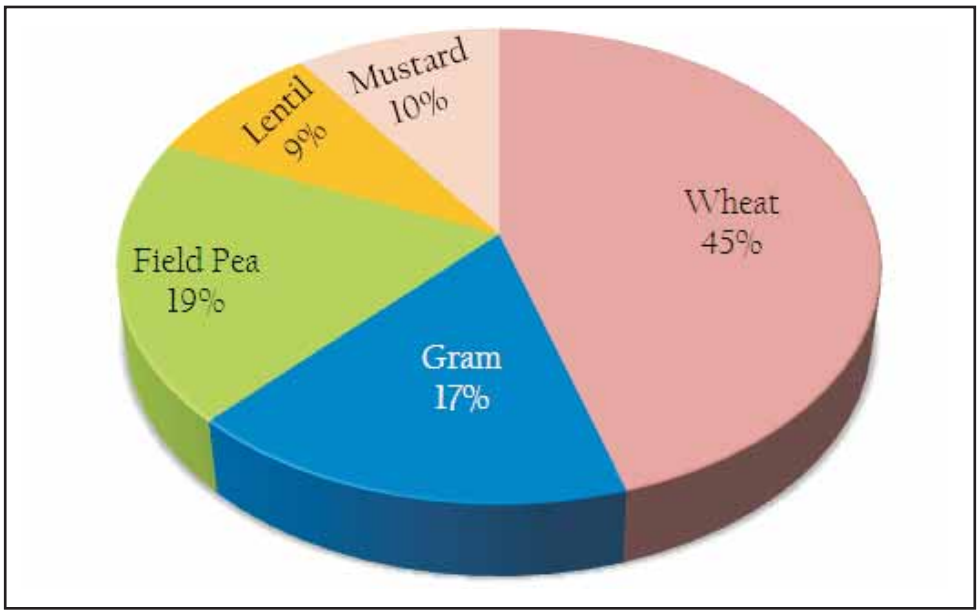

Fig. 3.2: Share of different Crops in Rabi Season (2.43 acres)

3.4 Farm Assets

The irrigation and other assets owned by kodo & kutki growers in terms of Rs./acre are presented in Table 3.4.

It is clear from the data presented in table 3.4 that on an average farmer was found to have submersibles, diesel pump, electric pump. On an average Kodo & Kutki growers were found to invest Rs. 3000 & 4600, 1861 & 1640 and 1416 & 1520 per acre to own the submersible, diesel & electric pump respectively, with total investment of Rs. 6267 & 7760/acre on irrigation assets. At an overall level farmers were found to invest Rs. 3800, 1751 & 1468/acre in the above mention categories respectively with total investment of Rs. 7019 per acre on irrigation assets to own the various irrigation assets as discussed above.

As for as other farm assets are concerned, kodo and kutki farmer used to invest on cattle shed (Rs.11091 & 12015) followed by buffalos (Rs.6385 & 6428), bullock (Rs.5800 & 5890), farm house (Rs.4975 & 5122), cow (Rs.4546 & 4608), bullock cart (Rs. 850 & 800), plough (Rs.520 & 584), farm shed (Rs.333 & 446), bukhar (Rs.257 & 275), sprayer (Rs.150 & 180) and cultivators (Rs. 00 & 210) per acre with total investment of Rs. 34907 & 36558/acre on farm assets. At overall level, farmers were found to invest Rs.390, 5049, 11553, 105, 552, 266, 165, 4577, 5845 and 6407/acre to own the farm shed, farm house, cattle shed, cultivator, plough, bukhar, bullock cart, sprayer, cow, bullock and buffalos, respectively with total investment of Rs. 35733 per acre on farm assets to own the various farm assets.

Table 3.4: Details of irrigation assets

Asset	Respondents related toMillets (Average Price-Rs./acre)		Overall
	Kodo	Kutki (Little)	
Irrigation Assets			
Tube well/bore well	0	0	0
Diesel Pump	1861	1640	1751
Electric Pump	1416	1520	1468
Submersibles	3000	4600	3800
Drip Irrigation	0	0	0
Total	6267	7760	7019
Farm Assets			
Farm shed	333	446	390
Farm House	4975	5122	5049
Cattle shed	11091	12015	11553
Tractor	0	0	0
Cultivator	0	210	105
Plough	520	584	552
Bukhar	257	275	266
Bullock card	850	800	825
Sprayer	150	180	165
Cow	4546	4608	4577
Bullock	5800	5890	5845
Buffalos	6385	6428	6407
Total	34907	36558	35733

It is concluded from the above findings that most of the tribal farmers (95%) used to grow Small Millets (Kodo & Kutki). The majority of them were found to be illiterate (50%) and on an average had a family of 5 members. On an average they were found to have 11.23 acre of land holding, out of which only 5 per cent was found to be under irrigation. They were found to devote their maximum gross cropped area in Kharif (76.46%) as compared to Rabi Crops (23.55%). Kodo, Kutki, paddy & maize and wheat, gram lentil and field pea were found to be grown by the respondents in kharif and rabi season, respectively for their livelihood. Some of the farmers were still found to grow traditional crops like sama, kangna and Jagni in Kharif season. An average famer had total assets of Rs. 35733/ only. There was no remarkable difference between the different parameters of socio economics status of farmers who cultivate kodo or kutki in the area under study.

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CHAPTER-IV

ECONOMICS OF CULTIVATION OF SMALL MILLETS

This chapter deals with the economics with respect to cultivation of small millets i.e. kodo and kutki by the respondents. The cost and return analysis of Kodo and Kutki and their comparison with other major kharif crops viz. maize and paddy which were found to be grown by the majority of farmers are presented in this chapter. An attempt has also been made to compare cost and return of Kodo and Kutki of Farmers' Practice (FP) with its Recommended Package of Practices (RPP) as suggested by the extension workers in the area under study.

4.1 Cost & Return Analysis

An analysis of cost and return of Kodo and Kutki and their comparison with other kharif crops viz. Maize and Paddy was done by considering total variable and fixed cost

4.1.1 Kodo & Kutki

The cost and return analysis in cultivation of kodo and kutki is presented in table 4.1. It is observed from the data that an average respondent found to invest Rs. 5528 and 5939 per acre in cultivation of kodo and kutki and obtained a net return of Rs. 526 and 238 only per acre with benefit cost ratio of only 1.10 and 1.04, respectively. In total cost of cultivation, the share of variable cost (operation, material & interest on working capital) and fixed cost was found to be 75 and 25 per cent respectively in both the crops (Fig. 4.1 & 4.2).

In total operational cost, the total labour used in different operation in cultivation of kodo and kutki have been analysed and none of the farmer was found to use machine and hired human and bullock labour in cultivation of these crops. An average farmer was found to invest Rs. 3227 and 3528 per acre in kodo and kutki respectively in owned labour to operate different farm operations right from sowing to harvesting of crops. The share of owned human and bullock labour was found to be nearly 45 and 55 percent respectively in both the crops.

Farmers were found to invest only on owned seed (57.54%) and manures (42.46%) as a material cost (Rs. 3731/Acre) in cultivation of Kodo, while Rs. 4065 per acre in cultivation of kutki as material cost constituting 46.22 and 53.78 per cent of manure and seed respectively. None of the farmer was found to use plant protection chemicals in cultivation of kodo and kutki.

Table 4.1: Cost and return analysis in cultivation of kodo and kutki (Rs./acre)

Particulars		Kodo	Kutki
1.Operational Cost			
A. Human labour	Family	1452 (45)	1654 (46.88)
	Hired	0	0
B. Bullock labour	Own	1775 (55)	1874 (53.12)
	Hired	0	0
C. Machine labour	Own	0	0
	Hired	0	0
Total Operational Cost		3227 (100)	3528 (100)
2.Material Cost			
A. Seed (Kg.)		271 (57.54)	232 (46.22)
B. Manure		200 (42.46)	270 (53.78)
C. Plant Protection & Chemicals		0(0)	0(0)
Total Material cost		471 (100)	502 (100)
Interest On Working capital		33	35
Total Variable cost		3731	4065
3. Fixed Cost			
A. Rental Value of own land		1121 (86.36)	1144 (85.55)
B. Depreciation		30 (2.31)	42 (3.14)
C. Revenue /tax		8 (0.62)	8 (0.6)
D. Interest on Fixed capital		139 (10.71)	143 (10.71)
Total Fixed Cost		1298 (100)	1337 (100)
Managerial Cost		499	537
Total Cost of Cultivation		5528	5939
Cost of production (Rs/q)		1858	1949
Returns			
Yield (q/acre)		2.71	2.80
Main Product (Rs./acre)		5604	5721
By Product		450	456
Gross Return		6054	6177
Net Income at Total cost		526	238
Return/Rs. investment		1.10	1.04

Figures in bracket show percentage to total

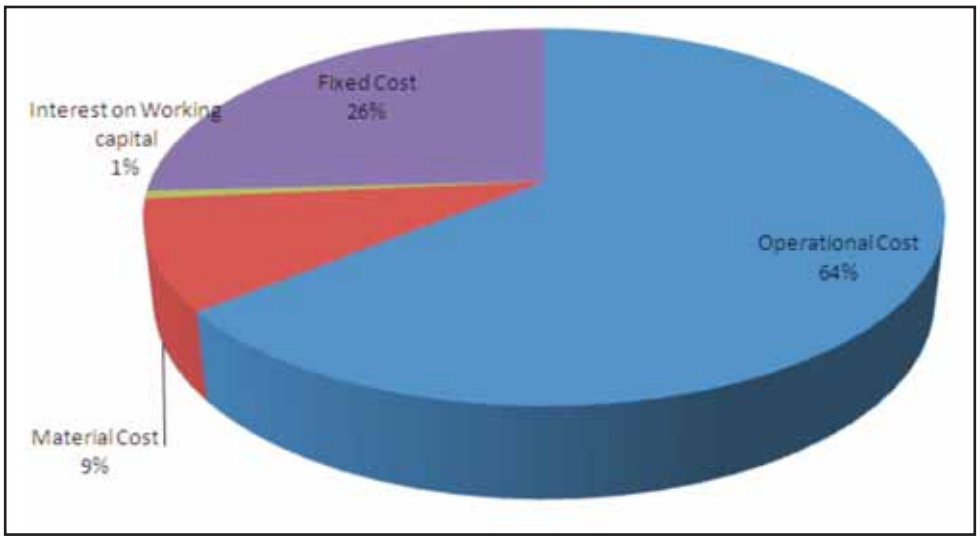

Fig 4.1Share of different Cost in Total Cost of Cultivation of Kodo

The rental value of owned land (about 86%) was the major component of fixed cost in cultivation of kodo (Rs. 1298/Acre) and kutki (Rs. 1337/Acre).

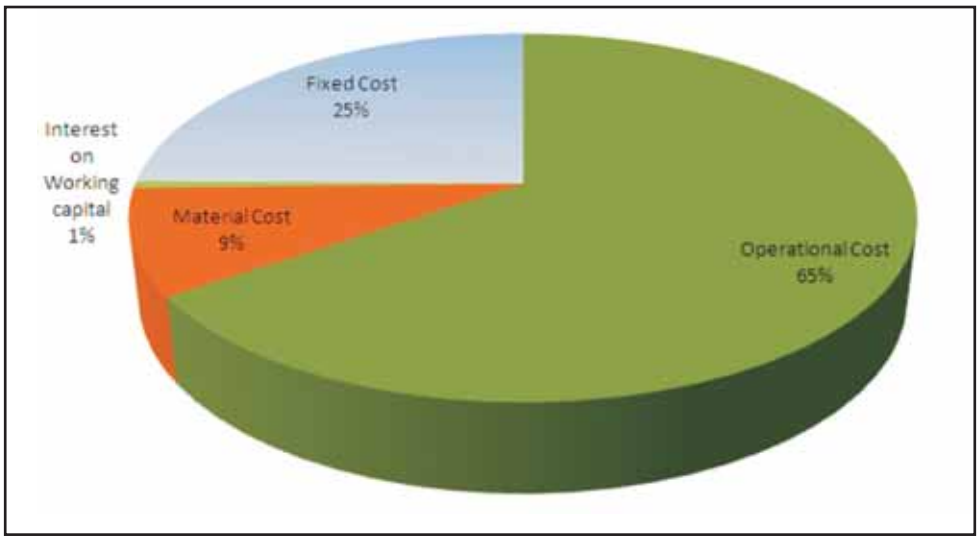

Fig 4.2 Share of different Cost in Total Cost of Cultivation of Kutki

Thus, it is clear from the above results that farmers used to fallow traditional method of cultivation of kodo and kutki since they were found to be grown in marginal land and can with stand against vagaries of nature, therefore, they do not put any additional efforts for its cultivation and produce so obtain is purely organic.

4.1.2 Kodo Vs Maize

The comparative picture of cost and return analysis in cultivation of kodo and maize is presented in table 4.2. It is observed from the data that operational cost per acre of an average farmer was found to be 10.44 per cent lesser in cultivation of maize (Rs. 2922/ Acre) as

compared to kodo (Rs.3227/Acre), while the material and fixed were found to be higher by 69.79 and 36.87 per cent respectively. The total cost of cultivation of maize (Rs. 7289/Acre) was found to be 24.16 per cent higher as compared to kodo (Rs.5528/Acre).

Table 4.2: Comparative cost and return analysis in cultivation kodo to maize (Rs./ Acre)

Particulars	Kodo	Maize	% Difference
1.Operational Cost			
A. Human labour	1452	1845	21.30
B. Bullock labour	1775	1077	-64.81
C. Machine labour	0	0	0
Total Operational Cost	3227	2922	-10.44
2.Material Cost			
A. Seed (Kg.)	271	153	-77.12
B. Fertilizer & Manure	200	1331	84.97
C. Plant Protection & Chemicals	0	75	100.00
Total Material cost	471	1559	69.79
Interest On Working capital	33	109	69.79
Total Variable cost	3731	4590	18.72
3. Fixed Cost			
A. Rental Value of own land	1121	1768	36.60
B. Depreciation	30	60	50.00
C. Revenue /tax	8	8	0.00
D. Interest on Fixed capital	139	220	36.87
Total Fixed Cost	1298	2056	36.87
Managerial Cost	499	643	22.40
Total Cost of Cultivation	5528	7289	24.16
Returns			
Yield (q/acre)	2.71	6.8	60.15
Main Product (Rs./acre)	5604	8840	36.61
By Product	450	940	52.13
Gross Return	6054	9780	38.10
Net Income at Total cost	526	2491	78.89
Return/Rs. investment	1.10	1.34	18.38

As a result of this the net income obtained from maize (Rs. 2491/Acre) was found to be 78.89 per cent higher as compared to kodo (Rs. 526/Acre). On an investment of Re.1.00, an average farmer obtained Rs. 0.24 more in cultivation of maize (1.34) as compared to kodo (1.10).

4.1.3 Kodo Vs Paddy

The comparative picture of cost and return analysis in cultivation of kodo and paddy is presented in table 4.3. It is observed from the data that operational cost per acre of an average farmer was found to be 50.73 per cent higher in cultivation of paddy (Rs. 6550/ Acre) as

compared to kodo (Rs.3227/Acre), while the material and fixed cost were found to be higher by 83.30 and 59.78 per cent, respectively, with 60.31 per cent higher total cost of cultivation of paddy (Rs.13929/Acre) as compared to kodo (Rs.5528/Acre).

Table 4.3: Comparative cost and return analysis in cultivation kodo to paddy(Rs./ Acre)

Particulars	Kodo	Paddy	% Difference
1.Operational Cost			
A. Human labour	1452	3300	56.00
B. Bullock labour	1775	3250	45.38
C. Machine labour	0	0	0
Total Operational Cost	3227	6550	50.73
2.Material Cost			
A. Seed (Kg.)	271	2200	87.68
B. Fertilizer & Manure	200	500	60.00
C. Plant Protection & Chemicals	0	120	100.00
Total Mater ial cost	471	2820	83.30
Interest On Working capital	33	197	83.30
Total Variable cost	3731	9567	61.00
3. Fixed Cost			
A. Rental Value of own land	1121	2808	60.08
B. Depreciation	30	65	53.85
C. Revenue /tax	8	8	0.00
D. Interest on Fixed capital	139	346	59.78
Total Fixed Cost	1298	3227	59.78
Managerial Cost	499	1135	56.04
Total Cost of Cultivation	5528	13929	60.31
Returns			
Yield (q/acre)	2.71	6.2	56.29
Main Product (Rs./acre)	5604	16850	66.74
By Product	450	2378	81.08
Gross Return	6054	19228	68.52
Net Income at Total cost	526	5299	90.08
Return/Rs. investment	1.10	1.38	20.67

As a result of this the net income obtained from paddy (Rs. 5299/Acre) was found to be 90.08 per cent as higher compared to kodo (Rs. 526/Acre). On an investment of Re.1.00, an average farmer obtained Rs. 0.28 more in cultivation of maize (1.38) as compared to kodo (1.10).

4.1.4 Kutki Vs Maize

The comparative picture of cost and return analysis in cultivation of kutki and maize is presented in table 4.4. It is observed from the data that operational cost per acre of an average farmer was found to be 20.74 per cent lesser in cultivation of maize (Rs. 2922/ Acre) as compared to kutki (Rs.3528/Acre).

Table 4.4: Comparative cost and return analysis in cultivation of kutki to maize (Rs./ Acre)

Particulars	Kutki	Maize	% Difference
1.Operational Cost			
A. Human labour	1654	1845	10.35
B. Bullock labour	1874	1077	-74.00
C. Machine labour	0	0	0
Total Operational Cost	3528	2922	-20.74
2.Material Cost			
A. Seed (Kg.)	232	153	-51.63
B. Fertilizer & Manure	270	1331	79.71
C. Plant Protection & Chemicals	0	75	100.00
Total Material cost	502	1559	67.80
Interest On Working capital	35	109	67.80
Total Variable cost	4065	4590	11.44
3. Fixed Cost			
A. Rental Value of own land	1144	1768	35.29
B. Depreciation	42	60	30.00
C. Revenue /tax	8	8	0.00
D. Interest on Fixed capital	143	220	34.97
Total Fixed Cost	1337	2056	34.97
Managerial Cost	537	643	16.49
Total Cost of Cultivation	5939	7289	18.52
Returns			
Yield (q/acre)	2.71	6.8	60.15
Main Product (Rs./acre)	5721	8840	35.28
By Product	456	940	51.49
Gross Return	6177	9780	36.84
Net Income at Total cost	238	2491	90.46
Return/Rs. investment	1.04	1.34	22.48

The material and fixed were found to be higher by 67.80 and 34.97 per cent respectively with 18.52 per cent higher total cost of cultivation of maize (Rs. 7289/Acre) as compared to kutki (Rs. 5939/Acre). As a result of this the net income obtained from maize (Rs. 2491/Acre) was found to be 90.46 per cent higher as compared to kodo (Rs. 238/Acre). On an investment of Re.1.00, an average farmer obtained Rs. 0.20 more in cultivation of maize (1.34) as compared to kodo (1.04).

4.1.5 Kutki Vs Paddy

The comparative picture of cost and return analysis in cultivation of kutki and paddy is presented in table 4.5. It is observed from the data that operational cost per acre of an average farmer was found to be 46.14 per cent higher in cultivation of paddy (Rs. 6550/ Acre) as compared to kutki (Rs. 3528/Acre).

Table 4.5: Comparative cost and return analysis in cultivation kutki to paddy (Rs./ Acre)

Particulars	Kutki	Paddy	% Difference
1.Operational Cost			
A. Human labour	1654	3300	49.88
B. Bullock labour	1874	3250	42.34
C. Machine labour	0	0	0
Total Operational Cost	3528	6550	46.14
2.Material Cost			
A. Seed (Kg.)	232	2200	89.45
B. Fertilizer & Manure	270	500	46.00
C. Plant Protection & Chemicals	0	120	100.00
Total Material cost	502	2820	82.20
Interest On Working capital	35	197	82.20
Total Variable cost	4065	9567	57.51
3. Fixed Cost			
A. Rental Value of own land	1144	2808	59.26
B. Depreciation	42	65	35.38
C. Revenue /tax	8	8	0.00
D. Interest on Fixed capital	143	346	58.56
Total Fixed Cost	1337	3227	58.56
Managerial Cost	537	1135	52.69
Total Cost of Cultivation	5939	13929	57.36
Returns			
Yield (q/acre)	2.8	6.2	54.84
Main Product (Rs./acre)	5721	16850	66.05
By Product	456	2378	80.82
Gross Return	6177	19228	67.87
Net Income at Total cost	238	5299	95.52
Return/Rs. investment	1.04	1.38	24.66

The material and fixed were found to be higher by 82.20 and 58.56 per cent respectively with 57.36 per cent higher total cost of cultivation of paddy (Rs.13929 /Acre) as compared to kutki (Rs.5939/Acre). As a result of this the net income obtained from paddy (Rs. 5299/Acre) was found to be 95.52 per cent higher as compared to kutki (Rs. 238/Acre). On an investment of Re.1.00, an average farmer obtained Rs. 0.24 more in cultivation of paddy (1.38) as compared to kutki (1.04).

4.2 Farmer's Practice Vs Recommended Package of Practices

The Farmer's Practice (FP) of cultivation of kodo and kutki in terms of cost and return per acre was further compared with Recommended Package of Practices (RPP) for both the crops.

Table 4.6: Comparison of cost of cultivation of farmer practices to recommended packages of practices of Kodo (Rs./ Acre)

Particulars	Kodo	RPP	% Difference
1.Operational Cost			
A. Human labour	1452	1619	10.32
B. Bullock labour	1775	0	
C. Machine labour	0	1700	100.00
Sub Total	3227	3320	2.80
2.Material C ost			
A. Seed (Kg.)	271	121	-123.12
B. Fertilizer & Manure	200	2705	92.61
C. Plant Protection & Chemicals	0	81	100.00
Total Material cost	471	2907	83.80
Interest On Working capital	33	204	83.84
Total Variable cost	3731	6431	41.99
A. Rental Value of own land	1121	1121	0.00
D. Interest on Fixed capital	139	139	0.00
Other Cost	38	38	0.00
Total Fixed Cost	1298	1298	0.00
Managerial cost	499	499	0.00
Total cost	5528	8228	32.82
Return			
Yield (q/acre)	2.71	6	54.83
Main Product (Rs./acre)	5604	12146	53.86
by-product	450	450	0.00
Gross Return	6054	12146	50.16
Net Income at total cost	526	3918	86.58
Return/Rs. Investment	1.10	1.48	25.81

It is clear from the data that expenditure on seed was found to be lesser by 123.12 percent in case of RPP (Rs.121/acre) as compared to FP (Rs.271/acre) indicating on an average farmer was found to use more seed rate in cultivation of Kodo as compared to RPP, which is not only the wastage of precious seed at the one end and reduction in yield to great extent due to more plant population on the other.

The operational and material cost in cultivation of kodo using RPP was found to be higher by 2.80. 83.80 per cent respectively as compared to FP resulting in to increase in yield by 54.83 per cent from 2.7 (FP) to 6.0(RPP) q/acre (Table 3.6) The net return was also found to be 86.58 per cent higher i.e. from Rs. 6054 (FP) to Rs. 12146 (RPP) per acre with higher per rupee investment from Rs. 1.10 (FP) to 1.48 (RPP) Table 4.6.

In cultivation of kutki an average farmer found to used 91.01 per cent higher seed rate in case of FP as compared to RPP . The expenditure on human labour was also found to be 2.16 per cent higher in FP as compared to RPP (Table 4.7).

Table 4.7: Comparison of cost of cultivation of farmer practices to recommended packages of practices of Kutki (Rs./ Acre)

Particulars	Kutki	RPP	% Difference
1.Operational Cost			
A. Human labour	1654	1619	-2.16
B. Bullock labour	1874	0	
C. Machine labour	0	1700	100.00
Sub Total	3528	3320	-6.27
2.Material Cost			
A. Seed (Kg.)	232	121	-91.01
B. Fertilizer & Manure	270	2705	90.02
C. Plant Protection & Chemicals	0	81	100.00
Total Material cost	502	2907	82.73
Interest On Working capital	35	204	82.77
Total Variable cost	4065	6431	36.79
A. Rental Value of own land	1144	1144	0.00
D. Interest on Fixed capital	143	143	0.00
Other Cost	50	50	0.00
Total Fixed Cost	1337	1337	0.00
Managerial cost	537	537	0.00
Total cost	5939	8305	28.49
Return			
Yield (q/acre)	2.8	6	53.33
Main Product (Rs./acre)	5721	12146	52.90
by-product	456	456	0.00
Gross Return	6177	12146	49.14
Net Income at total cost	238	3841	93.81
Return/Rs. Investment	1.04	1.46	28.88

The material cost in cultivation of kutki using RPP was found to be 82.73 per cent higher as compared to FP resulting in to increase in yield by 53.33 per cent from 2.8 to 6.0 q/ acre (Table 4.7) The net return was also found to be 93.81 per cent higher in RPP (Rs. 12146/acre) as compared to FP (Rs. 6177/acre) with increase in return per Rupee investment from Rs. 1.04 (FP) to 1.46 (RPP). Looking to the above findings it has become imperative that farmer should be made aware through various extension mechanism about the advantages of RPP over FP so that the farmers will not only be benefitted and able to generate higher income by adopting improved production technologies but their socio economic condition will also be uplifted manifolds.

4.3 Problems in efficient Production of Small Millets

The Problems in efficient production of small millets were also identified during the course of investigation as reported by the majority of producers, extension workers and scientists of Krishi Vigyan Kendra of the study area and presented in table 4.8.

Table 4.8: Problems in efficient production of small millets

S.No.	Problems	Ranking
1.	Research on genetic improvement in small millets was not given utmost importance.	I
2.	Low productivity	II
3.	Non-adoption of Recommended Package of practices of kodo & Kutki by the tribal farmers	III
4.	Lack of suitable extension and development support for production of millets.	IV
5.	Lack of organised seed production and supply of HYVs of seed	V
6.	Huge price spread (gap between price paid by the consumer and price received by the and producer due to absence of Minimum Support Price (MSP) for Kodo & Kutki	VI

It is observed from the data that research on genetic improvement in small millets was not given utmost importance probably because these crops cover very meager area in the gross cropped area in the state, low productivity as millets are predominantly grown in marginal lands with low water holding capacity of soil under rain-fed conditions, non-adoption of improved crop production practices due to lack of knowledge about RPP & poor socio economic conditions of the tribal farmers, lack of organised seed production and supply of HYVs of seed, lack of suitable extension and development support for production of millets in the state, and huge price spread (minimum of 200%) due to absence of minimum support price (MSP) were the fore most problems present in the area under study hindering efficient production of kodo and kutki in the State

Thus it can be concluded from the above findings that although cultivation of small millets viz. kodo & kutki were found to be remunerative and provide income and employment to tribal community, but these crops were found less remunerative than the other kharif crops i.e. maize and paddy. Most of the tribals were found to grow these crops with traditional practices in marginal lands by just broadcasting the seed in the field and harvest the produce without incorporating any additional inputs.

Low productivity of kodo/kutki was observed in farmers' fields as compared to RPP, as these crops were found to predominantly grown with in shallow soils with low water holding capacity and under rain-fed conditions. The farmers were not found to adopt improved crop production practices due to lack of knowledge about RPP in cultivation of these crops. Their poor socio economic conditions and non availability of HYVs seed also hampered the production of small millets. Lack of suitable extension and development support for production and research on genetic improvement in small millets was not given utmost importance as compared to other food crops troubled the production of small millet. Huge price spread (minimum of 200%) and

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CHAPTER-V

VALUE ADDITION IN SMALL MILLETS

This chapter deals with marketable and marketed surplus, disposal of marketed surplus in different months of a year, value added products and constraints in marketing and value addition of kodo and kutki.

5.1 Marketable & Marked Surplus

Marketable and marketed surplus of the produce of kodo and kutki obtained from a acre of land have been analysed and presented in Table 5.1.

Table 5.1 : Marketable & marketed surplus of kodo & kutki (q/acre)

Particulars	Kodo	Kutki
Total production	2.77 (100.00)	2.71 (100.00)
Stock of previous year	0.14 5.00	0.12 4.50
Self consumption	1.12 (40.60)	1.11 (41.10)
Kept for Seed next Year	0.15 (5.40)	0.10 (3.70)
Used as Animal Feed	0.02 (0.70)	0.015 (0.60)
Wastage	0.05 (1.80)	0.08 (3.00)
Marketable surplus	1.57 (56.50)	1.52 (56.20)
Marketed Surplus	1.43 (51.60)	1.40 (51.70)

Figure in parenthesis shows that percentage to total production

It is observed from the data that on an average the produce of kodo and kutki obtained by an average farmer was found to be 2.91 and 2.83 q /acre keeping an account of 0.14 and 0.12 q/acre stock of previous year. Out of which an average farmer was found to consume about 40 percent of total production of both the crops. He was found to keep 5.40 & 3.70 and 0.70 & 0.60 per cent of total production for seed and animal feed in case of kodo and kutki respectively. The wastage during the year was found to be 1.80 & 3.00 per cent of total production in case kodo & kutki respectively. On the basis of analysis the marketable surplus was found to be more than marketed surplus. Out of total production, marketable and marketed surplus were found to be about 56 and 51 per cent respectively across both the crops by an average farmer in the area under study.

5.2 Disposal Pattern of Marketed Surplus

Disposal pattern of marketed surplus of kodo and kutki during the different months of a year was examined for the area under study.

5.2.1 Kodo

Disposal pattern of marketed surplus of kodo during the different months of a year 2015-16 is presented in table 5.2.

Table 5.2 : Disposal of marketed surplus of kodo during different months of a year (2015-16)

Months	Quantity(in Kg.)	% Sold Qty.	Average Price (Rs./Kg.)	% change to average Price
September	0.15	10.49	18.00	-11.04
October	0.12	8.39	15.00	-25.86
November	0.21	14.69	19.00	-6.10
December	0.18	12.59	17.00	-15.98
January	0.17	11.89	19.00	-6.10
February	0.16	11.19	20.00	-1.15
March	0.13	9.09	23.00	13.67
April	0.06	4.20	22.00	8.73
May	0.07	4.90	20.80	2.80
June	0.05	3.50	23.00	13.67
July	0.06	4.20	22.00	8.73
August	0.07	4.90	24.00	18.62
Total	1.43	100.00	20.23	0.00
Average	0.12			
Peak Period	1.12	78.32	18.71	-7.51
Lean Period	0.31	21.68	22.36	10.51

It is observed from the data that an average producer sold his 78.30 per cent of marketed surplus of kodo in peak period i.e. during the months from September 2015 to March 2016 at an average price of Rs. 18.71/ Kg. The remaining 21.70 per cent was found to be sold during the lean period (April 2016 to August 2016 at average price Rs. 22.36/ Kg. The average price of kodo was found to be Rs. 20.23/kg, which was found to be fluctuated from Rs.15 to 24 /kg. This clearly indicated inverse relationship between price and quantity of kodo sold in the market in the area under study.

5.2.2 Kutki

Disposal pattern of marketed surplus of kutki during the different months of a year 2015-16 sn presented in table 5.3

Table 5.3: Disposal of marketed surplus of kutki during different months of a year (2015-16)

Months	Quantity (Kg.)	% Sold Qty.	Average Price (Rs./kg)	% change to average Price
September				
2015	0.12	8.57	18.00	-14.73
October	0.16	11.43	17.00	-19.47
November	0.19	13.57	19.00	-9.99
December	0.15	10.71	20.00	-5.25
January 2016	0.14	10.00	20.50	-2.89
February	0.13	9.29	20.81	-1.42
March	0.12	8.57	21.00	-0.52
April	0.11	7.86	21.00	-0.52
May	0.11	7.86	24.00	13.69
June	0.08	5.71	23.00	8.96
July	0.04	2.86	24.00	13.69
August	0.05	3.57	25.00	18.43
Total	1.40	100.00	21.11	0.00
Average	0.12			
Peak Period	1.01	72.14	19.47	-7.75
Lean Period	0.39	27.86	23.40	10.85

It is observed from the data that an average producer sold his 72.14 per cent of marketed surplus of kutki in peak period i.e. during the months from September 2015 to March 2016 at an average price of Rs. 19.47/ Kg. The remaining 19.47 per cent was found to be sold during the lean period (April 2016 to August 2016 at average price of Rs. 23.40 / Kg. The average price of kutki was found to be Rs. 21.11 /kg, which was fluctuated from Rs. 17 to 25 /kg. This clearly indicated inverse relationship between price and quantity of kutki sold in the market in the area under study.

5.3 Value Added Products

Kodo and kutki have more nutritive value as compared to other cereals. There are various value added products with good nutritive value can be prepared using these millets but marketing of value added products of kodo & kutki was not common in the area under study. Now a day's various dishes of kodo and kutki were found to be served in 5 Star Hotels,t metropolitan cities due to its nutritive and medicinal value. But the tribal farmers growing these millets were not able to fetch premium prices for value added product prepared from organically produce kodo &

Table 5.4: Economics of value added products of kodo & kutki (in Rs/kg)

Particulars	laddu		Chakli	
	Value	% age to total	Value	% age to total
Kodo				
Processed Kodo	13.50	9.00	12.00	11.54
Mixture of other grains (Rice, Pulse, Suji etc.)	0.00	0.00	14.40	13.85
Sugar	15.40	10.27	0.00	0.00
Liquid Material (Ghee/Milk/Water)	76.50	51.00	2.00	1.92
Other Material(dry fruits/Spices)	12.00	8.00	50.00	48.08
Labour charges	25.00	16.67	18.00	17.31
Sub Total	142.40	94.93	96.40	92.69
Transportation Cost	8.00	5.33	8.00	7.69
Total Cost	150.40	100.00	104.00	100.00
Selling Price	210.00		160.00	
Net Profit	59.60		56.00	
KUTKI				
Kutki(Processed)	13.30	7.14	12.25	10.83
Mix Other (Rice,pulse, Suji etc.)	0.00	0.00	15.36	13.58
Sugar	14.08	7.55	0.00	0.00
Liquide Material (Ghee/Milk/Water)	54.00	28.97	2.00	1.77
Other Material(dry fruits/Spices)	72.00	38.63	57.50	50.84
Labour charge	25.00	13.41	18.00	15.91
Manufacturing cost	178.38	95.71	105.11	92.93
Transportation Cost	8.00	4.29	8.00	7.07
Total Cost	186.38	100.00	113.11	100.00
Selling Price	276.00		180.00	
Net Profit	89.62		66.89	

Although farmers of the study area were found to use kodo and kutki as un-husked grain(rice) laddu, lai, papdi, kheer, halwa, chakli, upama etc. for their home consumption. They were also found to prepare Laddu and Chakli as a value added products and used to sell out in the weekly market (Haat Bazar). The economics related to these was analysed separately for kodo and kutki and presented in table 5.4.

In the study area the most common value added products which were found to be prepared and marketed in weekly haat bazaar are laddu and chakli. An average farmer used to invest Rs. 150.40 & 104.00 for preparation of a kg of laddu and chakli from kodo and received Rs. 59.60 & 56.00 as net profit respectively (Table 4.4), while a farmer used to invest Rs.186.00 & 113.00 for preparation of a kg of laddu and chakli from kutki and received Rs. 90.00 & 67.00 as net profit respectively (Table 4.5). This clearly indicates that by preparing value added products not only the income of the farmers was found to be increased but at the same time the employment was also generated in the area under study.

5.4 Constraints in efficient Marketing & Value Addition of Small Millets

The constraints in efficient marketing & value addition of Small Millets which were worked out during the course of investigation from the producers, extension workers and scientists of krishi vigyan Kendra of the study area are presented in table 5.5.

Table 5.5: Constraints in efficient marketing & value addition of small millets

S. No.	Constraints	Ranking
1.	Change in the consumption habits among the urban households coupled with time consuming and tedious procedure of food preparation making utilization difficult	I
2.	Lack of advance and cost effective processing technologies for entrepreneurship development	II
3.	Comparatively poor shelf life of miller based products	III
4.	Lack of remunerative price for the produce and marketing facilities	IV
5.	Lack of suitable extension and development support for production of value added products of millets in the state.	V

It is observed from the data that change in the consumption habits among the urban households coupled with time consuming and tedious procedure of food preparation making utilization difficult, lack of advance and cost effective processing technologies for entrepreneurship development, comparatively poor shelf life of miller based products, lack of remunerative price for the produce and marketing facilities and lack of suitable extension and development support for production of value added products of millets in the state were the fore most constraints in marketing and value addition of kodo and kutki in the state.

It can be concluded that the value addition of small millets was not found in commercial scale. The majority of tribal farmers were found to prepare various products of kodo and kutki but for their home consumption only. Very few of them found to sell the value added products in weekly (haat) bajar. Keeping these facts in view, as these products are prepared from organically produced small millets by the tribal community, the value addition in small millets needed to be up scaled by establishing micro /small level industries with capacity building in preparation of variety of products having wider acceptance at national and international markets. In this way geographical indicator based small millets products may be prepared matching the international norms/ srtandards by supporting tribal with end to end approach there by inculcating the

entrepreneurial skill among them and creating brand image of these value added products at global level. This will not only create an environment of auto welfare of tribal at one end and State will also be benefitted by generating foreign exchange reserve on the other.

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CHAPTER-VI

SUMMARY CONCLUSIONS & POLICY IMPLICATIONS

This chapter deals with the background of the study, conclusion drawn from the findings and policy recommendation related to small millets in Madhya Pradesh.

6.1 Background

Millets crops comprises of pearl millets, sorghum, finger millets and small millets namely fox millets (Kangni), Kodo millets (kodo), Proso Millets (Cheena), barnyard millets (Sawan) and little millets (Kutki). The term "millet" is used to represent many small-grained cereals. Millets are one of the oldest cultivated food-grains known to humans and have been a staple in Northern Africa for thousand years, and was a staple in China and India prior to the popularity of fine cereals like rice and wheat (Hariprasanna and Rao,2016). These crops have a long history of cultivation of more than 5000 years and grown in many States.

Millets are drought tolerant, climate resilient and hardy crops and quite adoptable to poor soil fertility and limited precipitation. They are drought hardy, ecologically sound and esuriently. Wide adaptability, early maturity, easy cultivation and assured harvests of these crops by and large have ensured regional food and feed security in the country (Michaelraj 2013). The millet grains are well known for their superior quality, nutritional security and human health. They are quite important in areas of their production as dry land crops, especially increase of argental and hill agriculture, providing staple food for the people of the region. Millets are also unique due to their short growing season. They can be developed from planted seeds to mature, properly stored, whole millets can be kept for two or more years.

Millets are highly nutritious, non-glutinous and not acid forming foods, and easy to digest. They are considered to be the least allergenic and most digestible. Compared to Paddy rice, especially polished Paddy rice, millets release lesser percentage of glucose and over a longer period, this lowers the risk of diabetes. Millets are particularly high in minerals like iron, magnesium, phosphorous and potassium. Finger millet (Ragi) is the richest in calcium content, about 10 times that of Paddy rice or wheat. Millets, like Kodo (Paspalum scrobiculatum) and Kutki (Panicum sumatrense) are high on fiber and low on calorie. Kodo/Kutki is Indian origin minor millets, short duration Kharif crops grown well in warm climate, divers soil, varying rain fall and in areas widely differing in thermo and photo periods. All these have made these crops quite indispensable to rain fed, tribal and hilly agriculrure were crop substitution is difficult. That is why it is important to enhance the production and productivity of these crops to ensure food and nutritional security not only to people living in harsh and difficult terrains but also other area. As they can be a good choice for diabetes patients, cooked just like rice, Kodo can be a substitute for rice. Its fibre content is five times that of rice and lower calorie content. Mixed with wheat Kodo is a good diet for diabetes patients. Protein-rich Kutki too is a good grain substitute for diabetics. It has 20 per cent less carbohydrate than rice and wheat.

Kodo is not only drought resistant but also grows on poor soil. It can be stored for 20 years without being spoiled by pests. Tribal communities eat Kodo millet when the paddy crop fails. Madhya Pradesh covers 33.4 per cent of area and contributes 26.6 per cent of production of small millets in the country. Kodo (70 %) and Kutki (24 %) account together 94 per cent of area of small millets in Madhya Pradesh. Looking to the importance of the small millets particularly Kodo and kutki in Madhya Pradesh, the present study will be undertaken with following specific objectives:

1. To examine the trend of area, production and productivity of small millets over competing crops.
2. To analyze profitability of small millets over other Kharif crops.
3. To identify different value added products of small millets and analyze their economics in the area under study.
4. To identify the problems in production of small millets and their value added products.

The study is confined to Madhya Pradesh keeping in view the maximum share of small millets and importance of these particular crops in view of the global perspectives. The study attempted to cover Kodo and Kutki with other crops during kharif season for in depth analysis. The study was based on primary as well as secondary data. The primary data were collected from the small millets growers. Two districts having the highest area under the selected crops in the State i.e. Dindori and Madla for kodo and Chhindwara and Dindori for Kutki were selected for the study. One block in each selected districts viz. Ghughari & Shapura in Mandla & Dindori, districts respectively for kodo and Tamiya and Shapura from Chhindwara and Dindori respectively for kutki have been further selected for the study on the basis of maximum area under selected crops. A list of all the villages in selected blocks where concentration of area was found to be more under these crops was prepared. Further, more number of villages nearby selected village were considered for collection of primary data to fulfill the requirement of desired sample size.

A list of all the Kodo and Kutki growers was prepared and 30 farmers from each block were selected randomly. Thus the study covered 120 tribal farmers comprises of 60 kodo and 60 kutki growers in the area under study. The primary data were collected by pretested interview schedule by survey method for the reference year 2015-16. The secondary data on area production and productivity of selected and other major kharif crops for the last twenty years were collected from the various sources viz. Agriculture statistics of Madhya Pradesh published by Directorate of Agriculture, various online information available at government websites like www.landrecordcommissioner.in, www.mpkrishi.org etc.

6.2 Conclusions

The following conclusions are emerged from the study

- ☑ The area and production of small millets was found to be decreased while the productivity was increased with highly significant rate in Madhya Pradesh and Country as well except production in Madhya Pradesh. The area and

production of other major kharif crops viz. paddy, maize and soybean were found to be increased at highly significant rte except area of paddy & maize and production in case of maize during the period from 2001-15 in Madhya Pradesh.

- ☑ most of the tribal farmers (95%) used to grow Small Millets (Kodo & Kutki). The majority of them were found to be illiterate (50%) and on an average had a family of 5 members. On an average they were found to have 11.23 acre of land holding, out of which only 5 per cent was found to be under irrigation. They were found to devote their maximum gross cropped area in Kharif (76.46%) as compared to Rabi Crops (23.55%). Kodo, Kutki, paddy & maize and wheat, gram lentil and field pea were found to be grown by the respondents in kharif and rabi season, respectively for their livelihood. Some of the farmers were still found to grow traditional crops like sama, kangna and Jagni in Kharif season. An average famer had total assets of Rs. 35733/ only. There was no remarkable difference between the different parameters of socio economics status of farmers who cultivate kodo or kutki in the area under study.
- ☑ although cultivation of small millets viz. kodo & kutki were found to be remunerative and provide income and employment to tribal community, but these crops were found less remunerative than the other kharif crops i.e. maize and paddy. Most of the tribals were found to grow these crops with traditional practices in marginal lands by just broadcasting the seed in the field and harvest the produce without incorporating any additional inputs.
- ☑ Low productivity of kodo/kutki was observed in farmers' fields as compared to RPP, as these crops were found to predominantly grown with in shallow soils with low water holding capacity and under rain-fed conditions. The farmers were not found to adopt improved crop production practices due to lack of knowledge about RPP in cultivation of these crops. Their poor socio economic conditions and non availability of HYVs seed also hampered the production of small millets. Lack of suitable extension and development support for production and research on genetic improvement in small millets was not given utmost importance as compared to other food crops troubled the production of small millet. Huge price spread (minimum of 200%) and absence of Minimum Support Price (MSP) forced famers to distress sell of their products at un-remunerative price.
- ☑ The value addition of small millets was not found in commercial scale. The majority of tribal farmers were found to prepare various products of kodo and kutki but for their home consumption only. Very few of them found to sell the value added products in weekly (haat) bajar. Keeping these facts in view, as these products are prepared from organically produced small millets by

the tribal community, the value addition in small millets needed to be up scaled by establishing micro /small level industries with capacity building in preparation of variety of products having wider acceptance at national and international markets. In this way geographical indicator based small millets products may be prepared matching the international norms/ srtandards by supporting tribal with end to end approach there by inculcating the entrepreneurial skill among them and creating brand image of these value added products at global level. This will not only create an environment of auto welfare of tribal at one end and State will also be benefitted by generating foreign exchange reserve on the other.

6.3 Policy Recommendations

The following suggestions/policy recommendations are made to popularize small millets in the tribal areas of Madhya Pradesh

- It is observed that more than 90 per cent of the small millets grown under rain-fed conditions particularly in tribal districts of M.P. Comparing to other kharif crop, productivity of small millets is mainly low as these crops are grown in skeletal or shallow /low fertile soils and non adoption of improved package of practices of crop production technology. Farmers are used to sow the seed and harvest the small millets. Major efforts are required to conserve rain water. Compartmental bunding and in-situ moisture conservation technologies are prerequisite for millets production by harvesting the rain water and subsequently utilizing for crop production. A pre-season tillage will greatly help in conserving the early showers thereby ensuring timely sowing and quick establishment of millets crop.
- Such technologies should also be extended to other millets crops for sustaining yield under rain-fed condition. The wide yield gap between actual and potential yield of the small millets was observed. Replacement of recommended varieties, timely sowing, and balanced nutrition with suitable inter-cropping can bring good income to the farmers. Small millets give better respond to small doses of fertilizers and other crop management practices such as optimum spacing and cultivation technologies. Cropping pattern for remunerative farming involving short duration varieties of pulses with millets are required to be involved. Location specific crop production technologies need to be identified. Large scale production demonstration combined with value added marketing technologies of the millet are required for enhancing production and income of the millets growers.
- Quality seed production and distribution of improved cultivars should ensure adequate and timely supply of true to type seed materials with high seed quality standards at farmers' doorsteps. The state seed committees must identify millets cultivars as per regional specific needs. Regional specific seed production should be taken up on priority basis. Extending liberal seed

subsidy to the millets farmers needs to be considered and executed. State agricultural Department should take up seed production and distribution engaging NGOs, producers' companies, farmers' cooperatives and self help groups etc. for active seed production and supply back to government. Opportunity for strengthening informal seed supply systems including direct trade between villages and between farmers should be encouraged in the area. Major initiative like "Initiative for Nutritional Security through Intensive Millets Promotion" (INSIMP) programmes to augment the availability of seed to farmers at an affordable price should be promoted for promoting millets production.

- Even though, nutritional superiorities of millets over others cereals are well known, its advantages are not being exploited on commercial scale. Processing and value addition technology advances have made it possible to process and made value added products to households. One of the limiting factors for diversified food uses of small millets is lack of appropriate processing technologies to prepare convenient ready to eat value added products. Advanced technologies such as extrusion cooking, methods of vermicelli/noodles, pasta, biscuits and other bakery products are also not available in most of the small millets. Due to these facts small millets remain un-researched and their nutritional potential is yet to be plugged in diversified ways. Therefore, processing technologies should take sufficient care while improving the consumer acceptance of millets foods the nutritional properties are retained intact.
- Entrepreneurship development of the stakeholder is prerequisite in food processing and product development for any products. The ultimate aim of the entrepreneurship development programme is to disseminate complete knowledge on nutritional importance of millets, linkage of farmers with market, processing, value addition etc. The stake holders should include the urban and rural entrepreneurs, progressive farmers, non governmental agencies, self help groups etc. Entrepreneurship development programme for the farmers and others stakeholders should be organised on regular basis through modern and innovative approaches. Trained entrepreneurs need to be motivated for value addition, product development and marketing in sustainable ways. Liberalization and Globalization has opened several opportunities and public private partnerships are one among them. Future research should aim at consortium mode by joining and the private partner for production and commercialization of millets products. Popularization of millets on the grounds of promoting nutritional and health benefits should receive adequate government attention. Rational fixation of minimum support price for the small millets will ensure that the farmers growing these crops get fair price for their produce.
- To encourage the small millets processing industries, concessions in form of subsidies/tax exemption while procurement of raw materials, production and processing should be given. Efforts to sensitize the

government departments to introduce millets in mid day meals scheme of school children and public distribution systems are required. The programme like INSIMP should be promoted in a bigger way and incentives scale with sufficient budget foe promotion of millets in the state.

- Awareness regarding nutritional health and environmental advantages may be created through communicational strategies so that the consumers will conscious and took the advantages of millets in their daily diet.

Thus, the promotion of millets can lead to much efficient natural resource management and ultimately to a more holistic approach in sustaining agro-biodiversity of the state

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ANNEXURE-I

REVIEWER COMMENTS AND ACTION TAKEN REPORT

1. Title of the draft report examined: "Problems and Prospects of Production of Small Millets and their value added Productions in Madhya Pradesh"

2.Date of receipt of the Draft report by email: 28th March, 2017

3.Date of dispatch of the comments: 30th March, 2017

4.Chapter-wise comments: All the objectives of the study have been addressed

Comments on Chapter-I:

The chapter-I has been presented very nicely but there is a need to little more elaborate in the method of selection of sample farmers. One or two paragraph may be written about the organization of report.

Action: Done as per comment.

Comments on Chapter- II:

This chapter has also been properly described. The graphic presentation is also very satisfactory. Tables are only interpreted necessary to bring in some discussion on every table to know the causes of decreasing area and production of small millets in M.P. during the study period.

Action: Done as per comment.

Comments on Chapter-III: Please check Table 3.1

Action: Done as per comment.

Comments on Chapter-IV:

There are no comments on this chapter. The economics of cultivation of small millets on the sample farms have been analyzed in a good manner. Even then, there is a need to little more elaborate the problems of sample farmers in the cultivation of small millets on their sample farms because this is a core objective of the study.

Action: Done as per comment.

Comments on Chapter-V: No comment because it has been nicely presented.

Comments on Chapter-VI:

Two or three key tables could be mentioned in the executive summary to support the findings. Please write a brief summary in the end of each chapter (IInd to Vth)

Action: Done as per comment.

Apart from this, the number of chapter in the list of content requires correction.

5. Overall view on accept ability of report the draft report can be accepted after revising in accordance with comments/suggestions

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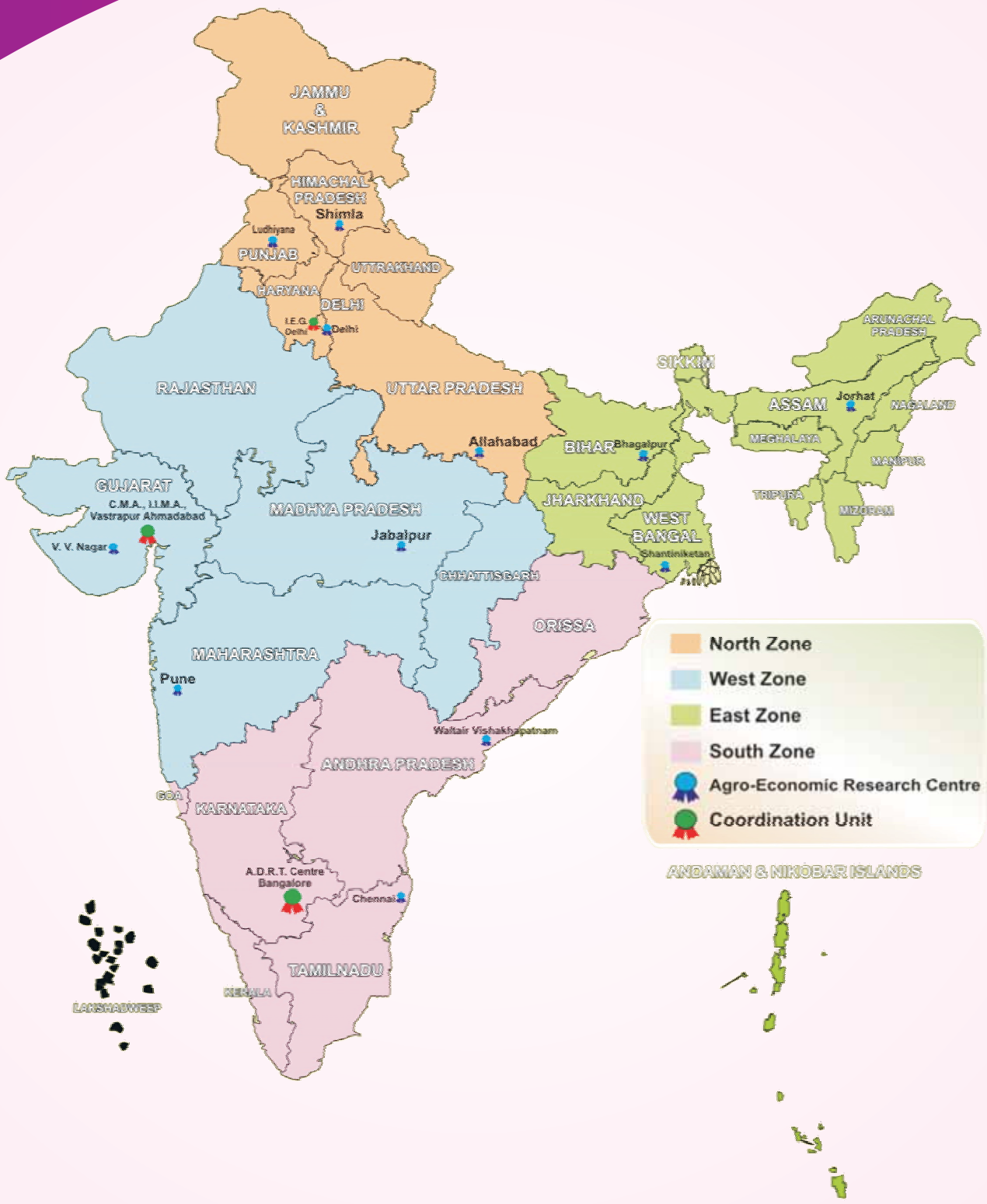

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