



Research Article

PRODUCTION OF RAGI (FINGER MILLET) IN KARNATAKA FARMERS NEED BETTER INCENTIVES

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Received: May 01, 2022; Revised: May 26, 2022; Accepted: May 27, 2022; Published: May 30, 2022

Abstract: Karnataka state has given importance to dry land development research since last five and half decades. Due to concerted efforts put forth by the State Agricultural Universities, they were able to release cultivars especially in minor cereals like ragi, predominantly grown in dry land areas which are high yielding and drought resistant. Finger millet commonly known as ragi widely grown in Africa and Asia and is originally native to the Ethiopian highlands. Ragi has been found in an Indian excavation which is dated at 1800 BC. Karnataka, Tamil Nadu, and Telangana are the major states where it is grown under semi-arid conditions. State accounts for nearly 60 percent of total area under the crop. The improvement of yields in ragi crop has not enabled farmers to realize higher returns due to high cost of cultivation. There has been a drastic decline in area under ragi crop as farmers are opting for better substitutes. Farmers need support in the form of input subsidies, remunerative price to their produce besides putting in place efficient procurement operation. Such comprehensive policy measures are crucial to arrest declining trend observed in the area under ragi crop as ragi being the staple food crop of half of the population of the State.

Keywords: Trend analysis, Structural break in ragi, Cost of cultivating ragi-CostC2, Market Intervention

Citation: Chandrashekar H., et al., (2022) Production of Ragi (Finger Millet) in Karnataka Farmers Need Better Incentives. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 14, Issue 5, pp.- 11346-11351.

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Academic Editor / Reviewer: Pushpendra Singh, Bikash Subba, Dr B. S. Vyakarnahal

Introduction

Karnataka state is the eight largest states located in southern peninsular India accounting for 6.3 percent of total geographical area and 5.3 percent of total population of the country. Nearly 66 per cent of state population live in rural areas. Based on physiographic and climatic conditions, state has been delineated into ten agro-climatic zones of which five agro-climatic zones are categorized as Dry-zones accounting for 64 per cent of total geographical area and 72 per cent of the net sown area of the state. In spite of massive investments in irrigation during the last seven decades, irrigation still covers only about 34 percent of state's total cropped area. Out of the state's geographical area of 19.04 million hectares, around 11.80 million hectare is under cultivation, and of this about eight million hectare is under dry land cultivation, particularly having low and erratic rainfall. Despite of natural disadvantages experienced by the state, unlike other states, the agricultural growth in Karnataka state is not confined to only better endowed regions and crops but it has also penetrated to dry land areas and as well as to dry land crops. Finger Millet (Ragi), Sorghum (Jowar) and Pearl Millet (Bajra) are predominantly dry land crops have registered considerable improvement in their productivity. State Agricultural Universities has played significant role in evolving location-specific drought-tolerant high yielding varieties and other appropriate dry land technologies. Also, extension agencies have played crucial role in taking these technologies to farmer's fields. Karnataka state has been in forefront in successfully harnessing improved dry land technology for agriculture development and implementing watershed development programme for enhancing livelihood opportunities in dry land areas of the state. Finger millet commonly known as ragi widely grown in Africa and Asia and is originally native to the Ethiopian highlands.

Ragi has been found in an Indian excavation which is dated at 1800 BC, therefore may be inferred that some unknown benefactor brought this food grain from Africa to India in about 2000 BC [1]. Karnataka, Tamil Nadu, and Telangana are the major states where it is grown under semi-arid conditions. Karnataka is one of the major ragi growing states in the country accounting for nearly 60 percent of total area under the crop. It is predominantly grown under rainfed conditions as only eight percent of area under ragi crop is under irrigation during 2017-18. Ragi is a staple food for nearly 50 percent of the population of Karnataka mainly dwelling in southern districts of Karnataka as it finds a prominent place in the dietary habits of people of southern districts of Karnataka. The grain is mainly consumed in rural areas and of late it is also gaining importance in urban area due to its nutritional and medicinal properties. Finger millet contains about 5-8% protein, 1-2% ether extractives, 65-75% carbohydrates, 15-20% dietary fiber and 2.5-3.5% minerals. Of all the cereals and millets, finger millet has the highest amount of calcium (344mg%) and potassium(408mg%). The cereal has low fat content (1.3%) and contains mainly unsaturated fat. 100 grams of Finger millet roughly on an average of 336Kcal of energy in them. Presently in Karnataka, ragi is grown in 7.78 lakh hectare area producing about 1.54 million tons of grains. It accounts for nearly 10 percent of total area under food grains and sixteen percent of total area under cereals in the State. In terms of production, it contributes 11 percent of total food grains production and 20 percent of total cereal production. The eight districts of southern Karnataka account for nearly 80 percent of area and production of ragi in the State. In 2018, Government of India (GOI) [2] has issued a notification that replaces the usage of coarse cereals with nutri-cereals.

Ragi crop which was earlier categorized under coarse cereals is categorized under nutri-cereals. GOI has also introduced a draft resolution (A/75/L63 under agenda item 14), leading to adoption of adopting International Year of Millets, 2023 by the United Nation General Assembly [3]. The cultivation of nutriceals assumes importance because of their nutritional advantages and climatic resilience that are grown under rain-fed conditions [4].

Keeping in view the importance of ragi crop in Karnataka, the present study has been taken up to analyze the growth in the area, production, and productivity of ragi, examine to what extent growing ragi crop is profitable to farmers, suggest measures to make growing of ragi crop remunerative, especially under rain-fed situation and examine the marketing facilities to ensure better price to farmers.

Material and Methods

Time series data for the period from 1961-62 to 2017-18 for area, production and productivity of Ragi for the state of Karnataka was collected from Directorate of Economics and Statistics, Government of Karnataka (GOK). Besides, data from 2015-16 to 2017-18 for the period of three years, data in respect of area, production and productivity of Ragi crop was collected from the Directorate of Economics and Statistics, GOK for the 10 southern districts of Karnataka where Ragi crop is predominantly grown.

Trend analysis

The exponential growth function was used to estimate the growth rates of area, production and productivity of Ragi crop for different periods. The periods represent different decades viz.; sixties, seventies, eighties, nineties, first decade of new millennium besides capturing the growth of ragi crop for the period of seventeen years of new millennium.

The model is $Y = ab^t e^{---(1)}$

Where Y= Dependent variable representing area, production and productivity of crops Representing different periods.

a= intercept

b=Regression coefficient

t= Time variable

e=error disturbance term.

Logarithmic form of equation (1) is given by;

$\ln Y = \ln a + t \ln b + e^{---(2)}$

Compound growth rate for area, production and productivity of crops for different periods are calculated using the formula;

$\text{Compound Growth Rate (CGR)} = (\text{Anti } \ln b - 1) * 100.$

The district wise data was analyzed using triennium average, contribution of area and production of ragi crop to the state and variation in area, production and productivity of ragi crop was captured by calculating coefficient of variation (CV).

Structural Breaks in Ragi

The structural breaks in time series were identified using R-programming using Bai-Perron break points in time series.

Cost of cultivation of Ragi

The Commission for Agricultural Costs and Prices (CACP) [5], Government of India fixes Minimum Support Price (MSP) to 23 crops based on detailed data collected on cost of production and other factors like demand and supply, market price trends, etc., of the crops. CACP considers A2+FL that include cost of all expenses in cash and kind on account of hired labour including human, bullock, machine, seed, insecticide, pesticide, manure, fertilizer, irrigation charges and misc. expenses and imputed cost on family labour while arriving at MSP to the crops. On the other hand, farmers are demanding considering cost C2 while arriving at MSP, where C2 is a more comprehensive cost that factors in rentals and interest forgone on owned land and fixed capital assets, on top of A2+FL. Besides farmers are also demanding 1.5-times MSP formula - originally recommended by the National Commission for Farmers headed by agricultural scientist M S Swaminathan. We have attempted to compare the Cost C2 and the value of output (VOP) realized by the framers over last 20 years. Data required for

the purpose was collected from various policy documents annually brought by the CACP. Shift in area from ragi to other crops was analyzed by measuring correlation between area under ragi and other dry land crops.

Market Intervention

The NSSO 77th report on situational assessment of agricultural households and land and holding of households in rural India, 2019 was utilized to examine the market intervention for procurement of crops in general and ragi in particular. The report documents number per 1000 crop producing agricultural households reporting disposals of selected crop to different agencies by level of satisfaction of the sale outcome for each agency of disposal. Information has been collected for two periods, viz., July-2018 to Dec 2018 (Visit-I) and Jan 2019 to June-2019 (Visit-II). Information from both the visits are utilized in the study. Information in respect of disposal ragi crop to different agencies is also analyzed in the study.

Results and Discussion

Performance of Ragi crop in Karnataka

The average area, production and productivity of ragi in Karnataka and their compound growth rates for six periods have been presented in [Table-1]. The periods represent different decades viz.; sixties, seventies, eighties, nineties first decade of new millennium besides capturing the growth of ragi crop for the period of seventeen years of new millennium.

The area under ragi crop had remained stable around 10.08 lakh hectares until 2000 and experienced sharp decline in the area since 2001. This fact is also well captured by the compound growth rates calculated for different periods. It may be seen from the [Table-1] that in none of the period there was significant growth in the area under ragi crop. In fact, area under ragi crop experienced significant decline to the extent of 1.96 percent per annum when we consider first seventeen years of new millennium that is from 2001-02 to 2017-18. It is interesting to note that though the area under the ragi crop has shown a steady decline over different decades considered for the analysis, except the fact that there was some increase in area under the crop during eighties. The increase in area during eighties has not resulted in breaking the stagnant trend experienced by the crop. The declining trend continued during nineties and new millennium periods.

The productivity of ragi was very low during sixties and did not register significant growth. On the other hand, there has been a considerable improvement in productivity of ragi during seventies where the increase in yield was almost five-quintal per hectare compared to sixties. This was also reflected very well where productivity registered a significant growth of 4 percent per annum during seventies. The productivity ragi experienced stagnation during eighties which is evident from non-significant growth registered by the crop despite the fact that the crop had experienced area expansion during this period. The situation improved during nineties where there was a significant improvement in productivity of ragi. The increase is nearly five quintals per hectare when compared to the productivity attained during seventies and eighties and almost ten-quintal when compared to productivity of ragi in sixties. However, either the first decade of new millennium or considering overall seventeen years of new millennium did not show any improvement in trend in respect of productivity. In fact, the average yield of the crop was almost similar to the one registered during nineties that is around 16 quintals per hectare.

Production of ragi had experienced productivity-led growth in the state. Productivity growth experienced by the crop during seventies and nineties had helped in boosting production substantially. The production of ragi was just 7.15 lakh tones during sixties, increased to eleven lakh tones during seventies and 15 lakh tones during nineties. The production did not experience growth during eighties as state itself was experiencing stagnation in respect of agricultural production. But even after 2000, the productivity of the crop did not experience significant growth. However, Suresh and Chandrakanth (2015) [6] have noted that the total factor productivity index of ragi grew at 4.75 per cent per annum, public research has significantly contributed to TFP growth in ragi. The additional investment of one rupee in ragi research generated additional income of Rs.26.84 indicating substantial rate of returns to investment on research in ragi in Karnataka.

Table-1 Average Area, production, productivity and Annual Compound growth Rate of Ragi crop in Karnataka

Period	Area		Production		Productivity	
	Average	Annual CGR (%)	Average	Annual CGR (%)	Average	Annual CGR (%)
1. 1961-62 to 1970-71(sixties)	10.81	-0.18 NS	7.15	-2.32 NS	694	-2.02 NS
2. 1971-72 to 1980-81(seventies)	10.65	1.05 NS	11.34	5.59 ***	1108	4.49 **
3. 1981-82 to 1990-91(eighties)	11.15	0.24 NS	12.16	-1.40 NS	1144	-1.64 NS
4. 1991-92 to 2000-01(nineties)	10.08	-1.01 NS	15.46	1.24 NS	1614	2.28 **
5. 2001-02 to 2010-11(first decade of new millennium)	8.38	-1.94NS	12.69	1.80 NS	1582	3.82NS
6. 2001-02 to 2017-18 (first seventeen years of new millennium)	7.76	-1.96*	12.01	1.63NS	1609	0.27NS

Area- Lakh hectares; Production- lakh tones; productivity- kg/hectare; CGR-Compound Growth Rate.

*- level of Significance at 1 % ; ** - level of significance at 5 %; *** level of significance at 10%; NS- non-significance.

Table-2 Endogenously identified Structural Breaks points in Ragi crop –Karnataka

Time series (1961-62 to 2017-18)	Number of structural breaks identified (years)	Periods identified based on breaks.	Average area/ production and productivity of crops
Area (lakh hectors)	1993,2005	1961-62 to 1993-94	10.85
		1994-95 to 2005-06	9.54
		2006-07 to 2017-18	7.20
Production (lakh Tons)	1974	1961-62 to 1974-75	762
		1975-76 to 2017-18	12.99
Productivity (kg/hectare)	1974,1991	1961-62 to 1974-75	742.5
		1975-76 to 1991-92	1196
		1992-93 to 2017-18	1619.5

Table-3 Ragi cultivation in Major districts of Karnataka

District	Area (in hectare)			Production (In tons)			Yield (kg/hectare)		
	Triennium Average (2015-16 to 2017-18)	Per cent to State total	Coefficient of variation (CV)	Triennium Average (2015-16 to 2017-18)	Per cent to State total	Coefficient of variation (CV)	Triennium Average (2015-16 to 2017-18)	Per cent to State total	Coefficient of Variation (CV)
Tumukuru	100781	14.52	72.7	187212	18.73	59.5	1295	89.4	56.6
Hassan	76144	10.97	21.3	130488	13.05	86.1	1649	113.8	68.8
Ramanagaram	70268	10.12	5.2	111669	11.17	65.5	1638	113.0	62.3
Kolar	61351	8.84	7.1	85656	8.57	96.4	1414	97.6	90.3
Mandya	60974	8.79	37.5	89992	9.00	56.7	1462	100.9	35.2
Chitrdurga	50688	7.30	5.8	66001	6.60	52.5	1397	96.4	24.9
Chikabalapura	46254	6.66	6.2	65077	6.51	62.3	1446	99.8	58.7
Chikmaglur	45658	6.58	12.5	51557	5.16	46.4	1164	80.3	40.4
Mysuru	41038	5.91	51.8	64605	6.46	68.9	1483	102.3	38.3
Bengaluru-Rural	37503	5.40	3.3	59248	5.93	53.5	1655	114.2	53.3
State	694066	85.10	13.0	999617	91.19	62.2	1449		54.6

Table-4 Cost –C2 and Value of output Ragi crop in Karnataka

Year	Cost of Cultivation (Rs/ha)		Profit (Rs/ha)		Ratio
	Cost C2	Value of output (VOP)	VOP-C2	VOP/C2	
1999-00	13878	6297	-7580	0.45	
2000-01	13112	7279	-5834	0.56	
2001-02	13125	6256	-6869	0.48	
2002-03	9418	5001	-4417	0.53	
2003-04	11480	5775	-5706	0.50	
2004-05	12108	5929	-6179	0.49	
2005-06	15459	7253	-8207	0.47	
2006-07	17450	13918	-3532	0.80	
2007-08	17872	10296	-7577	0.58	
2008-09	22595	15652	-6943	0.69	
2009-10	23940	15504	-8437	0.65	
2010-11	28548	19136	-9412	0.67	
2011-12	33157	22769	-10388	0.69	
2012-13	35938	31260	-4678	0.87	
2013-14	40061	31220	-8841	0.78	
2014-15	54317	32610	-21707	0.60	
2015-16	59842	35714	-24128	0.60	
2016-17	46719	42354	-4365	0.91	
2017-18	60199	57446	-2753	0.95	
2018-19	57254	34400	-22854	0.60	

Table-5 Number per 1000 crop producing agricultural households Reporting disposals of selected crop to different agencies by Level of satisfaction of the sale outcome for each agency of disposal
Visit-1(July-2018 to Dec-2018).

Agency	No. per 1000 crop producing Agri. HHs reporting sales of at least one crop to agency	Satisfactory		No. per 1000 crop producing Agri. HHs reporting sales of at least one crop to agency	Satisfactory		Ragi crop per 1000 distribution of agri. HHs Reporting sale of crop
		Satisfactory	Not-satisfactory (Lower than market price)		Satisfactory	Not-satisfactory (Lower than market price)	
Local Market	1024	639	336	1028	777	222	770
APMC Market	135	735	254	79	741	255	169
Input dealers	24	169	673	31	156	795	0
Co-operatives	11	861	139	8	185	0	0
Gov. Agency	11	548	342	7	977	0	0
FPOs	5	1000	0	4	990	0	0
Pvt. Processors	68	595	271	13	741	259	31
Contract Farming	12	829	0	11	462	331	0
Others	18	375	405	30	738	228	30

Structural Breaks in Ragi

The trend analysis of area, production and productivity of crops indicate that there appears to be no structural breaks in trend when the cut-off points are exogenously indicated. In order to examine whether there are any structural breaks in trends in ragi crop, an attempt was made to identify structural breaks endogenously in area, production and productivity of crops. Time series data spanning over 57 years, i.e. from 1961-62 to 2017-18 was utilized for the purpose. The structural breaks in time series were identified using R-programming using Bai-Perron break points in time series. The results are presented in [Table-2].

The endogenously identified breaks have identified two years, namely, 1993 and 2005 in respect of area under ragi crop. Based on these breaks, the series have been divided into three periods and average area in each of these of three periods are presented in [Table-2]. It may be noted from the [Table-2] that the years identified indicate a deceleration of trend in the area. The average area during the first period (1961-62 to 1993-94) was 10.85 lakh hectares, in subsequent period (1994-95 to 2005-06) area under ragi crop declined to 9.54 lakh hectares and there has been further substantial decline during the last period (2006-07 to 2017-18) to 7.20 lakh hectares. Thus the drastic decline in area to the extent of more than three lakh hectares have been experienced by the crop. In respect of production, the endogenously identified break has located only single year, namely, 1974. The jump in ragi production from 1961-62 to 1974-75 to 1975-76 to 2017-18 was to the extent of almost six lakh tons. On examination of time series data from 1975-76 to 2017-18, there was high variation in production of ragi in the state as the state had experienced many drought years where the production of crop had drastically declined though it has not been captured by the endogenous breaks. Interestingly endogenously identified breaks in respect of productivity of ragi crop has identified for two years, viz., 1974 and 1991. Based on these two breaks when entire series has been broken into three periods, in all the three years there has been a substantial increase in productivity of the crop. This strengthens our earlier contention that Karnataka has experienced productivity-led growth in ragi due to evolving location-specific drought-tolerant high yielding varieties and other appropriate dry land technologies.

As mentioned earlier cultivation of ragi crop is restricted southern part of Karnataka where red soils are predominant. Majority of area being under rain fed condition the crop obviously experience weather induced risk. District wise cultivation of ragi for top ten predominantly ragi growing districts of Karnataka which are mainly situated in southern part of Karnataka are presented in [Table-3]. The [Table-3] presents triennium average for area, production and productivity of crops covering the period 2015-16 to 2017-18. It may be noted from the [Table-3] that 85 per cent of total area under the ragi crop are accounted by the 10 districts reflected in [Table-3]. Further these 10 districts account for 91 per cent total ragi production of the state. Interestingly there has been wide variation in area, production and productivity of ragi crop being captured by the coefficient of variation (CV) calculated considering three years of data for the ten districts selected for the purpose. In respect of area, Tumkuru, Mysuru, Mandya and Hassan districts have registered high variation in area being sown during the period. Sowing of ragi crop is highly dependent on onset of monsoon. On the other hand, CV is considerably very high for production and productivity of crops for all the ten top districts where ragi is being cultivated. Despite the fact that farmers chose drought resistant varieties, ragi crop is highly sensitive for long dry spells experienced by ragi growing districts which has bearing on productivity of crop thereby on realised production. Less than 17 per cent of farmed land during 2019-20 has been brought under crop insurance in the state. Obviously, it is necessary to encourage farmers to go for weather-based crop-insurance though many of the farmers tend to neglect crop insurance for ragi crop for varied reasons.

An attempt was also made to examine the shift in the area that is being lost by the ragi crop to other crops in the state. Obviously crop which are predominantly grown in rainfed conditions were selected for the analysis, viz., maize, groundnut and some selected pulses crops. Correlation has been worked out between the areas under these crops considering the entire period namely, 1961-62 to 2017-18. Interestingly, the correlation between area under ragi crop and area under maize crop turned out to be the order of -0.84 in the state. Obviously, area lost by

the ragi crop has been shifted to maize crop due to high demand for the crop from feed industry and as well due to the remunerative prices fetched by the crop compared to ragi. This has led us to examine to what extent cost of production of ragi crop is remunerative to the farmers.

Cost of cultivation of Ragi

The Commission for Agricultural Costs and Prices (CACP), Government of India fixes Minimum Support Price (MSP) to 23 crops based on detailed data collected on cost of production and other factors like demand and supply, market price trends, etc., of the crops. CACP considers A2+FL that include cost of all expenses in cash and kind on account of hired labour including human, bullock, machine, seed, insecticide, pesticide, manure, fertilizer, irrigation charges and misc. expenses and imputed cost on family labour while arriving at MSP to the crops. On the other hand farmers are demanding considering cost C2 while arriving at MSP, where C2 is a more comprehensive cost that factors in rentals and interest forgone on owned land and fixed capital assets, on top of A2+FL. Besides farmers are also demanding 1.5-times MSP formula - originally recommended by the National Commission for Farmers headed by agricultural scientist M S Swaminathan. We have attempted to compare the Cost C2 and the value of output (VOP) realized by the farmers over last 20 years. Data required for the purpose was collected from various policy documents annually brought by the CACP. It may be noted that in none of the years the ratio of cost VOP to C2 has crossed more than one indicating that farmers are continuously incurring loss. Moreover, Ministry of Agriculture and Farmers Welfare has recognized Ragi as one of the important nutriceal crops as they provide most of the nutrients required for normal functioning of human body. Thus, it is important to ensure that farmers are not only get remunerative prices to their produce but state and as well union government should chalk out policies and programs that encourage more area being brought under ragi crop.

Market Intervention

The procurement of crop produce is highly dismal in state of Karnataka compared to northern states like Punjab, Haryana and Uttar Pradesh. The NSS 77th report on situational assessment of agricultural households and land and holding of households in rural India, 2019 has revealed certain interesting facts. The report has documented number per 1000 crop producing agricultural households reporting the disposals of selected crop from different agencies by level of satisfaction of sale outcome for each agency of disposal. The data has been recorded in two visits, from July-2018 to Dec 2018 and Jan 2019 to June 2019. The results of the survey in respect of major disposal of crops and as well specific to ragi crop is presented in [Table-5].

It may be noted from the [Table-5] that majority of crop producing agricultural households depend on local markets to sale their produce. It is evident from both visits that more than 100 per cent of farmers depend on local markets. Disposal at APMCs is just 13.5 and 7.9 per cent of the crop producing agriculture households. In regard to extent of non-satisfactory of sales made to different agency expressed by the households, survey has recorded the extent of households expressing different reasons, they are, lower than market price, delayed payments, deduction from loan borrowed, faulty weighing and grading, and others. Majority of farmers have expressed lower than the market price is the major reason for their dissatisfaction. Thus, we have only listed the response in [Table-5] only in respect of lower market price reported by the farmers. It may be noted from [Table-5] that, nearly one-third of farmers during the first visit and 22 per cent of farmers during second visit have expressed dissatisfaction regarding getting lower price at local markets. The figure stands at 25 per cent in respect of APMCs. Of course, more than two-thirds of crop producing households who have sold their produce to input dealers are not satisfied about the price received by them. This may be due to the interlocking of input/ output markets between input dealers and the farmers where farmers are forced to sell their produce at lower price than the prevailing market price. Surprisingly only one percent of farmers depend on government agency to sale their produce. The situation in respect of ragi is not different from other crops. The result of 77th NSSO survey in respect of ragi crop is presented in the last column of the [Table-5].

Nearly 77 per cent of ragi farmers depend on local market to sale the produce and other 17 per cent of them depend on APMC markets. Intervention from the government agency is almost non-existent in case of ragi crop. Of course, FPOs are still at infant stage and they are yet to make any impact. Therefore, unless the procurement of ragi is undertaken in large-scale farmers are bound incur losses due to lower market price received by the local and APMC markets.

Ragi being a drought resistance crop mainly grown by small and marginal farmers. As per the 77th NSSO round, gross cropped area of ragi under irrigated conditions was 0.09 hectares, while it was 0.512 hectares under unirrigated conditions. Hence decline in area under ragi crop will be detrimental to small and marginal farmers, as they have no other best alternate crops especially under adverse weather conditions. It is estimated that 50 percent of the total production of ragi comes to the market while the rest is retained by farmers for their consumption. Retaining or expanding area under ragi is essential from the point of view of securing livelihood of dry land farmers in drought prone area of the state.

On production side, emphasis may be laid to implementation of soil and water conservation measures and encourage farmers to adopt better farming practices using watershed development approach. Inter cropping of ragi with pigeonpea with adoption paired row technology will not only enhance optimum utilization of moisture available in soil but also ensure higher returns to farmers when compared to sole crop of ragi. Besides adoption of paired- row technique will enable farmers to insulate farmers from weather induced risk. Farmers can be encouraged to take up farm ponds which enable them to provide protective irrigation to crops that ensure assured higher yields thereby better returns. Integrated nutrient and pest / disease management will also go a long way in ensuring higher returns.

Coming to the market intervention, it may be noted here that the present year's budget has declared 2022-23 as international year of Millet's. Besides ragi is also included under nutriceals. During the current year Government of Karnataka has started procurement operation of ragi. Procurement of ragi was fixed at 2.10 lakh tons and restriction on procurement from each farmer owning less than four acres to a maximum of 20 quintals has been imposed. Considering the production of ragi on an average being around 12 lakh tons, procurement target works out be 17.5 per cent of total ragi production in the state. Even one was to assume that only 50 per cent of the produce will come to market, the procurement target only covers 35 per cent of marketed production. There is wide scope to enhance the procurement target at least by one more lakh ton or government should make provision to purchase whatever quantum that farmers bring to procurement center. According to the National Academy of Agricultural Sciences (2013) [7], a combination of factors like low remuneration as compared to other food crops, lack of input subsidies and price incentives, subsidized supply of fine cereals through Public Distribution System (PDS), and change in consumer preference (difficulty in processing, low shelf life of flour and low social status attached to millets), have led to shift from production of millets to other competing crops. There is a vast gap between productivity of millets in field demonstrations vs. farmers' field pointing to the need for robust extension activities, and transfer of state-of-the-art farming practices, as well as access to good quality seeds to the farmers. The academy suggests that the demand for millets can be increased by awareness creation regarding their environmental sustainability, nutritional and health benefits, provision of millets through PDS, value addition, and including millets under feeding programs such as mid-day meal, Integrated Child Development Services (ICDS) scheme. Farmers Producer Organization (FPOs) should take keen interest in promoting nutriceals especially ragi in southern parts of Karnataka by promoting more value-added products and promoting functional / readymade foods keeping in view urban consumers.

Conclusion

Dry land areas have privilege of providing livelihood opportunities to most of the rural poor in India. Efforts to improve dry land agriculture in Karnataka can be traced back to colonial period, where as early as 1930, three out of five dry land research centers were established by Imperial Government in the state. University of Agricultural Sciences, Bangalore has played a pivotal role in evolving location specific technology and especially instrumental in releasing many droughts

resistant ragi cultivars which are not only of high yield but also highly drought resistant cultivars. During last two to three decades, Karnataka state has experienced a decline in area under ragi where more than three lakh hectares have been shifted to growing other alternative crops, specifically for maize cultivation. This trend needs to be reversed by encouraging farmers to bring more area under ragi cultivation by providing necessary incentives for production and more specifically to ensure remunerative price to the crop. Farmers undertaking ragi cultivation may be provided custom hiring services at more subsidized rate which enable them to reduce cost incurred on machine and human labour. Farmers have to be ensured that they will receive cost C2 while fixing MSP for ragi crop instead of fixing MSP based on the cost incurred on A2+FL, present procedure adopted by the CACP. State government can declare additional price over and above the MSP declared by CACP, as done in several instance.

Application of research: Government should also facilitate by opening number of procurement centers to reduce transportation cost and relax restriction on overall quantity to be procured and as well restriction imposed on quality imposed on individual farmers. When compared to large scale procurement operation carried out for rice and wheat, the procurement process undertaken for ragi crop is negligible. A comprehensive package for enhancing ragi production is need of the hour especially when Government of India has announced 2002-23 as international year of Millet's.

Research Category: Trend analysis and Market Intervention

Acknowledgement / Funding: Authors are thankful to University of Agricultural Sciences, Bengaluru, 560065, Karnataka, India. Authors are also thankful to Department of Dairy Business Management, Dairy Science College, Hebbal, 560024, Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar, 585401, Karnataka, India

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University: University of Agricultural Sciences, Bengaluru, 560065, India

Research project name or number: Research station study

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Karnataka

Cultivar / Variety / Breed name: Ragi (Finger Millet)

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors. Ethical Committee Approval Number: Nil

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