The Pharma Innovation Journal 2019; 8(2): 261-265

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2019; 8(2): 261-265

www.thepharmajournal.com
Received: 02-12-2018
Accepted: 06-01-2019

Veeresh S Wali
Ph. D Scholar, Department of Agricultural Economics, OUAT, Bhubaneswar, Odisha, India

Kiran L Kadam
Ph. D Scholar, Department of Agricultural Economics, OUAT, Bhubaneswar, Odisha, India

Upasana Mohapatra
Assistant Professor, Department of Agricultural Economics, SOA (DU), Bhubaneswar, Odisha, India

RK Mishra
Professor and Head, Department of Agricultural Economics, OUAT, Bhubaneswar, Odisha, India

Correspondence
Veeresh S Wali
Ph. D Scholar, Department of Agricultural Economics, OUAT, Bhubaneswar, Odisha, India

Economics of sugarcane cultivation in Bagalkot district of Karnataka

Veeresh S Wali, Kiran L Kadam, Upasana Mohapatra and RK Mishra

Abstract
Sugarcane plays a pivotal role in the agro-industrial economy of India and in fact in the real economy. Sugarcane production for the year 2015-2016 stood at 306.02 million tonnes with yield of 61.94 tonnes per hectare (Indiastat, 2015-2016). The Sugar Industry in Karnataka has more than 50 sugar factories distributed well across the state. The major benefits of Karnataka sugar industry are many as it has generated many facilities in the state such as communication, employment and transport. The sugar industry in Karnataka contributes around ₹36 crore per year to the state exchequer as central excise duty. The study was conducted in the Bagalkot district of Karnataka. Both primary and secondary data were used for the study. The secondary data was obtained from District Agricultural office, Bagalkot and the primary data was obtained from farmers of Bagalkot district. Sugarcane growing farmers were purposively selected for the study. Trend analysis was used for assessing the area, production and productivity of sugarcane. Regtression analysis was used to compute the Resource Use Efficiency of the crops. Budgeting technique was used to estimate the cost and returns of the sugarcane cultivation. Sugarcane is a major crop of the study area. It was observed that compound annual growth rates in area under sugarcane (4.26%) was positive and it was positive in the case of sugarcane production (10.25) also. The total cost (₹48,751.86/hectare) incurred by sample farmers in sugarcane cultivation was high as compared to other crops. Besides the net returns realized per hectare of sugarcane cultivation was (₹66,248.14).

Keywords: Economics, sugarcane cultivation

Introduction
Sugarcane is a tropical, perennial grass that forms lateral shoots at the base to produce multiple stems, typically 3 to 4 m (10 to 13 ft.) high and about 5 cm in diameter. The stems grow into cane stalk, which when mature constitutes around 75 percent of the entire plant. A mature stalk is typically composed of 11 to 16 percent fibre, 12 to 16 percent soluble sugars, 2 to 3 percent non-sugars, and 63 to 73 percent water. The crop is sensitive to the climate, soil type, irrigation, fertilizers, insects, disease control, varieties, and the harvest period. The average yield of cane stalk is 60 to 70 tonnes per hectare per year. Sugarcane is a cash crop, but it is also used as livestock fodder.

Sugarcane is indigenous to tropical South and Southeast Asia. Different species likely originated in different locations, with *Saccharum barberi* originating in India and *S. edule* and *S. officinarum* in New Guinea. Sugarcane (*Saccharum officinarum* L.) is one of the most important commercial crops of the tropics and is the main source of sugar in the world. Sugarcane belongs to family *Poaceae* and genus *Saccharum.*

Agriculture is the backbone of Indian Economy and about 65 percent of Indian population depends directly upon agriculture. It has to support almost 17 percent of world population from 2.3 percent of world geographical area and 4.2 percent of world's water resources (Pandey, 2009). Indian agriculture is characterized by small farm holdings. The average farm size is only 1.57 hectares. Around 93 percent of farmers have land holdings smaller than 4 hectares and they cultivate nearly 55 percent of the arable land. The latest statistics claim that, out of the total GDP and the exports of India, one-fifth and 10 percent respectively are contributed by agriculture.

Sugarcane plays a pivotal role in the agro-industrial economy of India and in fact in the real economy. Sugarcane production for the year 2015-2016 stood at 306.02 million tonnes with yield of 61.94 tonnes per hectare (Indiastat, 2015-2016).

The Commission for Agricultural Costs and Prices (CACP) recommended a fair and remunerative price (FRP) for sugarcane for 2015-16 sugar season to be ₹230 per quintal at 9.5

percent recovery level. With every increase in recovery by 0.1 percent point, the FRP will increase by ₹ 2.42 per qtl. All India average recovery rate being 10.05 percent, the FRP recommended would come to ₹ 243 per quintal. (Ministry of Agriculture & Farmers Welfare, Govt. of India 2015-16).The annual consumption of sugar in India is estimated at about 20 million tonnes. The per capita annual consumption of white sugar is 14.10 kg and that of gur and khandsari is 8.10 kg. India exported about 2.78 million tonnes of sugar during 2015-16.

Karnataka is one among the major sugarcane and sugar-producing states in the country as sugarcane is being cultivated in large areas since many years for production of jaggery, khandsari and white sugar. It is also a major provider of livelihood to millions of agricultural families and their dependents particularly in rural areas. In Karnataka, the sugarcane is cultivated over an area of 4.80 lakh ha with production 36.76 million tonnes of sugarcane and productivity of 85.50 tonnes per hectare (Indiastat 2015-2016). Belgaum, Bagalkot, Mandya, Vijayapur and Bidar are the leading districts in terms of area under sugarcane. Karnataka has tremendous potential for increasing the cane cultivation and achieving higher yields, as the soil and climatic conditions are most favorable for planting the cane in different seasons. In the state, Belagavi district ranked first in area occupying 115849.00 hectares and production of 9841129.00 tonnes (Keraba, 2014).

The Sugar Industry in Karnataka has more than 50 sugar factories distributed well across the state. The major benefits of Karnataka sugar industry are many as it has generated many facilities in the state such as communication, employment and transport. The sugar industry in Karnataka contributes around ₹36 crore per year to the state exchequer as central excise duty.

The district of Bagalkot is situated entirely on the North Karnataka plateau, which is a part of the larger Deccan Plateau. Located in north-central Karnataka, Bagalkot is surrounded by Belagavi district to the west, Vijayapur district and Gulbarga district to the north and north-east, Raichur district to the east and Koppal district, Gadag district and Dharwad district to the south-east, south and south-west respectively.

Materials and Methods

The present study was carried out at Bagalkot district. Both primary and secondary data were used for the study. The secondary data was obtained from District Agricultural office, Bagalkot and the primary data was obtained from farmers of Bagalkot district. Sugarcane growing farmers were purposively selected for the study. Trend analysis was used for assessing the area, production and productivity of sugarcane. Regression analysis was used to compute the Resource Use Efficiency of the crops. Budgeting technique was used to estimate the cost and returns of the sugarcane cultivation.

In order to analyze growth in area, production and productivity of major crops compound growth rate is estimated using the function as under.

$Y = a\, b^{T} e^{u}$ ……..……. (1)

Where,
Y = Dependent variable
a = Intercept term
b = (1 + r) and r is the compound growth rate
T = Time
e^{u} = error term

In the logarithmic form the function could be expressed as,

$\log Y = \log a + T \log b + u$ ..... (2)

Log a and Log b were obtained using the Ordinary Least Squares (OLS) procedure and (Antilog of log (b - 1)) *100 provided the percent growth rate.

The production function approach was used to find out the productivity of resources used in sugarcane and cotton cultivation. For this purpose, the Cobb-Douglas production function was employed. The single most advantage of this production function has been that the input coefficients constituted the respective elasticities. The function was modified to include dummy variables.

The modified form of Cobb-Douglas production function is by Eq. (1):

$Y = a\, X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} X_7^{b7} X_8^{b8} + e$ ……. (1)

Where,
Y = Total returns from crop cultivation (Rs)
X_1 = Value of seed/seedlings (Rs)
X_2 = Cost on application of Farm Yard Manure
X_3 = Cost on chemical fertilizers (Rs)
X_4 = Cost on labour used in cultivation (Rs)
X_5 = Cost of machinery used in cultivation (Rs)
X_6 = Cost on plant protection chemicals (PPC) (Rs)
X_7 = Amount of water applied (ha cm)

This Cobb-Douglas function was estimated using ordinary least square (OLS) approach after converting it into log linear form. The estimable form of the equation is given below:

$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + \mu$ …….. (2)

The coefficients were tested for statistical significance by using 't' test. Where profit maximization was the objective of the rational farmer, it was imperative that he allocated his resources consistent with their respective marginal contributions in monetary terms. The degree to which it was accomplished was measured by allocative efficiency. If the marginal contribution of one unit of input was greater than the price of the input in question, then the farmer was said to be allocating the resources efficiently and there was further scope for allocating more unit of that particular input. If the marginal contribution was negative, then the farmers were said to be using the input excessively so that the fixed resources were no longer responsive to the variable input-applied.

Allocative efficiency (AE) was determined by calculating the ratio of the marginal value product (MVP) to the marginal factor cost (MFC), i.e.

AE = MVP/ MFC …… (3)

MVP = MPPi × Py

where,
MVP = Marginal value product

MPPi = Marginal physical product of the ith input
Py = Price of output

MPPi = bi Y/ Xi …….. (4)

Where,
bi = Elasticity coefficient of the ith independent variable
Y = Geometric mean of the output, and
Xi = Geometric mean of the ith input

Technical Efficiency

The technical efficiency evaluated the farm's ability to obtain the maximum possible output from a given level of resources. The Cobb-Douglas production function did not distinguish between technical and allocative efficiencies (Sampath, 1979). It ignored the problem of technical efficiency by assuming that all the techniques of production were identical across farms and each farmer was technically efficient, which many a times was not true. The concept of frontier production function introduced by Farrel (1957) distinguished technical and allocative efficiencies. Timmer (1971) operationalized the concept by imposing Cobb-Douglas type on the frontier and evolved an output-based measure of efficiency. The approach adopted here was to specify a fixed parameter frontier amenable to statistical analysis. This takes a general form as:

Y = f (X) e(μ) …….. (5)

Where,
Y = Output (dependent variable)
X = Vector of inputs (independent variables)
μ = Error-term
Budgeting technique was followed for estimating the cost and returns in the production of sugarcane.

Results and Discussion

Trends in area, production and productivity of sugarcane in Bagalkot district

Growth rates in area, production, productivity of sugarcane in Bagalkot district were worked out with help of secondary data for the period of seventeen years from 2000 to 2016 and are presented in the Table 1. The results revealed that the area under sugarcane increased over the years at the rate of 4.26 percent whereas the production of sugarcane increased significantly over the years at the rate of 10.25 percent and productivity increased about 0.14 percent annually. The results explain that from last seventeen years in Bagalkot district, area under sugarcane had been increasing as it is a commercial crops and it yielded high income.

The above results are in line with findings of Menasinahal (2011), who indicated that growth in area, production and productivity of paddy were negatively significant whereas for cotton they were positively significant. The results are also in conformity with the results of Sekar (2014) [2], who revealed that there has been declaration in growth rate of area, production and productivity of rice in India.

Cost involved in production of Sugarcane in study area

Sugarcane is the major biennial crop in the study area. The cost incurred by sample respondents in the study area presented in in Table 2. The variable costs viz; setts cost, FYM cost, fertilizers cost, plant protection chemicals cost, human labour, bullock labour and interest on working capital. The amount spent on seeds, FYM, fertilizes, chemicals, human labour, bullock labour and interest on working capital were ₹18,750, ₹7,500, ₹9,000, ₹6,900, ₹37,500, ₹9375 and ₹5341.50 respectively. The variable cost contributed a share of 81.60 percent to the total cost. The total fixed cost for sugarcane cultivar to be ₹21,279.50 with the share of 18.40 percent of the total cost. The total cost of cultivation of sugarcane is ₹48,751.86 per hectare with gross returns about ₹2,64,500 and the B: C ratio 2.29.

The variable cost component included costs for inputs such as setts, FYM, fertilizers, plant protection chemicals, human labour, bullock labour and interest on working capital. Among these the farmer spent more capital on human labour, around 32.43 percent of the total cost was spent on labour, it showed that sugarcane was more labour intensive crop. Fixed cost spent in sugarcane cultivation was ₹21,279 which was 18.40 percent of the total cost. The total cost for producing one hectare of sugarcane was ₹1,15,646 with high B: C ratio of 2.29. Most of the sample farmers sent sugarcane to sugar factory under contract farming mode.

The above results are in line with the findings of Nagpure *et al.* (2004) [1] in their study on economics of sugarcane production in Vidarbha region of Maharashtra. The estimated per hectare cost of cultivation in sugarcane was found out to be higher in the case of ratoon crop as against sugarcane as main crop. The efficiency. of per rupee investment in the cultivation of ratoon vis-à-vis sole crop of sugarcane was estimated to be 1.36 and 1.21 respectively. Which represent the sugarcane cultivation to be profitable.

Production function estimates for sugarcane

A perusal of Table 3 explains the inputs included in model explained about 86 percent of the variation in sugarcane output as revealed by the coefficient of multiple determinations (R^2). The summation of regression coefficients indicated increasing returns to scale (1.85) *i.e.*, for each incremental use of inputs simultaneously farmers would get more than one (1.85 units) unit of output. The regression coefficients for Farm Yard Manure (0.09), chemical fertilizers (1.23), labour (0.03) and machinery (00.009) were observed to be non-significant positive elasticities. The regression co-efficient for PPC (0.22) was positive and found to be significant at one percent level and for seed (0.42) found significant at 5 percent. The regression co-efficient for water (-0.1) was negative and found to be significant at one percent level.

Allocative efficiency of Sugarcane

The Cobb-Douglas function estimates and geometric levels of inputs were used to estimate the marginal value product. The knowledge of the marginal value products of resources facilitates comparison of marginal value product with marginal factor cost of the resources to arrive at optimal use of resources.

The MVP to MFC ratios of resources in sugarcane cultivation in command area are presented in Table 4. The positive MVP to MFC ratio for seeds, FYM, labor, machinery and PPC were 0.51,0.11,0.03,0.01 and 0.36 respectively indicating returns of Rs 0.51,0.11,0.03,0.01 and 0.36 thus indicating that factors were used in more quantities than required and it can be reduced till it reaches 1.00.

The negative ratio of MVP to MFC for water (-0.19) indicated that the factor was used at higher level than necessary, resulting in a loss due to excess use.

Sugarcane showed positive and significant coefficients for

seeds and PPC which implied an increase in one rupee on seeds and PPC would increase the returns by Rs 0.42 and Rs 0.225, respectively. This was because these inputs were not used in full quantities and there was scope to increase them. Water showed highly negative significance because it was used in highly excess quantities which increased the chances to cause a decline in the yields. The results suggested that urgent measures were needed to improve water management.

Conclusion and policy

Sugarcane is a major crop of the study area. It was observed that compound annual growth rates in area under sugarcane (4.26%) was positive and it was positive in the case of sugarcane production (10.25) also. The total cost (₹48,751.86/hectare) incurred by sample farmers in sugarcane cultivation was high as compared to other crops. Besides the net returns realized per hectare of sugarcane cultivation was (₹66,248.14). The economics of sugarcane show a positive sign of increasing the net returns of the farmers. The government should formulate the policies to encourage sugarcane cultivation within the ambit conservation of fertility of soil and protecting the soil from the problems of salinity and alkalinity. An efficient crop water management technique also may be evolved keeping the requirement of water for the crop and availability of irrigation water.

Table 1: Trend analysis of sugarcane in Bagalkot district (2000 to 2016)

Year	Area (000' hectare)	Production (000' tonnes.)	Productivity (Quintals. /ha.)
2000	36.60	39.89	109
2001	40.40	43.64	108
2002	43.37	48.58	112
2003	45.97	50.56	110
2004	46.80	51.48	110
2005	47.55	51.83	109
2006	65.73	70.99	108
2007	71.89	79.80	111
2008	84.04	89.92	107
2009	99.76	10.77	108
2010	104.79	11.21	107
2011	116.11	13.81	119
2012	129.70	14.00	108
2013	130.34	13.94	107
2014	133.75	14.71	110
2015	136.52	15.29	112
2016	140.20	16.12	115
Cagr	4.26%	10.25%	0.14%

Source: Bagalkot district at a glance 2015-16

Table 2: Cost involved in production of sugarcane in study area (per hectare) (n=120)

Sl No	Particulars	Quantity	Rate (in ₹)	Cost (in ₹)	Percent
	Variable Costs				
1	Seeds (Kg)	06.25	3,000.00	18,750.00	16.21
2	FYM (Tonnes)	03.75	2,00.00	7,500.00	06.49
3	Fertilizer (Quintals)	250.00	-	9,000.00	07.78
4	PPC (Liters)	6.25	-	6,900.00	05.97
5	Human Labour(Man day)	125.00	300.00	37,500.00	32.43
6	Bullock Labour(bullock pair)	12.50	750.00	9,375.00	08.11
7	Interest on working Capital @ 6%		-	5,341.50	04.62
A	Total Variable Costs			94,366.50	81.60
	Fixed Costs				
1	Land Revenue	-	75.00	75.00	00.06
2	Rent Value of The Land	-	15,000.00	15,000.00	12.97
3	Depreciation	-	5,000.00	5,000.00	04.32
4	Interest on Fixed Capital @ 12%		-	1,204.50	01.04
B	Total Fixed Costs	-	-	21,279.50	18.40
Total Costs	(A+B)			1,15,646.00	100.00
	Returns	115	2,300.00	2,64,500.00	
	B:C Ratio			2.29	

Table 3: Production function estimates of Sugarcane

Sl.no	Particulars	Parameters	Coefficients
1	Intercept	A	5.34
2	Seed (X1)	b_1	0.429* (0.220)
3	FYM (X2)	b_2	0.095 (0.175)
4	Chemical Fertilizers (X3)	b_3	1.239 (0.432)
5	Labour (X4)	b_4	0.030 (0.112)
6	Machinery (X5)	b_5	0.009 (0.085)
7	PPC (X6)	b_6	0.227** (0.054)
8	Water (X7)	b_7	-0.171** (0.039)
9	Coefficient of multiple determination	R^2	0.86
10	Returns to scale ($\sum b_i$)		1.85

Table 4: Ratio of marginal value product to the marginal factor cost of cotton and sugarcane grown in Command area

Sl. No	Resources	MVP/MFC
1	Seeds	0.51
2	FYM	0.11
3	Chemical fertilizers	0.48
4	Labor	0.03
5	Machinery	0.01
6	PPC	0.36
7	Water	-0.19

References

1. Nagpure SC, Jhakare AB, Khandare AP, Patil RK. Economics of sugarcane production in Vidarbha region of Maharashtra state. Rural India. 2004; 67(6, 7):123-125.
2. Sekar I. Yield response modeling and decomposing production of rice in India. Indian J Agric. Res. 2014; 48(2):89-96.
3. Bagalakote District at a Glance
4. www.indiastat.com
5. www.worldsugarstat.com