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Estimation of compound growth rate and cost of cultivation of soybean in the Chhattisgarh plain

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Abstract

Soybean is one of the prominent leguminous oilseed crops in tropical and subtropical regions of India and this crop can grow in the wide range of climatic conditions. Soybean occupies 0.13 m ha with production of 0.86 lakh MT with average productivity of 654 kg/ ha in Chhattisgarh (Anonymous 2016). The study registered a significant growth rate of 3.43 per cent, in Chhattisgarh and in case of India the compound growth rate of area was registering a positively significance of 4.30 per cent per annum. CAGR for soybean registered a significant growth rate of 3.43 per cent, in Chhattisgarh and in case of India the compound growth rate of area was registering a positively significance of 4.30 per cent per annum. A significant growth in area of soybean is estimated as during the study period at Rajnandgaon and Bemetara districts with the 54.35 percent per annum and 4.45 percent per annum respectively. The district-wise production of growth rates of soybean varies from positively non-significant 24.60 per cent in Rajnandgaon district to 13.01 per cent in Bemetara and 11.61 per cent per annum in Kabirdham district. The cost of cultivation in case of small farm was higher (Rs. 26041.37/ha.) followed by marginal farms (Rs. 25970.65/ha).

Keywords: Chhattisgarh plain, soybean production, compound growth, cost of cultivation

Introduction

Soybean is one of the prominent leguminous oilseed crops in tropical and subtropical regions of India and this crop can grow in the wide range of climatic conditions. It is a short duration and the most sensitive crop and its response to yield varies with variety and temperature. Soybean has largely been responsible in uplifting farmer's economic status in many pockets of the country. It usually fetches higher income to the farmers owing to the huge export market for soybean de-oiled cake. India ranks fifth after USA, Argentina Brazil and China in production of soybean. In the recent past, soybean cultivation has increased manifold as compared to any other oilseed crop in India and stands next only to groundnut. India is the third largest edible oil economy in the world after USA and China. Soybean is a world's first rank crop as a source of vegetable oil and in India it occupies number one position among oilseed crops. In India, Soybean occupies an area of 10.1 m ha with production of 8.35 m t and productivity of 822 kg per ha. The major Soybean growing states are Madhya Pradesh (5.01 m ha), Maharashtra (3.44 m ha), Rajasthan (0.92 m ha) Karnataka (0.27 m ha), Andhra Pradesh (0.16 m ha) and Chhattisgarh (0.13 m ha). The total geographical area of Chhattisgarh is 13.8 m ha out of which 5.9 m ha is under cultivation. Soybean occupies 0.13 m ha with production of 0.86 lakh MT with average productivity of 654 kg/ ha (Anonymous 2016).

Chhattisgarh state is divided into three Agroclimatic zones viz Chhattisgarh Plains, Bastar Plateau and Northern Hills zone covering 51.0%, 28.0% and 21.0% of the geographical area, respectively. The location of the state is such that it is close to the Bay of Bengal, which is instrumental in bringing monsoon in the Northern part of the country. By keeping in view the resource management in soybean production, the present investigation has been undertaken to determine the resource use efficiency in soybean production. Soybean can be grown successfully during kharif season in Chhattisgarh. In recent past, cultivation of soybean has been gaining popularity in Chhattisgarh. The important soybean growing districts are Bemetara, Rajnandgaon, Durg, Raipur, Mungeli and Kawardha.

Methodology

The study is conducted in Agro climatic zones viz. Chhattisgarh Plains. Chhattisgarh Plains was selected purposively due to more acreage under soybean cultivation and conventions as well as knowing to well acquaintance of researchers. The study was conducted in three major soybean growing districts, Bemetara, Kabirdham and Rajnandgaon out of 27 district of Chhattisgarh.

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The two blocks were selected from each district; thereafter 2 villages from each block were selected randomly from each of the selected villages. Thus, the total number of responded selected were 300. The primary data were recorded regarding general information of the respondents, cropping pattern, farm resource structure and resource use pattern in soybean cultivation etc. The specific and detail information on costs incurred and returns obtained in the cultivation of soybean were also collected from the sample respondent. The required secondary data were collected from Department of Agriculture and other statistical data were collected from published record of Statistics Department. All the collected primary data were related to the agricultural year 2016-17. The data were collected using survey method.

Compound Growth Rate

Annual compound growth rates in area, production and productivity of soybean was worked out for the Chhattisgarh plain by fitting an exponential function of the following form -

$$Y = a B^t$$

$$\log y = \log a + t \log B$$

Where,

Y= Area / Production /Productivity

a= constant

B= regression coefficient

t= time in year

Compound growth rate (%) = (Antilog B-1) 100

To calculate the production performance of soybean in the Rajnandgaon, Bemetara and Kabirdham district in the Chhattisgarh state secondary data of area, production and productivity of soybean were collected from different publication of Agricultural Statistics, Government of Chhattisgarh. Compound growth rate was estimated for the period from 2001-02 to 2015-2016.

Cost of cultivation

The various cost concepts recommended by CACP was used to determine the cost of cultivation while analyzing the data as:

Cost A1: All actual expenses in cash and kind incurred in production by owner.

1. Value of hired human labour.
2. Value of hired and owned bullock labour.
3. Value of hired and owned machine labour.
4. Value of seed (both farm seed and purchased).
5. Value of manures (owned and purchased).
6. Cost of fertilizers.
7. Plant protection charges (insecticide/pesticide).
8. Irrigation charges.
9. Land revenue.
10. Interest on working capital.
11. Miscellaneous expenses.
12. Depreciation.

Family labours were charged at the rate of hired labour charges prevailing in the region. Owned bullock labour was taken on the basis of hire rate prevailing in the village.

Cost A₂: Cost A₁+rent paid for leased in land.

Cost B₁: Cost A₁+interest on value of owned capital assets (excluding land)

Cost B₂: Cost B₁+rental value of owned land + rent paid for leased in land.

Cost C₁: Cost B₁+imputed value of family labour.

Cost C₂: Cost B₂+imputed value of family labour.

Cost C₃: Cost C₂ + 10 percent of cost C₂ as management cost.

Gross income

Input- output ratio = -----
Cost of cultivation

Results and discussion

(I) Compound Growth Rate of Area, Production and Productivity of soybean in India and Chhattisgarh:

The compound growth rates of area, production and productivity of soybean in Chhattisgarh state and India during the period of study 2006-07 to 2016-17 is presented in Table 1. The table reveals that area of soybean in the Chhattisgarh state increased significantly. The compound growth rate of area 3.43 per cent in the state may be the consequence of significance.

Table 1: CGAR of Area, Production and Productivity in India and Chhattisgarh

Particulars	India	Chhattisgarh
Area	4.30 *	3.43 *
Production	2.38	12.54
Productivity	-1.79	8.85

Note: * - Significant at 1% level of p ** - Significant at 5% level of probability

Growth rate of production 12.54 per cent and productivity 8.85 per cent per annum was registered as nonsignificant. And in case of India the compound growth rate of area was registering a positively significance of 4.30 per cent per annum. In the country may be the consequence of positive insignificant growth rate of production 2.38 per cent per annum and negatively insignificant growth rate of productivity -1.79 per cent per annum.

(II) Compound Growth Rate of Area, Production and Productivity of soybean in selected districts of Chhattisgarh plain

Table 2 showed that the maximum growth rate of area (54.35percent) is observed in Rajnandgaon followed by Bemetara (4.45percent) and Kabirdham (3.53percent) districts hence the lowest growth rate in area is observed in Kabirdham district. The fast growth of area of soybean in Rajnandgaon district is due to cluster basis approaches scheme of government. A significant growth in area of soybean is estimated as during the study period at Rajnandgaon and Bemetara districts with the 54.35 percent per annum and 4.45 percent per annum respectively.

Table 2: CGAR of Area, Production and Productivity of soybean in selected districts Chhattisgarh plain.

Particulars	Kabirdham	Rajnandgaon	Bemetara
Area	3.53	54.35**	4.45*
Production	11.61	24.60	13.01
Productivity	7.80	5.98	8.41

Note: * - Significant at 1% level of probability, ** - Significant at 5% level of probability

The district-wise production of growth rates of soybean varies from positively non-significant 24.60per cent in Rajnandgaon district to 13.01per cent in Bemetara and 11.61 per cent per annum in Kabirdham district. The production of soybean shows insignificant growth rate in all the districts. The maximum growth rate of productivity (8.41percent per annum) is observed in Bemetara followed by Kabirdham (7.80percent) and Rajnandgaon (5.98 percent) districts.

Productivity of soybean also shows an insignificant growth rate in all the districts.

(III) Cost of cultivation of soybean in selected districts of Chhattisgarh plain

The cost of cultivation of soybean crop is presented in Table 3. It clearly showed that the cost of cultivation per hectare of soybean was higher on large farms as compared to marginal farms.

Table 3: Cost of cultivation of soybean per hectare on the basis of cost concept.

S. No.	Particulars	Farm size				Overall
		Marginal	Small	Medium	Large	
1	Family human labour	5500.70 (21.18)	4561.42 (17.52)	2404.33 (9.50)	1135.55 (4.48)	2996.87 (11.72)
2	Hired human labour	1573.40 (6.06)	1727.20 (6.63)	4561.65 (18.02)	5403.60 (21.34)	3707.23 (14.49)
3	Total human labour	7074.10 (27.24)	6288.62 (24.15)	6965.98 (27.51)	6539.15 (25.82)	6704.10 (26.21)
4	Bullock labour	513.50 (1.98)	511.02 (1.96)	16.44 (0.06)	0.00 (0.00)	195.58 (0.76)
5	Machine labour	4099.34 (15.78)	4601.65 (17.67)	2822.17 (11.15)	2296.12 (9.07)	3285.36 (12.84)
6	Seed cost	3388.08 (13.05)	3643.91 (13.99)	3382.59 (13.36)	3771.97 (14.89)	3546.37 (13.86)
7	Plant protection material	2099.68 (8.08)	2150.00 (8.26)	2536.57 (10.02)	2828.20 (11.17)	2461.21 (9.62)
8	Manure and fertilizers	2490.49 (9.59)	2427.94 (9.32)	3057.86 (12.08)	3066.05 (12.11)	2834.58 (11.08)
9	Interest on working capital	94.43 (0.36)	100.41 (0.39)	109.18 (0.43)	115.77 (0.46)	106.87 (0.42)
A	Total variable cost	19759.62 (76.08)	19723.56 (75.74)	18890.7 (74.61)	18617.25 (73.51)	19134.07 (74.80)
10	Land revenue	12.00 (0.05)	12.00 (0.05)	12.00 (0.05)	12.00 (0.05)	12.00 (0.05)
11	Dipreciation	445.12 (1.71)	490.20 (1.88)	520.14 (2.05)	712.12 (2.81)	552.14 (2.16)
12	Interest on fixed capital	251.00 (0.97)	254.00 (0.98)	284.00 (1.12)	258.00 (1.02)	265.94 (1.04)
13	Rental value of land	5502.90 (21.19)	5561.61 (21.36)	5611.08 (22.16)	5727.67 (22.61)	5615.07 (21.95)
B	Total fixed cost	6211.02 (23.92)	6317.81 (24.26)	6427.22 (25.39)	6709.79 (26.49)	6445.15 (25.20)
C = A+B		25970.65 (100.00)	26041.37 (100.00)	25318.01 (100.00)	25327.04 (100.00)	25579.22 (100.00)

Over all, on an average the cost of cultivation per hectare of soybean was found to be Rs. 25579.22 per hectare. The cost of cultivation in case of small farm was higher (Rs. 26041.37/ha.) followed by marginal farms (Rs. 25970.65/ha.), large farms (Rs. 25327.04/ha.) and medium (Rs. 25318.01/ha.). It seems similar cost of cultivation in all the farm sizes, due to the fact that the all farmers approach similar kind of practises applied on their farms input like quality seed, fertilizer, plant protection material, hired labour etc. Sharma (2016) [7] also reported that the inverse relationship in cost of production and productivity of soybean was observed in major growing states. As the productivity of crop is the major factor in reducing the relative cost of production government should focus on the non-price incentives to increase the productivity and also to reduce the cost of cultivation, apart from price incentives.

(IV) Break-up of total cost, according to Cost Concept

The cost on the basis of cost concept in the production of soybean has been presented in Table 4.

Table 4: Break-up of total cost as per cost Concept.

Particular	farm size				Overall
	Marginal	Small	Medium	Large	
Cost A1	14258.92	15162.14	16486.46	17481.70	16137.19
Cost A2	14258.92	15162.14	16486.46	17481.70	16137.19
Cost B1	14509.92	15416.14	16770.46	17739.70	16403.13
Cost B2	20012.83	20977.75	22381.54	23467.37	22018.21
Cost C1	20010.62	19977.56	19174.79	18875.25	19400.01
Cost C2	25513.53	25539.17	24785.87	24602.92	25015.08
Cost C3	28064.88	28093.08	27264.46	27063.21	27516.59

The cost on the basis of cost concept in the production soybean on different size groups have been overall Cost A1, Cost A2, Cost B1, Cost B2, Cost C1 Cost C2, and Cost C3 were worked out to ₹16137.19, ₹16137.19, ₹16403.13,

₹22018.21, ₹19400.01, ₹25015.08 and ₹27516.59 ha. respectively on the sampled farms.

Conclusion

This crop has a potential to enhance economic development of the country by providing cheap food products. It has tremendous industrial potential also. Soybean has largely been responsible in uplifting farmer's economic status in many pockets of the country. Chhattisgarh plain has favourable climate for soybean as oilseed crop. Hence, soybean is predominant crop in cropping pattern of farmer in the zone. In recent past, cultivation of soybean has been gaining popularity in Chhattisgarh. CAGR for soybean registered a significant growth rate of 3.43 per cent, in Chhattisgarh and in case of India the compound growth rate of area was registering a positively significance of 4.30 per cent per annum. The cost of cultivation in case of small farm was higher (Rs. 26041.37/ha.) followed by marginal farms (Rs. 25970.65/ha).

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