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Sarita Sharma
Department of Agricultural Economics and Farm Management, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

RM Sahu
Department of Agricultural Economics and Farm Management, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

HO Sharma
Department of Agricultural Economics and Farm Management, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

Sebin Sara Solomon
Department of Agricultural Economics and Farm Management, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

Corresponding Author:
Sarita Sharma
Department of Agricultural Economics and Farm Management, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

A time series analysis of cost components of rice cultivation in major rice producing states of India

Sarita Sharma, RM Sahu, HO Sharma and Sebin Sara Solomon

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Abstract
In India rice is grown in almost all the states and its one of the major food crop. This paper analyzed the growth rate of different cost components used for rice cultivation. The growth rate where observed for the states are West Bengal, Uttar Pradesh, Punjab, Odisha, Bihar, Chhattisgarh, Andhra Pradesh, Assam, Haryana, and Madhya Pradesh for 15 years from 2002-03 to 2016-17. Orissa contributed maximum share (55.16%) on human labour cost in the total cost of cultivation as compared to other states whereas, the human labour contributed maximum share as compared to other inputs in the states. The study revealed Madhya Pradesh has maximum positive and significant growth per annum for the total cost of cultivation, insecticide and fertilizer cost as compare to other states and inputs cost.

Keywords: Rice, trend, compound growth rate, cost of production

Introduction
Rice (*Oryza sativa*) is an important cereal crop growing in Kharif and Rabi season in India. In the world, India holds the first ranks in the area of 437.89 million ha and third ranks in the production of 1685 million tonnes of rice (FAOSTAT, 2017). In the global scenario rice serves as the staple food for more than fifty per cent of the population and is known as the king of cereals. In almost all the states of India rice is grown and is widely cultivated in the river valleys, deltas and low-lying coastal areas of the southern and northeastern parts of the country. The major rice-producing states are West Bengal, Uttar Pradesh, Punjab, Odisha, Bihar, Chhattisgarh, Andhra Pradesh, Assam, Haryana, and Madhya Pradesh (DES, 2016-17). All these states together contributed over 78.50 per cent of India's total rice production during Kharif season (between June and September) and Rabi season (between November and February). The importance of rice in a daily meal is significant, and people have given more value to rice (Maneesh and Sankaranarayanan, 2016). The country recorded a productivity of rice as 2578 kg per ha in 2017-18 which was higher than the previous year of 2494 kg per ha (GOI, 2018). So the present paper is based on the objective to analyze the trend and growth of factors cost responsible for rice production in major rice producing states in India.

Materials and methods
The present study was based on time-series data. The data collected from the relevant published sourced of the Ministry of Agriculture and Directorate of Economics and Statistics. The responsible factors for rice production are seed, manure, fertilizer, insecticide, irrigation charges, human labour, machine labour, animal labour and land cost concerned to last 15 years, i.e. 2002-03 to 2016-17. The present study carried out in all the major rice producing states viz; West Bengal, Uttar Pradesh, Punjab, Odisha, Bihar, Chhattisgarh, Andhra Pradesh, Assam, Haryana and Madhya Pradesh, contributed 78.50 per cent of the total production of rice in India. The following analytical tools employed to accomplish the objectives.

Estimation of trend and growth
Trend
Trend analysis for expenses on seed, manure, fertilizer, insecticide, irrigation charges, human labour, machine labour, animal labour and land are estimated using the following equation:

$$Y = a+bx$$

Where,
Y = Trend value of the dependent variable (Area, Production and Productivity)
a = Constant
b = Regression coefficient
X = Independent variable

Compound growth rate (CGR)
CGR (%) = [antilog b-1]*100

Result and discussion
Rice is a major cereal crop in India. It is grown as Kharif crop in all the states while, as Rabi in some of the states. Table 1 represents the state-wise average contribution of different types of costs to the total costs of cultivation for the period 2002-03 to 2016-17. During the study period, various variable costs -human labour and machine labour had the largest share for almost all the states. The per cent contribution of land cost varied from 20 per cent to 55 per cent. The land cost included a rental value of owned land, miscellaneous, rent paid for lease in the land, land revenue and taxes.
The Orissa contributed maximum share (55.16%) on human labour cost in the total cost of cultivation followed by West Bengal (52.73%), Assam (41.73%), Bihar (37.90%), Uttar Pradesh (34.83%), Andhra Pradesh (32.41%), Haryana (30.76%), Chhattisgarh (30.45%), Madhya Pradesh (30.23%) and Punjab (23.95%), respectively. In case of land cost Punjab, Haryana, Andhra Pradesh and Madhya Pradesh state revealed maximum contribution in the total cost of cultivation.
In the case of contribution of seed costs to total cost, the maximum contribution was observed in Uttar Pradesh (6.86%) followed by Madhya Pradesh (4.07%), Bihar (3.64%), Chhattisgarh (3.01%), Punjab (2.69%), West Bengal (2.58%), Andhra Pradesh (2.53%), Haryana (1.84%), Assam (1.55%) and Orissa (1.48%), respectively. Madhya Pradesh contributed maximum share (2.77%) on manure cost, as compared to other states. In case of fertilizer, expenses were maximum share contributed Andhra Pradesh (9.63%) in the total cost of cultivation followed by Uttar Pradesh (7.40%), Chhattisgarh (7.01%), Madhya Pradesh (6.96%), West Bengal (6.98%), Bihar (6.71%), Orissa (4.41%), Haryana (3.66%), Punjab (1.90%) and Assam (1.66%), respectively. The contribution in the total cost of cultivation on insecticide cost maximum share was observed in Punjab (6.52%) as compared to other states and Assam contributed minimum (0.08%) share. Uttar Pradesh contributed maximum (9.83%) share in irrigation charges in the total cost of cultivation, as compared to other states. The expenses on machine labour maximum share contributed in Chhattisgarh (16.83%) in the total cost of cultivation followed by Andhra Pradesh (15.41%), Madhya Pradesh (13.73%), Bihar (10.53%), Orissa (9.72%), Assam (9.00%), Uttar Pradesh (7.43%), West Bengal (7.20%), Punjab (6.45%) and Haryana (6.41%), respectively. Assam contributed maximum share (16.96%) on animal labour as compared to the other states, in the total cost of cultivation.

Table 1: State-wise average contribution of cost components to the total cost of cultivation (C3) for the period 2002-03 to 2016-17

S. N.	States	Seed (%)	Manure (%)	Fertilizer (%)	Insecticide (%)	Irrigation Charges (%)	Human Labour (%)	Machine Labour (%)	Animal Labour (%)	Land (%)
1	Andhra Pradesh	2.53	0.40	9.63	3.35	0.39	32.41	15.41	-0.75	32.41
2	Assam	1.55	1.38	1.66	0.08	1.32	41.73	9.00	16.96	16.68
3	Bihar	3.64	0.82	6.71	0.09	8.79	37.90	10.53	-2.41	25.57
4	Chhattisgarh	3.01	2.71	7.01	2.85	1.36	30.45	16.83	4.51	22.70
5	Haryana	1.84	-0.03	3.66	1.91	7.83	30.76	6.41	-0.09	39.69
6	Madhya Pradesh	4.07	2.77	6.96	2.86	1.46	30.23	13.73	6.61	21.65
7	Orissa	1.48	2.29	4.41	0.44	0.08	55.16	9.72	2.82	18.88
8	Punjab	2.69	0.60	1.90	6.52	-2.17	23.95	6.45	-0.09	54.48
9	Uttar Pradesh	6.86	-0.19	7.40	0.58	9.83	34.83	7.43	0.13	21.67
10	West Bengal	2.58	1.84	6.98	2.67	3.28	52.73	7.20	-2.11	20.60

Source: Directorate of Economics and Statistics
Land includes (Rental value of owned land +Miscellaneous +Rent paid for leased in land+ Land revenue, taxes)

Trend and growth
Table 2 measures the state-wise trend and growth of the input cost of rice production in India. During the study period, the maximum total cost revealed a growth rate of 12.81 per cent per annum in Madhya Pradesh followed by Assam 12.00, Chhattisgarh 11.52, Orissa 10.99, Uttar Pradesh 10.50, West Bengal 10.26, Bihar 10.06, Andhra Pradesh 9.49, Haryana 8.84 and Punjab 8.60 per cent per annum. All the states showed increasing and significant trend in the total cost. The cost of seed per hectare for rice cultivation increased significantly over the year across all the states in India like; Uttar Pradesh 11.14 per cent, Punjab 10.49 per cent, West Bengal 10.24 per cent, Haryana 9.90 per cent, Madhya Pradesh 9.82 per cent, Chhattisgarh 8.95 per cent, Andhra Pradesh 8.57 per cent, Bihar 7.10 per cent, Orissa 6.65 per cent and Assam 6.52 per cent. The increased in cost or expenses was due to use of high yielding varieties and traditional techniques because traditional sowing (broadcasting) method required higher quantity of seed as compared to other methods of seed sowing like line sowing and transplanting.
The cost of manure registered a positive and significant growth rate in the states; i.e. Bihar (22.11%), Assam (13.44%), West Bengal (11.02%), Chhattisgarh (10.18%), Punjab (8.99%), Orissa (8.96%), Madhya Pradesh (7.40%) and Andhra Pradesh (3.07%) but in Haryana and Uttar Pradesh growth was found negative.
Fertilizer cost has increased and significant growth over the year among all states in India, where the growth was the maximum in Madhya Pradesh (16.49) and Assam (14.78%) as compared to Punjab (3.50%) and Haryana (4.88%).
The growth of insecticide cost was positive and significant in almost all the states- Madhya Pradesh (50.61%), Chhattisgarh (33.48%), Assam (25.56%), Bihar (22.59), West Bengal (17.09%), Uttar Pradesh (14.83%), Punjab (10.84%), Andhra Pradesh (8.45%), Haryana (5.26%) and Orissa (3.21%), respectively. The irrigation cost has no significant effect on the overall cost of cultivation in states like; Punjab (-1.93%), Orissa (1.08%), Andhra Pradesh (2.41%) and Madhya

Pradesh (4.12%). The irrigation cost increases significant growth in Assam (28.92%) followed by Bihar (21.14%), Chhattisgarh (18.39%), West Bengal (7.94%) and Haryana (7.54%).

Human labour cost growth in all the states registered positively and significantly over the year. Whereas, the maximum cost growth observed in Orissa (13.68%) followed by West Bengal (12.31%), Assam (12.20%), Madhya Pradesh (12.17%), Chhattisgarh (11.87%), Uttar Pradesh (11.28%), Punjab (11.26%), Bihar (10.88), Haryana (10.24%) and Andhra Pradesh (10.06%) per annum. Human labours required for maintaining smoothly cultural practices.

Machine cost observed increasing at a significant growth rate over the time across all the states in India, i.e. Assam (32.19%), Chhattisgarh (24.26%), Madhya Pradesh (22.15%), Orissa (19.71%), West Bengal (16.87%), Andhra Pradesh (15.84%), Bihar (12.94%), Uttar Pradesh (10.92%), Haryana (6.93%) and Punjab (5.76%), respectively.

The positive and significant growth rate of animal labour was observed maximum in Assam (11.39%) followed by Madhya Pradesh (7.16%), Chhattisgarh (6.27%) and Orissa (5.09%) but decline growth per annum in Bihar (-10.37%), Haryana (-6.37%), Punjab (-4.31%), Andhra Pradesh (-3.43%) and West Bengal (-3.18%), respectively due to use of machinery; tractors, power tillers, seed drill and plough etc.

The growth rate of expenses on land were significantly positive in all the selected states of India, whereas the highest growth of land cost over the year observed in Madhya Pradesh (14.18%), Punjab (10.56%), Chhattisgarh (10.55%), Assam (10.36%), Uttar Pradesh (9.88%), West Bengal (9.80%), Haryana (9.91%), Orissa (9.63%), Andhra Pradesh (9.19%) and Bihar (8.91%), respectively.

The study by Chatterjee S, (2017) also showed a similar result. The study showed cost of seed, fertilizer, insecticides, human labour and machine labour increased positively in all the selected states i.e. Andhra Pradesh, Assam, Bihar, Haryana, Madhya Pradesh, Orissa, Punjab, Uttar Pradesh and West Bengal but manure, animal labour and the land costs showed negative growth rate.

Table 2: State-wise growth of factors (cost) responsible for rice production in different states of India

S.N.	States	Seed		Manure		Fertilizer		Insecticide		Irrigation (Electricity) Charges		Human Labour		Machine Labour		Animal Labour		Land		Total Cost (C3)	
		B	CGR (%)	b	CGR (%)	b	CGR (%)	B	CGR (%)	b	CGR (%)	b	CGR (%)	b	CGR (%)	b	CGR (%)	b	CGR (%)	b	CGR (%)
1	Andhra Pradesh	0.04***	8.57	0.01*	3.07	**0.04***	10.22	0.04***	8.45	0.01^{NS}	2.41	0.04***	10.06	0.06***	15.84	-0.02***	-3.43	0.04***	9.19	0.03***	9.49
2	Assam	0.03***	6.52	0.05***	13.44	0.06***	14.78	0.10***	25.56	0.11***	28.92	0.05***	12.20	0.12***	32.19	0.05***	11.39	0.04***	10.36	0.05***	12.00
3	Bihar	0.03***	7.10	0.09*	22.11	0.04***	9.76	0.09**	22.59	0.08**	21.14	0.04***	10.88	0.05***	12.94	-0.05***	-10.37	0.04***	8.91	0.04***	10.06
4	Chhattisgarh	0.04***	8.95	0.04***	10.18	0.05***	11.40	0.13***	33.48	0.07***	18.39	0.05***	11.87	0.09***	24.26	0.03***	6.27	0.04***	10.55	0.05***	11.52
5	Haryana	0.04***	9.90	-0.05^{NS}	-10.93	0.02***	4.88	0.02***	5.26	0.03***	7.54	0.04***	10.24	0.03***	6.93	-0.03^{NS}	-6.37	0.04***	9.91	0.04***	8.84
6	Madhya Pradesh	0.04***	9.82	0.03***	7.40	0.07***	16.49	0.18***	50.61	0.02^{NS}	4.12	0.05***	12.17	0.09***	22.15	0.03***	7.16	0.06***	14.18	0.05***	12.81
7	Orissa	0.03***	6.65	0.04***	8.96	0.03***	8.39	0.01^{NS}	3.21	0.004^{NS}	1.08	0.06***	13.68	0.08***	19.71	0.02***	5.09	0.04***	9.63	0.05***	10.99
8	Punjab	0.04***	10.49	0.04***	8.99	0.01***	3.50	0.04***	10.84	-0.01^{NS}	-1.93	0.05***	11.26	0.02***	5.76	-0.02^{NS}	-4.31	0.04***	10.56	0.04***	8.06
9	Uttar Pradesh	0.05***	11.14	-0.03**	-6.74	0.04***	10.39	0.06***	14.83	0.07***	16.46	0.05***	11.28	0.05***	10.92	0.01^{NS}	2.23	0.04***	9.88	0.04***	10.50
10	West Bengal	0.04***	10.24	0.05***	11.02	0.05***	11.25	0.07***	17.09	0.03***	7.94	0.05***	12.31	0.07***	16.87	-0.01***	-3.18	0.04***	9.80	0.04***	10.26

Source: Directorate of Economics and Statistics

Land includes (Rental value of owned land +Miscellaneous +Rent paid for leased in land+ Land revenue, taxes)

*** Significant at 1 per cent level of probability, ** Significant at 5 per cent level of probability, * Significant at 10 per cent level of probability, NS = Non-Significant

Conclusion

The compound growth rate of the total cost, seed, fertilizer, human labour, machine labour cost and land for rice cultivation observed positively significant in all the selected states. The Madhya Pradesh found to be higher positively significant growth in insecticide cost as compare to all the states and inputs. While, manure cost, irrigation charges and animal labour cost revealed positively significant in some of the states.

References

1. Chatterjee S. State-wise comparative analysis of different cost components and factor productivity of rice in India during last decade. RASI 2017;2(1):83-97.
2. Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi. https://eands.dacnet.nic.in/APY_96_To_07.html
3. FAOSTAT. Food and Agriculture Organization Corporate Statistical Database (Rome, Italy), 2017.
4. GOI. Agricultural Situation in India, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, New Delhi, 2018.
5. GOI. (various issues). Cost of Cultivation of Principal Crops in India. Directorate of Economics and Statistics, Ministry of Agriculture and Co-operation, New Delhi, 2002.
6. Maneesh P, Sankaranarayanan R. A Comparative Study of Trend in Area, Production and Productivity of Rice in Kerala and Tamil Nadu. Journal of Agricultural Economics, Extension and Rural Development 2016;4(6):468-475.