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Kharif Sorghum in Karnataka: An Economic Analysis

H. Basavaraja[1], A.Y. Hugar[2], S.B. Mahajanshetti[3], V.V. Angadi[4] and B. Dayakar Rao[5]

Abstract

Sorghum, which once occupied more than 18 M ha of area in the country, has been on a continuous decline during the past two decades and has fallen down to 10.39 M ha. Most of the decline in area has occurred in *kharif* sorghum. This warrants critical examination of the changing scenario of *kharif* sorghum and identification of the reasons thereof. For the macro analysis, secondary data on various aspects of *kharif* sorghum have been used, whereas the farm survey data have been used to draw the inferences at the micro level with respect to changing scenario of *kharif* sorghum. The growth rates in area, production and productivity of *kharif* sorghum have been computed. The Herfindahl index has been computed to find out crop diversification in the sample districts of Dharwad and Belgaun. The deceleration in the *kharif* sorghum area in the overall period 1970-71 to 1997-98 and different sub-periods has been found due to the diversion of *kharif* sorghum area to more remunerative crops like oil seeds (groundnut and sunflower), and pulses. Belgaum district displayed a moderate degree of crop diversification compared to that of Dharwad district. Unfavourable prices, declining yields, inadequate credit and adverse climatic conditions have been identified as the major reasons for the replacement of *kharif* sorghum crop in the two sample districts. The net returns and benefit-cost ratio have been found low in the cultivation of *kharif* sorghum compared to those of its competing crops, viz. cotton, green gram and groundnut.

[1] Associate Professor, [2]Senior Research Fellow, [3]Assistant Professor, [4]Agronomist, University of Agricultural Sciences, Dharwad-580 005, and
[5] Senior Scientist (Agricultural Economics), National Research Centre for Sorghum, Rajendranagar, Hyderabad

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Introduction

Sorghum is the world's fourth most important cereal in terms of production and area. Its area stood at 43 M ha and its production at 59.5 Mt in 2000. About 90 per cent of the world's sorghum area is concentrated mainly in the developing countries of Africa and Asia. It is one of the main staple food crops for the world's poor and food-insecure people. The crop is genetically suited to the hot and dry agro-ecological regions characterized by low rainfall. In India, sorghum ranks third in area and production, after rice and wheat, with 10.39 M ha area under its cultivation, accounting for 24.40 per cent of the world sorghum area. However, the yield per hectare of sorghum in India is only 852 kilograms, which is lower than the world average yield of 1391 kg/ha. The crop is grown in both *kharif* (rainy) and *rabi* (post-rainy) seasons and the share of *kharif* crop in area as well as production constitutes 45.75 per cent of the total area and 54.42 per cent of the total production of the crop in the country. Maharashtra, Karnataka, Madhya Pradesh, Andhra Pradesh and Tamil Nadu are the top five sorghum-growing states of India. These five states together account for about 91 per cent of the country's total sorghum production.

Karnataka is the second largest sorghum producer in India, after Maharashtra. Sorghum is the most important crop of Karnataka in terms of area, accounting for about 36 per cent of the total area under food crops, followed by paddy (24.3 per cent), finger millet (18.1 per cent), maize (7.9 per cent) and pearl millet (7.5 per cent). It is cultivated in over two million hectares in the state with high-yielding varieties (HYVs), accounting for only 37.70 per cent of the total area under the crop. In terms of production, however, the crop ranks second, next only to paddy, sharing 22 per cent of the total cereal production.

The HYVs of sorghum released so far vary from early to mid-late varieties in duration and offer a very congenial condition for the occurrence of "grain mold". Grain mold, apart from causing severe losses in yields, leads to blackening of grains with the consequential fall in its market prices. The crop, which once occupied more than 18 M ha of area in the country, has been on the continuous decline during the past two decades and has fallen down to 10.39 M ha. Most of the decline in area has occurred in *kharif* sorghum. For instance, the area under *kharif* sorghum in the country, which was to the tune of 8.59 M ha in 1990-91 declined to 4.76 M ha in 1999-2000, showing a decline of about 45 per cent over the period of one decade. The area under *kharif* sorghum in the state of Karnataka showed a similar declining trend. Over a period of ten years (1990-91 to 1999-2000), the *kharif* area in the state fell down from 7.18 lakh hectares to 4.09

lakh hectares. More remunerative and high-value crops such as groundnut, soybean, cotton, etc. are replacing *kharif* sorghum, leading to a drastic shrinkage in the area of the latter. The situation warrants critical examination of the changing scenario of *kharif* sorghum and identification of the reasons thereof. Such an effort would help design appropriate policies to check the declining trend in the area under *kharif* sorghum, an important staple food crop of the poor. The present study was undertaken to analyze the changing scenario of *kharif* sorghum in Karnataka with the specific objectives of (i) studying the growth in area, production and productivity of *kharif* sorghum, (ii) examining the shift in cropping patterns, and (iii) assessing the competitiveness of *kharif* sorghum in relation to other competing crops.

Methodology

For the present study, analysis was conducted both at macro and micro levels. For the macro analysis, secondary data on various aspects of *kharif* sorghum were used, whereas the microanalysis was conducted with the help of primary farm survey data.

Database

The study utilized both the time series data and primary data. The time series data on area, production and productivity of *kharif* sorghum, and the corresponding data for other crops for the selected districts and the state as a whole were obtained for the period 1970-71 to 1997-98 from the Directorate of Economics and Statistics, Government of Karnataka, Bangalore. The study period from 1970-71 to 1997-98 was divided into three sub-periods based on the moving average trends in the production of *kharif* sorghum, namely Sub-Period-I: 1970-71 to 1975-76; Sub-Period-II: 1976-77 to 1990-91 and Sub-Period-III: 1991-92 to 1997-98.

The micro-level analysis of the changing scenario of *kharif* sorghum was conducted using the farm survey data of the selected districts. Since most of the *kharif* sorghum area was concentrated in the districts of Dharwad and Belgaum, these were purposively selected for the study. These two districts together accounted for about 35 per cent of the *kharif* sorghum area in the state. The multistage sampling technique was employed for the selection of taluks and villages for the study. In the first stage of sampling, two taluks having the highest share in the total *kharif* sorghum area of the respective districts were selected. In the second stage, four villages predominantly growing *kharif* sorghum were selected from each of the four selected taluks. In the third stage, 10 farmers growing *kharif* sorghum from each sample village were randomly selected for the interview. The

farm data on various aspects of *kharif* sorghum cultivation for the crop year 1999-2000 were collected from the sample farmers using pre-tested schedules prepared for the purpose. Thus, the farm survey data pertained to a total of 160 sample farmers from the four taluks of the Dharwad and Belgaum districts in Karnataka.

Methods of Analysis

The growth rates in area, production and productivity of *kharif* sorghum were computed fitting the exponential growth functions to the data. The functions were estimated through the Ordinary Least Squares (OLS) technique after log transformation. The compound growth rates were estimated for the three sub-periods as well as for the entire study period. To identify the existence of acceleration /deceleration in the growth pattern, log quadratic trend model [$\log Y = a + bT + cT^2$] was used. The sign of the co-efficients 'b' and 'c' in the equation were used to identify acceleration/ deceleration in the growth pattern.

To study the contributions of changes in *kharif* area and yield to the changes in *kharif* sorghum production, decomposition model was used. The change in *kharif* sorghum output (DP) was viewed as a sum of change in the area effect (DAY_1), change in the yield effect (DYA_1) and change in area-yield interaction effect (DADY). For the purpose of estimating contributions of the change in these effects to the change in the *kharif* sorghum output, each sub-period was further divided into two equal parts. The mean area and yield data of these parts were used to estimate the respective contributions.

The area under *kharif* sorghum has been on the continuous decline during the past two decades, due possibly to diversion of *kharif* sorghum area to other high-value crops. Thus, it was felt essential to examine the shift or change in the cropping pattern in the sample districts and measure the extent of crop diversification with a view to identifying the dispersion or concentration of crop activities over a period of time. This would enable one to know whether the land was allocated to the same set of crops or to different crops. To study the nature of shift in the cropping pattern in the sample districts, the Kendall's rank correlation co-efficient was worked out. The ranks were assigned based on the share of each crop in the gross cropped area. When two or more cropping patterns were compared by arranging the area under same crops in an increasing or decreasing order and if they did not exhibit similarity between them, then, it was said that the shift had occurred. The concept of shift here rested on the notion of relative order of placement of constituents making up a cropping pattern. For this

purpose, the acreages under each crop in the cropping pattern were ranked according to their magnitude, and the changes in cropping pattern were measured with the help of Kendall's rank correlation coefficient, which did not require normality assumption. The total change over a period was examined with the help of concordance co-efficient. The major limitation of Kendall's rank correlation coefficient was that the ranking became difficult when the number of observations was large, and when tie occurred between the observations. The Herfindahl indices were computed to find out crop diversification, if any, in the sample districts. The value of Herfindahl indices ranged between 0 and 1. The value close to 0 indicated diversification, while the value close to 1, depicted specialization (Shiyani and Pandya, 1998). With increase in the diversification, the Herfindahl index would decrease. The major limitation of the index, however, was that it could not assume the theoretical minimum, i.e. zero for smaller number of crop activities.

The farm survey data were subjected to tabular analysis, and averages, percentages and frequencies were computed. The economics of *kharif* sorghum and its competing crops was studied by computing the costs and returns for these crops. The Cost A, Cost B and Cost C were also computed and compared.

Results and Discussion

The growth rates of area, production and productivity of *kharif* sorghum in the study districts and for the state as a whole have been presented in Table 1. The growth rates were calculated separately for the overall period (1970-71 to 1997-98) and the three sub-periods identified by plotting three-year moving averages of *kharif* sorghum production. The area under sorghum was found declining by about three per cent per annum at the state level and also in the study districts during the period 1970-71 and 1997-98. During the same period, *kharif* sorghum productivity recorded a marginal increase at the state level (0.56 %) and in Belgaum district (1.38 %), while Dharwad district showed a marginal decline of 0.12 per cent per annum. With respect to production of *kharif* sorghum, the state as a whole and the selected districts experienced a negative growth, which was more pronounced in the Dharwad district (- 3.78 %). Thus, it was evident that the decrease in *kharif* sorghum production in the state was due to contraction in its area during the period 1970-71 and 1997-98, which offset the impact of increase in productivity. The sub-period growth analysis revealed that the decrease in area was a common phenomenon during all the sub-periods, both at the

Table 1. Annual growth rates of area, production and productivity of *kharif* sorghum

(in per cent)

Period	Karnataka state			Belgaum district			Dharwad district		
	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity
1970-71 to 1975-76 (Sub-period I)	0.57	6.58	5.97	5.62	9.56	3.73	-2.66	4.94	7.81
1976-77 to1990-91 (Sub-period II)	-1.58	-2.67	-1.11	-0.90	1.98	2.91	-2.02	-6.25	-4.32
1991-92 to 1997-98 (Sub-period III)	-10.43	-8.76	1.87	-9.37	-9.73	-0.39	-11.26	-7.51	4.22
1970-71 to 1997-98 (Entire period)	-3.21	-2.67	0.56	-2.53	-1.19	1.38	-3.66	-3.78	-0.12
c-value (for entire period)	-0.00035	-0.00061	-0.00026	-0.00041	-0.00071	-0.0031	-0.00033	-0.00048	-0.00014

district and state levels, except during the first sub-period 1970-71 to 1975-76 for Belgaum district and the entire state. The area contraction was however, more pronounced during the sub-period 1991-92 to 1997-98. With respect to productivity, Belgaum district registered a positive growth in all the sub-periods, except during the sub-period 1991-92 to 1997-98, when the productivity fell down by a marginal rate of 0.39 per cent per annum. In the case of Dharwad district, the productivity decreased during the sub-period-II, registering a fall of 4.32 per cent. The productivity for the state as a whole grew at a positive rate during the sub-periods 1970-71 to 1975-76 and 1991-92 to 1997-98. The overall trend in area and productivity was that the production of *kharif* sorghum declined in the state as well as in the study districts during all the sub-periods, except during the sub-period 1970-71 to 1975-76. The annual rate of fall in the *kharif* sorghum production was more pronounced during the sub-period 1991-92 to 1997-98. The production in the Dharwad district fell relatively more steeply during the sub-period II and sub-period III, while a fall in production was witnessed in the Belgaum district during the sub-period III only.

The average area under different crops in the two districts has been reported in Table 2. The *kharif* sorghum area in the Belgaum district had come down from 138 thousand hectares during the sub-period I to 76 thousand hectares during the sub-period III, whereas the areas under more remunerative crops like sunflower, groundnut and pulses had increased substantially. In the Dharwad district, the shrinkage in *kharif* sorghum area was more pronounced and it came down from 208 thousand hectares during the sub-period I to 93 thousand hectares during the sub-period III. The areas under sunflower and pulses in this district had witnessed expansions.

The deceleration in the sorghum area during the overall period and most of sub-periods was due to the diversion of *kharif* sorghum area to the more remunerative crops like oilseeds (sunflower, groundnut), and pulses. Further, in the areas where irrigation was introduced (e.g. Malaprabha command), sugarcane, maize, cotton and other commercial crops had replaced *kharif* sorghum. The important consideration of farmers in the selection of crops was the relative benefit-cost ratio of crops. As per the Farm Management Studies conducted by the Department of Agriculture, the ratio of farm harvest price to the cost of production was quite low at 0.98 for *kharif* sorghum in 1989-90 and for the earlier years from 1980-81 to 1985-86 also, the ratio was not much different. Since the prices offered for *kharif* sorghum were quite low compared to those of its competing crops, this benefit-cost ratio was in favour of the latter crops, inducing the farmers to opt for them.

Table 2. Mean area under different crops in study districts of Karnataka

(Area in '000 ha)

Period	Belgaum district					Dharwad district				
	Sorghum-*kharif*	Sorghum-*rabi*	Ground-nut	Sun-flower	Pulses	Sorghum-*kharif*	Sorghum-*rabi*	Ground-nut	Sun-flower	Pulses
1970-71 to 1975-76 (Sub-period I)	138.80	92.77	129.27	—	94.02	208.70	48.98	161.33	—	110.36
1976-77 to1990-91 (Sub-period II)	104.14	124.78	111.86	8.26	95.38	141.51	97.22	135.99	27.40	134.32
1991-92 to 1997-98 (Sub-period III)	76.12	142.58	104.70	23.81	105.66	92.82	158.64	152.96	80.38	173.03
1970-71 to 1997-98 (Entire period)	104.56	122.37	113.29	11.92	99.34	143.73	102.24	144.79	39.87	134.76

Table 3. Contribution of changes in area and yield to change in production of *kharif* sorghum in Karnataka

(in per cent)

Period	Karnataka state			Belgaum district			Dharwad district		
	Area	Yield	Interaction	Area	Yield	Interaction	Area	Yield	Interaction
1970-71 to 1975-76 (Sub-period I)	19.02	76.23	4.75	59.19	30.56	10.25	-41.87	155.30	-13.33
1976-77 to1990-91 (Sub-period II)	-89.25	-12.00	1.25	-9.86	113.76	-3.91	-39.35	-71.50	10.85
1991-92 to 1997-98 (Sub-period III)	-119.09	28.60	-9.50	-93.66	-8.97	2.63	-154.59	85.69	-31.30
1970-71 to 1997-98 (Entire period)	-135.86	86.78	-50.93	-176.17	140.06	-63.90	-125.11	73.11	-48.30

The low prices for *kharif* sorghum could be attributed to the falling demand for sorghum and its non-inclusion in the Public Distribution System which supplied only superior grains like rice and wheat at the subsidized prices. The change in tastes and preferences of the farm households was yet another factor contributing to the decline in demand for *kharif* sorghum and consequent decline in the sorghum area in the state and in the study districts. During the sub-period I (1970-71 to 1975-76) however, the state as a whole and the study districts witnessed a positive growth in the yield of *kharif* sorghum which compensated for the retarded area growth. The growth in productivity was mainly the result of release of sorghum hybrids, the productivity of which was substantially higher than that of traditional varieties. Improvement in production technology and use of high doses of fertilizers also led to the increase in the productivity of *kharif* sorghum between 1970-71 and 1975-76. Similar results have been reported by Tejappa (1980) for the period 1955-56 to 1976-77 and Nachappa (1995) for the 1970s.

The growth in the productivity of sorghum for the entire study period was only marginal in the state. This reflected the fact that cultivation of *kharif* sorghum had been shifted to marginal lands due to competition from the high-value commercial crops. Further, the hybrids, which were location-specific and highly susceptible to pests and diseases, also started losing their yield potential. The area under *kharif* sorghum decreased by about three per cent in the state during this period, with similar trends in the sample districts. The reduction in area coupled with almost stagnant yields resulted in the poor growth of *kharif* sorghum production.

The relative contributions of area and yield to change in production were worked out and are presented in Table 3. In most of the cases, the interaction effect of changes in area and productivity on the changes in production was meagre. The state as a whole experienced a continuous decline in *kharif* sorghum output from 1976-77 onwards. The contraction in the area was the major contributor to the reduced output. The positive yield contribution (28.60%) during the sub-period III could not compensate for the negative area contribution (-119.09%) for the decline in output. The *kharif* sorghum output in the state and the Belgaum district grew during the sub-period I due to the positive contributions of both area and yield, while in the Dharwad district, the expansion, of output came through the substantial contribution of yield (155.30%), though the area contribution was negative (-41.87%). During the sub-period II, the negative contribution of both area (-39.35%) and yield (-71.50%) resulted in the fall of output in the Dharwad

district, whereas in the Belgaum district, a strong positive yield (113.76%) contribution led to output expansion, though the area contribution was negative (-9.86%). However, both the sample districts witnessed a fall in output during the sub-period III, and it was due to the negative contribution of both area (-93.66%) and yield (-8.97%) in the Belgaum district and the strong negative area contribution (-154.59%) more than offset the positive yield contribution (73.11%) in the Dharwad district. For the state as a whole, *kharif* sorghum production witnessed a negative growth not only for the entire period but also for two sub-periods II and III (Table 1). The decrease in production was very high during the sub-period II (1991-92 to 1997-98) for the state and the sample districts as well. The decrease in area led to a substantial decrease in the sorghum production in the state and a similar trend was also true for the sample districts. The falling trend in yields also contributed to the falling sorghum production, especially during the sub-period II. The rates of change in growth in the area, production and productivity indicated that the area and production of *kharif* sorghum in the state as well as in the sample districts decreased at a decreasing rate over the years (negative 'b' value and negative 'c' value). As far as the sorghum productivity for the Belgaum district and state as a whole was concerned, it increased, but only at a decreasing rate (positive 'b' value and negative 'c' value). For the Dharwad district, the productivity decreased at a decreasing rate over the years.

The shifts in cropping patterns in the sample districts were analyzed with the help of co-efficient of concordance ('c' value), which turned out to be 0.79 and 0.85 for Belgaum and Dharwad districts, respectively (Table 4). The calculated 'F' values were statistically significant. The concordance value approaching zero implied a complete and radical shift in the cropping pattern, while the values close to one implied a perfect repetition in the

Table 4. Measure of shift in cropping pattern in the study districts of Karnataka

Districts	Coefficient of concordance	F-value
Belgaum	0.79**	64.18
Dharwad	0.85**	94.86

Table 5. Herfindahl index of crop diversification

Districts	1970-71 to 1975-76	1976-77 to 1990-91	1991-92 to 1997-98	1970-71 to 1997-98
Belgaum	0.11	0.09	0.09	0.09
Dharwad	0.12	0.12	0.10	0.10

cropping pattern over time. The calculated concordance values thus indicated that there was a moderate shift in the cropping pattern over the past three decades in the study districts. To ascertain the extent of crop diversification, Herfindahl indices were worked out (Table 5). These indices revealed that there was crop diversification in the study districts. The Belgaum district displayed a higher degree of crop diversification compared to that of the Dharwad district, as indicated by the lower Herfindahl indices for the Belgaum district for all the periods. The negative growth rates in area, moderate shift in cropping pattern and low degree of crop diversification in the sample districts implied diversion of the *kharif* sorghum area to some other crops.

The season-wise average area devoted to sorghum in the years 1999-2000 and 1994-1995 by the sample farmers in the sample districts has been presented in Table 6. It may be noted that the gross cropped area in the sample districts across different categories of farmers (small, medium and large) increased over time. The percentage increase in the gross cropped area was however, more in respect of small farmers compared to that in other categories of farmers in both the districts. Table 6 also clearly revealed that the area under *kharif* sorghum decreased and under *rabi* sorghum increased across all the categories of farmers in both the districts. The magnitude of decrease in the *kharif* sorghum area was slightly more in the Belgaum than Dharwad district. Between 1994-95 and 1999-2000, the proportion of *kharif* sorghum area to the gross cropped area decreased from 24.21 per cent to 12.62 per cent in Dharwad and from 21.15 per cent to 8.90 per cent in Belgaum.

Farmers were asked to assign ranks to the reasons for decline in the *kharif* sorghum area. The average ranks worked out have been presented in Table 7. The analysis of the ranking of reasons revealed that unfavourable prices, declining yields, inadequate credit and adverse climatic conditions were the major reasons advanced for the replacement of *kharif* sorghum crop area by other crops in the two sample districts. In the recent years, however, *rabi* sorghum assumed greater importance due to higher consumer preference and better prices. Hence, *rabi* sorghum witnessed area expansion, although its productivity was relatively low compared to that of *kharif* sorghum. Farmers used about 50 per cent of *kharif* sorghum grains (Table 8) for home consumption and its proportion was higher for small farmers, followed by medium and large farmers. About 35 per cent of the grains was marketed and about 5 per cent was fed to animals, while more than 80 per cent of the fodder produced was fed to livestock.

Table 6. Changes in gross cropped area and sorghum area in Karnataka

(in acres)

Year	Particulars	Dharwad district				Belgaum district			
	Category of farmer	Small	Medium	Large	Overall	Small	Medium	Large	Overall
1999-2000	Gross cropped area (GCA)	6.48	12.04	30.23	17.34	5.51	15.97	45.21	24.51
	Kharif sorghum area	1.07	2.16	3.12	2.19	1.01	1.79	3.33	2.18
	% *Kharif* sorghum area to GCA	16.57	17.94	10.33	12.62	18.32	11.21	7.37	8.90
	Rabi sorghum area	0.96	1.78	3.92	2.35	1.18	2.65	6.64	3.80
1994-95	% *Rabi* sorghum area to GCA	14.86	14.78	12.98	13.57	21.45	16.57	14.68	15.51
	Gross cropped area (GCA)	5.06	11.54	27.80	15.79	4.30	14.48	37.62	20.76
	Kharif sorghum area	1.89	2.70	6.26	3.82	1.70	3.48	7.03	4.39
	% *Kharif* sorghum area to GCA	37.36	23.40	22.51	24.21	39.60	24.05	18.69	21.15
	Rabi sorghum area	0.63	1.60	3.74	2.12	0.86	1.97	4.12	2.51
	% *Rabi* sorghum area to GCA	12.45	13.86	13.46	13.44	20.06	13.59	10.95	12.10
Change over 1994-95, %	Gross cropped area (GCA)	28.22	4.33	8.72	9.76	27.98	10.25	20.18	18.09
	kharif sorghum area	-43.14	-20.00	-50.12	-42.77	-40.80	-48.61	-52.59	-50.28
	kharif sorghum area to GCA	52.95	11.25	4.86	10.80	36.83	34.42	61.03	51.38

Table 7. Ranking of reasons for replacement of *kharif* sorghum in Karnataka

Reasons	Dharwad district				Belgaum district			
	Small	Medium	Large	Overall	Small	Medium	Large	Overall
Unfavourable prices	I	I	I	I	I	I	I	I
Changes in food habit	VIII	VIII	VII	VII	IX	IX	IX	IX
Decrease in fodder requirement	VII	VII	IX	VIII	VII	VI	VII	VII
Decrease in yield	II	II	II	II	II	II	II	II
Labour problem	VI	VI	V	V	VI	VII	V	VI
Climate problem	IV	IV	IV	IV	IV	III	IV	III
Marketing problem	V	V	VI	VI	III	V	VI	V
Inputs problem	IX	IX	VIII	IX	VIII	VIII	VIII	VIII
Credit problem	III	III	III	III	V	IV	III	IV

Table 8. Utilization of *kharif* sorghum produce in Karnataka

(in per cent)

Particulars	Dharwad district				Belgaum district			
	Small	Medium	Large	Overall	Small	Medium	Large	Overall
Grain								
Home consumption	84.48	75.05	35.15	49.66	78.37	60.88	53.47	58.81
Livestock	0.00	4.13	8.19	6.22	3.28	3.74	5.99	4.92
Market	13.79	17.29	49.57	38.48	17.04	35.17	39.86	35.67
Wages	1.72	3.54	5.09	4.30	1.31	0.22	0.68	0.60
Barter	0.00	0.00	1.50	1.01	0.00	0.00	0.00	0.00
Relatives	0.00	0.00	0.50	0.34	0.00	0.00	0.00	0.00
Fodder								
Livestock	93.72	94.74	77.70	83.69	95.09	96.01	81.82	88.64
Market	0.00	5.26	9.46	7.07	4.91	3.99	8.88	5.92
Wages	0.00	0.00	0.68	0.43	0.00	0.00	7.23	4.23
Barter	6.28	0.00	6.76	5.35	0.00	0.00	2.07	1.21
Relatives	0.00	0.00	5.41	3.45	0.00	0.00	0.00	0.00

One of the objectives of the present investigation was to study the economics of sorghum and compare its profitability with that of its competing crops. The different types of costs incurred in the cultivation of *kharif* sorghum and its competing crops are presented in Table 9. The per acre average yield of sorghum was 7.75 quintals in Dharwad district and 6.74 quintals in Belgaum district. The large farmers in Dharwad district and the medium farmers in Belgaum district realized slightly higher yields. The per acre fodder yield was 6.86 quintals in Dharwad district and 5.23 quintals in Belgaum district. Thus, the performance of *kharif* sorghum was slightly better in Dharwad than Belgaum district. However, the per acre gross returns from sorghum worked out to be Rs 4898 for Dharwad district and Rs 5838 for Belgaum district. The higher gross returns in Belgaum district were due to higher prices for *kharif* sorghum grains and fodder compared to those in Dharwad district.

The per acre cost of cultivation of *kharif* sorghum worked out to be Rs 4138 for Dharwad district and Rs 3014 for Belgaum district. The per acre net benefit from the *kharif* sorghum cultivation was Rs 760 for Dharwad district and Rs 2824 for Belgaum district at the aggregate level. The small farmers in Belgaum district and the large farmers in Dharwad district however, incurred net losses in the cultivation of *kharif* sorghum. The benefit-cost ratio at the overall level was 1.18 for Dharwad district and 1.94 for

Table 9. Economics of *kharif* sorghum and its competing crops in Karnataka

(Rs/acre)

Particulars	Dharwad district				Belgaum district			
Category of farmers	Small	Medium	Large	Overall	Small	Medium	Large	Overall
***Kharif* sorghum**								
Cost 'A'	2411.11	2030.54	5388.36	3411.88	2923.12	2278.62	1936.06	2302.41
Cost 'B'	2615.03	2234.46	5592.28	3615.80	3127.04	2482.54	2139.98	2506.33
Cost 'C'	3331.94	2740.49	5966.19	4138.38	3837.25	2914.75	2590.45	3014.40
Gross returns	4283.80	4313.63	5929.40	4898.46	3437.50	5640.69	7519.06	5838.76
NR over Cost 'A'	1872.69	2283.09	541.04	1486.58	514.38	3362.07	5583.00	3536.35
NR over Cost 'C'	951.86	1573.14	-36.79	760.08	-399.75	2725.94	4928.61	2824.36
B:C ratio	1.29	1.57	0.99	1.18	0.90	1.94	2.90	1.94
Cotton								
Cost 'A'	4652.18	3884.96	4975.83	4593.25	2514.49	2193.55	2135.40	2355.55
Cost 'B'	4860.64	4093.42	5184.29	4801.71	2722.95	2402.01	2343.86	2564.01
Cost 'C'	5902.99	4979.81	5857.05	5625.29	3214.27	2960.05	2541.78	2932.46
Gross returns	6765.00	9850.00	11670.45	10034.00	5775.00	7554.00	14985.71	11015.71
NR over Cost 'A'	2112.83	5965.04	6694.63	5440.75	3260.51	5360.45	12850.31	8660.16
NR over Cost 'C'	862.01	4870.19	5813.41	4408.71	2560.73	4593.95	12443.93	8083.25
B:C ratio	1.15	1.98	1.99	1.78	1.80	2.55	5.90	3.76

Contd

Table 9. Economics of *kharif* sorghum and its competing crops — *Contd*

(Rs/acre)

Particulars	Dharwad district				Belgaum district			
Category of farmers	Small	Medium	Large	Overall	Small	Medium	Large	Overall
Greengram								
Cost 'A'	1462.91	4159.14	2248.00	2491.80	2286.64	1193.24	2078.45	1871.70
Cost 'B'	1667.76	4363.99	2452.85	2707.39	2491.49	1398.09	2283.30	2076.55
Cost 'C'	2022.58	5482.02	2946.69	3315.57	2935.53	1744.89	3056.38	2672.55
Gross returns	4333.33	8280.00	10838.89	8247.50	4141.66	9358.27	10480.00	8823.21
NR over Cost 'A'	2870.43	4120.86	8590.89	5755.70	1855.02	8165.04	8401.55	6951.52
NR over Cost 'C'	2310.76	2797.98	7892.20	4931.93	1206.14	7613.38	7423.62	6150.67
B:C ratio	2.14	1.51	3.68	2.49	1.41	5.36	3.43	3.30
Groundnut								
Cost 'A'	2889.29	2412.73	6102.75	4383.89	3138.42	1843.99	3142.64	1688.59
Cost 'B'	3094.14	2617.58	6307.60	4588.74	3343.27	2048.84	3347.49	1893.44
Cost 'C'	4017.78	3435.94	6515.82	5129.89	4192.04	2482.75	5912.51	2635.13
Gross returns	4662.00	5887.50	9603.24	7420.97	5700.00	7644.29	3583.33	3547.35
NR over Cost 'A'	1772.71	3474.77	3500.49	3037.08	2561.58	5800.30	440.69	1858.76
NR over Cost 'C'	644.22	2451.56	3087.42	2291.08	1507.96	5161.54	-2329.18	912.22
B:C ratio	1.16	1.71	1.47	1.45	1.36	3.08	0.61	1.35

Belgaum district. Cotton, greengram and groundnut were the major competing crops for *kharif* sorghum in the sample districts. The cost and returns per acre of these crops have also been presented in Table 9. The average cost of cultivation for cotton was Rs 5625 in Dharwad district and Rs 2932 in Belgaum district. The gross returns were Rs 10034 and Rs 11015 for Dharwad and Belgaum districts, leaving a net profit of Rs 4408 and Rs 8083, respectively. The benefit-cost ratio was 1.78 for Dharwad district and 3.76 for Belgaum district. Greengram appeared to be a highly profitable crop in both the districts, with the net returns per acre of Rs 4931 in Dharwad district and Rs 6150 in Belgaum district. The benefit-cost ratio was 2.49 in Dharwad district and 3.30 in Belgaum district. Groundnut was another important competing crop to *kharif* sorghum in the sample districts. The gross returns were Rs 7420 and Rs 3547 and the net returns were Rs 2291 and Rs 912, respectively for Dharwad and Belgaum districts with the respective benefit-cost ratios of 1.45 and 1.35. From the above analysis, it was clear that both the net returns and benefit-cost ratio were low for the cultivation of *kharif* sorghum compared to those for the cultivation of its competing crops, cotton, green gram and groundnut. In fact, greengram proved to be the most profitable crop in the sample districts.

Conclusions

The area under *kharif* sorghum has been declining at the state level and in the study districts during the period 1970-71 and 1997-98. During the same period, *kharif* sorghum productivity has registered a marginal increase at the state level as well as in Belgaum district, and a marginal decline in Dharwad district. The deceleration in the *kharif* sorghum area during the overall period and sub-periods has been due to the diversion of *kharif* sorghum area to more remunerative crops like cotton, groundnut and pulses. Belgaum district has shown a high degree of crop diversification compared to that for Dharwad district. Unfavourable prices, declining yields, inadequate credit and adverse climatic conditions are the major reasons advanced for the replacement of *kharif* sorghum crop by other crops in the two sample districts. The net returns and benefit-cost ratios have been recorded low for the cultivation of *kharif* sorghum compared to the cultivation of its competing crops, cotton, greengram and groundnut. Greengram has proved to be the most profitable crop in the sample districts. Therefore, development of improved varieties with better quality grains may enhance the supply of and demand for *kharif* sorghum and its prospects.

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