Concept Paper

Millet production and its scope for revival in India with special reference to Tamil Nadu

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ABSTRACT

The millets belong to a group of small size food grains mainly grown around the world for food and fodder. Millets are cultivated as important staple food particularly in poor and semi-arid tropics of Asia and Africa. In this paper an attempt has been made to analyze the trend in area, production and yield of millets across the states including Tamil Nadu and to suggest suitable future strategies to revive these crops considering their economic value. In the country the cereals occupy 51 per cent of the gross cropped area. Within the area under total cereals, total coarse cereals constitute 14.20 per cent of the area. Among the coarse cereal crops, jowar and bajra are the predominant millet crops constituting about 60 per cent of the area. The area under coarse cereals was found declining ie from 41 (1980-85) to 26 Mha (2010-13) and thus resulting in decline in area of about 1.50 per cent per annum though a marginal gain in production has been achieved owing to increase in productivity levels. The trend in area, production and yield of the millet crops in Tamil Nadu would imply that barring barnyard millet all other millet crops suffered from decline in area and yield. Such loss in area was to the tune of 6 to 10 per cent every year and 4 to 8 per cent in case of yields. There is a need to formulate suitable strategies considering the economic value of the crops. Yield difference analysis indicates that there is significant difference in yield obtained by cultivating local and high yielding varieties; also it indicates inter-year differences in the yield achieved by cultivating either local or high yielding varieties.

Keywords: Trend; cost; yield; returns; millets; area; production

INTRODUCTION

Millets are a group of highly variable small-seeded grasses widely grown around the world as cereal crops or grains for fodder and human food (Michaelraj and Shanmugam 2013a). These are cultivated as important food staples particularly in poor and semi-arid tropics of Asia and Africa (Mahendra Dev 2012, Narloch et al 2011). These millet crops are grown mostly in water stressed/starved and rainfed conditions where normal crops could not be effectively cultivated (Maikhuri et al 1997). Owing to their nutritional content any improvement in production, availability, storage and utilization technology for millets could significantly contribute to the food and nutritional security of India's population (Prakash et al 2004). These millets contribute in diversifying our food basket which is at present very narrow because of excessive dependence on major cereals like rice and wheat. They are now called as 'nutria cereals' realizing the nutrient richness these grains possess (Nautiyal and Kaechele 2006). Nevertheless cultivation of these millets now faces many limitations/constraints resulting in decline in area and cultivation of these crops, existence of high yield gaps, low prioritization in research agenda and subsequently less technology breakthrough in these crops.

This paper analyzes the trend in area, production and yield of millets across India including Tamil Nadu state and suggests suitable future strategies to revive these crops considering their economic value. The study was carried out with the objectives to analyze the trend in area, production and yield of millets in India and Tamil Nadu to calculate the yield differences and cost of cultivation in major millets, to examine the marketed surplus and farm diversity and suggest suitable future strategies to revive millet crops.

METHODOLOGY

Compound growth rate (CGR): In the present study compound growth rate (CGR) of area, production and productivity for the millets in India and Tamil Nadu state were estimated to study the growth in area, production and productivity. The compound growth rates are found very convenient for any comparison of growth between two periods and two crops. It seems more appreciable to analyse the movement of agricultural crops in terms of compound rather than linear growth rate (Dandekar 1980). Hence the compound growth rates were computed for the selected millet crops in Tamil Nadu state. The compound growth rates (CGRs) are usually estimated by fitting a semi-log trend equation of the form:

$$\text{Log } Yt = \alpha + t\beta t + \varepsilon t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where Yt= Area, production and yield of selected major agricultural crops in years 't', t= Year which takes value 1, 2……n, α and β are the parameters to be estimated, ε= Random error term

Equation (1) was estimated using ordinary least squares (OLS) technique. The t-test was applied to test the significance of β. This equation is generally used on the consideration that change in agricultural output in a given year would depend upon the output in the preceding year (Nikam and Deosthali 2004).

Compound growth rate was then estimated by using the following equation:

$$CGR = [(\text{Antilog of } \beta - 1)*100] \quad \ldots\ldots\ldots\ldots\ldots (2)$$

The study considered the yearly database for the major agricultural crops to examine the growth performance of area of cultivation, production and productivity in Tamil Nadu. The millet crops under examination including coarse cereals, jowar, bajra and ragi for India and Tamil Nadu were analyzed to predict the better growth performance. The necessary data were collected purely based on secondary sources and these were collected from various issues of statistical handbook of Tamil Nadu and seasonal and crop reports. Also the data were gathered from the unpublished sources of department of economics and statistics, Chennai, Tamil Nadu.

Cost of cultivation: Cost of cultivation included variable and fixed costs. Variable costs included the cost of human labour, bullock power, machine power, seeds, farmyard manure, fertilizer, plant protection chemicals, irrigation charges and interest on working capital. Fixed costs comprised depreciation, land revenue, rental value of land and interest on fixed capital.

Gross return: Per hectare gross return was calculated based on what the sample farmers realized actually at the market prices for the quantum of the produce in rupees.

Net return: It was calculated by taking into account gross return subtracting the total costs.

Cost of production: This was calculated by dividing the total cost per hectare by the yield per hectare (quintal/tonnes/kg).

RESULTS and DISCUSSION

Trend in area, production and yield of millets in India

Next to rice and wheat, millets occupy a significant position in the area under total cereal crops. In the country the cereals occupy 51 per cent of the gross cropped area. Within the area under total cereals, total coarse cereals constitute 14.20 per cent of the area. The rice is the major cereal crop grown in the country with 22 per cent of the area under cereals. Wheat occupies 15 per cent of the total area under cereals. Thus beside rice and wheat the other crops like jowar, bajra, maize and ragi also play a significant role in fulfilling the food security of the country.

The data on area, production and yield of coarse cereals, jowar and bajra are shown in the Table 1 and the major producing states and their percentage share at national level are presented in Table 2.

Coarse cereals are being cultivated in an area of about 26 Mha with production of about 42 MT and productivity of 1582 kg/ha. The area under such coarse cereals was found declining ie from 41 (1980-85) to 26 Mha (2010-13) and thus resulting in decline in area of about 1.50 per cent per annum though a marginal gain in production was achieved owing to increase in productivity levels. The data indicated that cultivation of coarse cereals was restricted to only nine states in the country. Among the various states Rajasthan had a share of about 25 per cent of area and contributed

Table 1. Trend in area, production and yield of coarse cereals, jowar and bajra in India

Period	Coarse cereals			Jowar			Bajra		
	Area (Mha)	Production (MT)	Yield (kg/ha)	Area (Mha)	Production (MT)	Yield (kg/ha)	Area (Mha)	Production (MT)	Yield (kg/ha)
1980-81 to 1984-85	41.12	30.59	744.20	16.23	11.31	696.80	11.37	5.96	523.80
1985-86 to 1989-90	38.43	29.12	759.20	15.50	10.93	707.40	10.71	5.18	475.80
1990-91 to 1994-95	33.83	31.20	921.80	12.80	10.59	825.00	10.18	6.51	636.00
1995-96 to 1999-00	30.48	31.04	1020.00	10.72	8.98	836.60	9.48	6.73	707.20
2000-01 to 2004-05	29.32	32.32	1099.60	9.48	7.20	760.40	9.39	7.96	833.40
2005-06 to 2009-10	28.28	36.47	1291.20	8.04	7.33	913.40	9.26	8.29	895.20
2010-11 to 2012-13	26.47	41.83	1582.33	6.60	6.10	922.67	8.53	9.80	1154.67
CGR (%)	-1.53	0.96	2.54	-3.04	-2.11	0.96	-0.90	1.99	2.91

Source: Season and Crop Reports, Government of Tamil Nadu (various issues)

Table 2. Major coarse cereals, jowar and bajra producing states of India (2011-12 and 2012-13)

State	Area (Mha)	% share	Production (MT)	% share	Yield (kg/ha)
Coarse cereals					
Rajasthan	6.45	25.24	7.19	17.51	1118
Karnataka	3.54	13.85	6.48	15.79	1835
Andhra Pradesh	1.33	5.21	4.84	11.78	3621
Maharashtra	4.95	19.37	5.24	12.77	1054
Uttar Pradesh	2.02	7.89	3.63	8.85	1802
Madhya Pradesh	1.71	6.68	2.50	6.09	1469
Bihar	0.72	2.80	2.01	4.90	2808
Gujarat	1.42	5.56	2.15	5.24	1530
Tamil Nadu	0.67	2.62	1.99	4.84	2991
Total (above 9 states)	22.78	89.23	36.03	87.77	2025
All India	25.53	100.00	41.04	100.00	1608
Jowar					
Maharashtra	3.16	50.84	2.33	41.20	734
Karnataka	1.23	19.79	1.30	22.90	1051
Madhya Pradesh	0.34	5.47	0.55	9.73	1627
Andhra Pradesh	0.29	4.59	0.44	7.69	1527
Rajasthan	0.62	9.90	0.42	7.34	682
Uttar Pradesh	0.19	2.98	0.23	4.07	1247
Tamil Nadu	0.21	3.30	0.22	3.80	1054
Total (above 7 states)	6.02	96.86	5.49	96.73	1132
All India	6.22	100.00	5.66	100.00	910
Bajra					
Rajasthan	6.50	56.08	4.24	44.53	943
Uttar Pradesh	1.35	11.60	1.70	17.82	1894
Gujarat	1.06	9.10	1.15	12.09	1570
Haryana	0.70	6.04	0.99	10.36	1981
Maharashtra	1.04	8.97	0.62	6.52	827
Karnataka	0.46	3.93	0.30	3.15	999
Madhya Pradesh	0.28	2.42	0.32	3.36	1734
Total (above 7 states)	11.39	98.14	9.32	97.83	1421
All India	11.59	100.00	9.51	100.00	1193

about 17 per cent of the total coarse cereals produced in the country. Among the coarse cereal crops jowar and bajra were the predominant constituting about 60 per cent of the area.

Jowar is being cultivated in an area of 6.6 Mha with production of 6.10 MT and a productivity level of 923 kg/ha. The area under this crop was found declining from 16 (1980-85) to 6.6 Mha (2010-13) thus resulting in loss of area and production to the level of about 3.0 and 2.0 per cent per annum respectively though a marginal gain in productivity level was achieved. Among the various states in the country cultivation of jowar was concentrated only in seven states contributing 97 per cent of the area and production in the country. Maharashtra state ranked first in area (51%) and production (41%) followed by Karnataka. Similarly bajra is being cultivated in an area of 8.53 Mha with production of 9.8 MT and productivity of 1155 kg/ha. The area under this crop was found declining from 11.37 (1980-85) to 8.53 Mha (2010-13) resulting in loss of area of about 0.90 per cent with a gain in production (2%/year) and about 3 per cent in productivity level. Among the various states in the country cultivation of bajra is concentrated mainly in seven states contributing 98 per cent of the area and production. Rajasthan ranked first in area (56%) and production (44%) followed by Uttar Pradesh.

Trend in area, production and yield of millets in Tamil Nadu

Millets in Tamil Nadu occupy an area of about 32000 ha (Table 3) with an annual production of about 31000 tonnes. Among the different millet crops grown in the state little millet (Samai) is grown in an area of about 20000 ha. But the yield levels obtained are relatively very low. The trend in area, production and yield of the millet crops in the state would imply that barring barnyard millet all other millet crops suffered from decline in area and yield. Such loss in area was to the tune of 6 to 10 per cent every year and 4 to 8 per cent in case of yields. There is a need to formulate suitable strategies considering the economic value of the crops.

Yield differences

An attempt was made to compare the yield obtained through local and high yielding varieties of jowar and bajra (Table 4). It indicated that there was significant difference in yield obtained by cultivating local and high yielding varieties. However over the years there was no perceptible improvement in the yield

Table 3. Area, production and yield of millets and their trend in Tamil Nadu

Crop	Area, production and yield in triennium ending 2011-2012			Trend in area, production and yield (CGR) during 2000-2012 (%)		
	Area (ha)	Production (tonnes)	Yield (kg/ha)	Area	Production	Yield
Fox Tail millet (Tenai)	875.33	412.67	470.67	-10.285	2.187	-8.477
Kodo millet (Varagu)	6041.67	10037.67	1701.33	-9.798	4.214	-4.628
Little millet (Samai)	20207.67	20664.00	1024.67	-6.149	3.209	-6.175
Barnyard millet (Kudhraivali)	4497.33	NA	NA	0.739	NA	NA
Common millet (Panivaragu)	200.67	NA	NA	-4.452	NA	NA
Total	31822.67	31114.33				

Source: Season and Crop Reports, Government of Tamil Nadu (various issues), NA= Data not available

Table 4. Yield differences between jowar and bajra

Year	Jowar yield (kg/ha)			Bajra yield (kg/ha)		
	Local	HYV	Yield difference	Local	HYV	Yield difference
2001-02	728	1207	479	795	1314	518
2002-03	551	1030	478	543	1023	479
2003-04	720	1016	296	816	1503	687
2004-05	756	1058	302	1062	1275	213
2005-06	736	1122	386	810	1320	510
2006-07	733	1143	410	1077	1470	393
2007-08	923	1385	461	1114	1525	411
2008-09	996	1330	334	1153	1525	373
2009-10	757	1184	427	841	1271	430

obtained through cultivating high yielding varieties. The data also indicate inter-year differences in the yield achieved by cultivating either local or high yielding varieties. Many factors could b e responsible for such yield differences. Cultivation of millet crops under rainfed condition especially by marginal and small farmers, poor agronomic practices, low level of technology adoption and substitution of high value crops especially in irrigated condition were found to be major reasons in yield differences (Anon 2012).

Cost estimates and returns

The cost estimates in terms of cost of cultivation (Rs/ha) production (Rs/q) for the three millet crops are presented in Table 5. The data also show the average yield obtained and the minimum support price (MSP) announced by the government for these crops.

Table 5. Cost of cultivation/production and returns of the millets

Crop	Cost of cultivation (Rs/ha)	Yield (q/ha)	Cost of production (Rs/q)	MSP (Rs/q)	Gross return (Rs/ha)	Net return (Rs/ha)
Jowar	19821.67	10.30	1925.06	1500	15445	-4377
Bajra	18634.88	16.51	1128.47	1310	21632	2998
Ragi	32845.57	21.05	1560.36	1500	31575	-1271

It is evident that except bajra the other two millets viz jowar and ragi could not cover the cost of production and therefore it is essential either the yield or the price has to be increased to make the cultivation remunerative.

Marketed surplus

Marketed surplus (Table 6) is another important factor which reveals the actual quantity of farm output marketed for the consumers. Farm output like cotton or sugarcane will have a very surplus ratio as the quantity retained for own consumption is very low. In the case of millets almost 50 per cent of the total production is consumed by the producers themselves leaving little quantity available for market.

Table 6. Marketed surplus ratio among the millets

Year	Jowar	Bajra	Ragi
2007-08	61.47	61.78	22.17
2008-09	54.60	57.78	20.11
2009-10	65.00	70.25	37.18
2010-11	62.03	67.38	25.73
2011-12	53.46	67.48	53.25

Source: Season and Crop Reports, Government of Tamil Nadu (various issues)

Strategies to recognize and retrieving millets

Millets are water saving and drought tolerant crops. These crops must be viewed as climate change compliant crops or climate resilient crops and thus could make India's food and farming future secured. Millets can also be distributed through public distribution system (PDS) though few states have been supplying the millets through ration shops and the PDS system can be strengthened with the high nutritive quality of these millets. Compared to rice a nutritive analysis of millets vis a vis the major grains such as rice and wheat proved that nutrient to nutrient millets scored high over other grains. They have 30 to 300 per cent more nutritional elements such as calcium, minerals, iron, fibre, beta carotine and many other micronutrients (Michaelraj and Shanmugam 2013b). The problem of malnutrition can be overcome by providing space for millet-based foods in the integrated child development services (ICDS), school meals and welfare hostel programmes etc. All these actions would no doubt open up new markets for millet farmers and revitalize them.

Number of institutional mechanisms needs to be created to retrieving millets. The millets need a number of enabling conditions. The principal among these is to increase livestock which are local breeds and adapted to local ecosystems. This will create a symbiotic relationship between farming and pastoralism such as increased organic manure, fodder availability, milk production and increased incomes for farmers. Urgent attention must be given to the productivity enhancement of the rainfed lands where millets are grown. This could be achieved through special watersheds on millet lands and supporting government's employment programmes such as NREGA to support millet cultivation from sowing to harvesting (Pray and Latha 2009).

Millet farms are intrinsically biodiverse. The monitoring, evaluation and research on millet cultivation must be tailored to this special quality of millet farming system. Policy makers need to take note of the fact that millets make way for a dynamic diversity on farmers' fields. Millets can be cultivated without using groundwater or surface irrigation. Their energy requirement from sources such as chemical fertilizers, pesticides, water and power can be near zero. This amazing capacity of this production system must be honoured through offering socio-ecological bonus to millet growing farmers. Institutional finance and insurance which are offered generously to farmers who cultivate preferred grains such as rice and wheat and non-food crops must be extended to millet farmers also. Research institutions must give a new thrust on millet areas and issues. But such research initiatives must be led by farmers since they offer exciting perspectives for the research which has to be people-centered and people-directed.

CONCLUSION

The preceding analysis on the trend in area under millets show that there was a gradual decline. As millets are predominantly grown in marginal and sub-marginal dry lands by poor farmers. The fluctuations in area, production and productivity not only bring hardship to farmers but also instability. Considering the economic significance of the crops developmental efforts should be made through demonstrations and training programmes and thus popularizing the cultivation of these crops among the farmers. The gradual decline in net availability of cereals and the trend being more towards consumption of rice and wheat the consumer dietary cereals are being slowly replaced by major cereals like rice and wheat. This is the perspective from which the millet cultivation and its promotion must be regarded.

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