

Growth and Instability in Wheat Production: A Temporal Analysis in Santhal Region of Jharkhand

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Received: 18 -05-2020

Revised: 27-05-2020

Accepted: 18-08-2020

ABSTRACT

The growth and instability analysis of wheat in Santhal region was carried out keeping in view its importance in the region. It is also used as a cash crop by the farmers. The secondary data for 50 years i.e. from 1966 to 2015 was collected from different sources for the present study. The data was divided into the three sub-periods, namely sub-period I (1966-67 to 1982-83); sub-period II (1983-84 to 1999-2000) and sub-period III (2000-01 to 2015-16). The present study involves use of Cuddy-Della Valle Index and decomposition and multiple regression analysis to examine the effects on wheat productivity. Rural literacy and irrigation facility in the region are important determinants of wheat productivity. Decomposition analysis also indicated that market price of produce remain the governing factor for income enhancement of farmers in the region.

Keywords: Growth, instability, Cuddy-Della Valle Index, decomposition analysis

The Santhal region of Jharkhand state is known for maximum contribution in the agricultural Gross Domestic Product (GDP). Among the field crops, wheat occupies most important place of *Rabi* season. This is mainly because of the suitable soil and agro-climatic condition of the region. The improvement in efficiency of productive resources in the region enhances the overall production of crops, including wheat. Growth and instability of wheat is the subject of major concern for the policy makers, in terms of reducing the fluctuation of income of wheat growers' in the region. The nature and sources of growth and instability in production has been debated since the period of Green Revolution. Recognizing the initiatives taken by the central government for doubling of farmers' income by 2022, the contribution of overall income through this crop has important especially for the growers of Santhal region. This paper makes an attempt to analyze

the nature and sources of growth and instability in area, production and productivity of wheat and also factors responsible for the enhancement of income of the wheat producer in the Santhal region. This will help in exploring the possibilities to augment the production of wheat in areas of vast potential for improving the livelihood of small farmers.

MATERIALS AND METHODS

Growth and instability of Wheat in Santhal region of Jharkhand state has been measured by taking the variables like total area under crop, total production and yield in different years. The period of study was characterized by wider technology

How to cite this article: Prakash, J. and Roy, B.C. (2020). Growth and Instability in Wheat Production: A Temporal Analysis in Santhal Region of Jharkhand. *Agro Economist - An International Journal*, 7(1): 25-29.

Source of Support: None; **Conflict of Interest:** None



dissemination and new state formation. The whole study period is divided into three sub periods, i.e. sub-period I (1966– 1982) characterized by early green revolution, sub-period II (1983–1999) characterized by liberalization of agriculture trade and early effect of WTO on growth and sub-period III (2000–2015). Growth in wheat production can be measured by using the formula,

$$X_t = ab^t \quad \dots(1)$$

By taking log on both sides in the equation 1 it becomes,

$$\text{Log } X_t = \text{Log } a + t \log b$$

$$\text{Or } b = (1 + r) / 100$$

Where,

X_t = Area/production/productivity of Wheat in the year 't'

t = Time period which takes the value 1, 2, 3, n

a = Intercept

b = Regression coefficient.

CGR was measured as follows:

$$\text{CGR } (r) = (\text{antilog } b - 1) \times 100$$

For instability measurements, the Cuddy Della Valle Index was used. This instability index has been used after de-trending of variables like total area under wheat; total production and productivity of wheat with the help of HP filter that give clear direction and extent of the instability. The use of coefficient of variation as a measure to show the instability in any time series data have some limitations. If the time series data exhibit any trend the variation measured by CV can be over-estimated, i.e. the region which has growing production are at constant rate will score high in instability of production if CV is applied for measuring instability. On the other hand, Cuddy-Della Valle index attempts at de-trending the CV by using adjusted R^2 . Thus it is a better measure to capture instability in agricultural production. A low value of this index indicates low instability in farm production and vice-versa.

$$\text{Cuddy-Della Valle Index} = C.V. \times \sqrt[1/2]{1 - R^2}$$

In the present study, the magnitude of CDVI was divided into three categories, which represents different ranges of instability as follows:

- ♦ Low instability = between 0 to 15
- ♦ Median instability = greater than 15 and lower than 30
- ♦ High instability = greater than 30

Birthal approach of decomposition analysis was used to identify the effect of area, yield, price and diversification effect on growth of income of wheat as given below:

$$dI = \left(\sum_{i=1}^n a_i Y_i P_i \right) d \left(\sum_{i=1}^n A_i \right) + \sum_{i=1}^n A_i \sum_{i=1}^n a_i Y_i dP_i + \sum_{i=1}^n A_i \sum_{i=1}^n (a_i Y_i dY_i) + \sum_{i=1}^n A_i \sum_{i=1}^n (Y_i P_i da_i)$$

Where, I = Total Revenue, a_i = Particular crop area in i^{th} year, Y_i = Yield of crop i^{th} year, P_i = Price of particular crop i^{th} year, A_i = Gross cropped area i^{th} year.

RESULTS AND DISCUSSION

Wheat growth in the region is essential not only to increase producer surplus of staple foodgrain but also to provide nutritional balance and enhance income level of the farmers.

Growth in area, production and productivity of wheat

The effect of green revolution was clearly visible in terms of enhancement in area, production and productivity of wheat in Santhal region. The annual growth in area during sub-period I, i.e. during 1966 to 1982 was 9.14 per cent per year under wheat, which is higher than the growth in area under Jharkhand state (7.34 per cent per annum). During sub-period II which is the period of liberalization and globalization, negative growth was observed in area under wheat for both Santhal as well as state of Jharkhand. The momentum in area under wheat was again gained during sub-period III which was the period of new state formation (Table 1).

The growth in wheat production was very high during sub-period I, at the rate of 15.02 per cent per annum. During sub-period II, very low negative

growth in wheat production was observed in the region. The state had also very low growth rate in production of wheat. After formation of new state, again momentum was gained in total production in the Santhal region at the rate of 9.82 per cent per annum, slightly lower than the growth at state level i.e. 10.67 per cent per annum.

The growth in wheat productivity in Santhal region was medium during sub-period I, as observed in state wheat productivity growth. This was mainly due to positive effect of green revolution on wheat crop. During 2nd sub period, growth was very low in state as well as Santhal region. The productivity growth was observed again good during third sub period. Overall low productivity growth was observed in the region with 1.68 per cent per annum. The new state formation and policies towards growth of wheat in this region had positive effect for growth.

Table 1: CAGR in area, production and productivity of wheat

Sub Period	Area		Production		Productivity	
	Santhal	Jharkhand	Santhal	Jharkhand	Santhal	Jharkhand
I	9.14	7.34	15.02	11.31	3.61	3.00
II	-0.82	-1.24	-0.21	0.67	0.55	1.97
III	7.16	8.90	9.82	10.67	2.89	1.67
Overall	2.12	2.03	4.01	3.73	1.68	1.59

Instability of wheat in study region

The instability records in area production and productivity during different sub period is presented in Table 2. During the sub-period I, instability was medium in the region but state had high level of instability under wheat production. In the sub-period II, Santhal as well as whole state had low instability. This was basically due to low growth in area under wheat production during this period. With increase in growth rate of area under wheat crop, instability increased in state as well as in Santhal region.

The magnitude of wheat production instability shows that medium range of instability existed in Santhal region whereas the instability was high in production of wheat in the state. Again low

instability was observed during sub-period II in the production of wheat both in Santhal and the state, mainly because of low growth. Again, with increased growth in production in the region, instability was high with magnitude of 43.63 per cent and in the state with magnitude of 48.30 per cent. The overall a very high range of instability was observed in the total production of wheat in the region as well as in the state.

There was a low instability in productivity of wheat crop during all sub-periods in the Santhal region which was mainly due to suitable climatic condition and availability of irrigation facility. Similarly instability in state was medium during sub-period I and decrease during sub-period II and III. The overall instability remained low in wheat productivity.

Table 2: Caddy Della Valle Index of wheat

Sub Period	Area		Production		Productivity	
	Santhal	Jharkhand	Santhal	Jharkhand	Santhal	Jharkhand
I	15.23	32.43	16.94	41.96	4.89	15.65
II	4.01	7.04	2.94	4.56	0.98	9.92
III	33.54	40.94	43.63	48.30	13.57	8.36
Overall	28.28	33.43	39.66	43.75	7.55	4.85

Factors affecting productivity of wheat

The determinants of wheat productivity in Santhal region during five decades are depicted in Table 3.

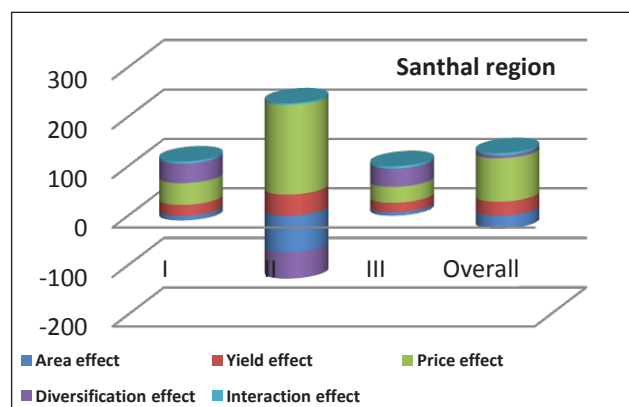
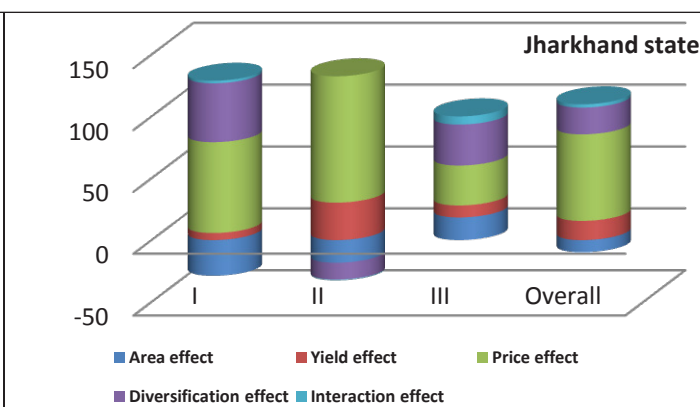
Table 3: Determinants of wheat productivity

Explanatory variables	Coefficient	Standard Error
Intercept	1.076	0.156
Rural Lit (%)	0.044***	0.006
Ag Lab (%)	-0.044***	0.011
GIA (%)	-0.028***	0.009
NPK (Kg/ha)	0.000	0.001
Annual rainfall (in mm)	0.000	0.000
Pump/ha	0.757**	0.364
Power tiller/ha	-1.019*	0.581
MSP (₹)	0.000	0.000
R ²	0.963	

Note: *= Significant at 10 percent level, **= Significant at 5 per cent level, ***= Significant at 1% level.

Table 4: Contribution of different sources of income growth

Sub period	Particulars					
In Santhal region						
	Area effect	Yield effect	Price effect	Diversification effect	Interaction effect	Total
I	-9.49	21.94	43.79	39.45	4.31	100
II	-73.37	42.67	181.12	-53.70	3.27	100
III	6.73	19.39	32.18	36.81	4.88	100
Overall	-26.35	28.30	87.64	6.27	4.14	100
In Jharkhand region						
I	-28.82	5.73	73.44	47.64	2.01	100
II	-18.29	30.26	102.18	-13.68	-0.47	100
III	18.31	9.69	32.29	33.15	6.56	100
Overall	-9.78	15.53	69.97	21.63	2.64	100


Fig. 1: Sources of income growth in Santhal

Fig. 2: Sources of income growth in Jharkhand

Rural literacy, agricultural labour and gross irrigated area had significant contribution in the productivity of wheat at 1 per cent level of significance. Pump set availability and power tiller had also significantly contributed in explaining the changes in productivity of wheat in the region with 5 per cent and 1 per cent significance level, respectively. The variables selected in the model explain 96 per cent of variability in the productivity of wheat in the region.

Sources of income growth of wheat producers' in Santhal region

The factors responsible for the growth of income of the wheat growers' in the Santhal region and state are presented in Table 4.

During the sub-period I, price of the produce in market was responsible for the income growth of farmers in both Santhal as well as in the state. The

trend continues during sub-period II, the period of liberalization and globalization. During sub-period II, the yield of crop occupies second position affecting growth of farmers' income. During sub-period III, price along with diversification was responsible for enhancement of farmers' income in Santhal region. The price of produce remains the prime factor for the growth of farmers' income both in state as well as in the Santhal region.

CONCLUSION

Since the macro analysis of growth and instability of the wheat crop does not give the true picture of Santhal region. Hence a micro level analysis of Santhal region was conducted to get the real sense of existing situation of wheat crop in the region for giving suggestions to policy makers. The growth in area, production and productivity of wheat was favorable in Santhal region after green revolution,

although instability was high. The liberalization period adversely affected the crop in this region due to non-exclusion in priority list of policy maker. After formation of new state, wheat production gained momentum and shown high growth in area and production. The factors affecting growth in wheat productivity included literacy, gross irrigated area, pump sets etc. The decomposition analysis reveals that price of the produce was the main factor affecting the growth in income of wheat growers.

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