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Economic Analysis of Production and Instability of Lentil in Major Lentil Growing States of India

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ABSTRACT

Protein-energy malnutrition as well as micronutrient deficiencies may be reduced by increasing the consumption of pulses which are of rich sources of proteins, minerals, iron and fibre. Pulses are, traditionally, vital component of our cropping system. Pulses are climate resilient and can be sown in rain-fed areas. They can fix nitrogen in the soil and reduce dependence on nitrogenous fertilizers. They enrich the soil in nitrogenous compounds and are beneficial for crop rotation and mixed cropping. Hence, increasing area under pulses or planting pulses as an inter-season crop promotes sustainable agriculture. The compound growth rate of area under lentil crop was found to be negative for almost states under study except for Uttar Pradesh, where it was observed positive. Similarly, the growth of the production and productivity of the crop over the period of investigation was found to be positive in all the states except Uttar Pradesh and for the last few years, it's growth in area, production and productivity have been registered negative. In decomposition analysis, the interaction effect for all the states and nation as a whole was estimated high resulted better productivity of the crop. Despite good returns associated with yield uncertainty, this crop does not compete with the other rabi crops grown in the state as evidenced under investigation. Now, the state governments of the region and the policy makers need to come forward to formulate appropriate policy decisions to augment the productivity through, evolving new disease and pest resistant varieties, better management practices and good institutional supports so as to eliminate hunger, assured nutritional security and to promote sustainable agriculture.

Key words: *Lentil, Malnutrition, Compound Growth rate, Instability, Decomposition analysis, Food security, Hunger*

INTRODUCTION

Pulses are major source of protein, high fiber content and provide ample quantity of vitamins and minerals. Realizing its importance for human health, the United Nation declared 2016 as International Year of Pulses. To provide dietary requirement of protein for ever rising population, due attention is required to enhance the production of pulses crops not only to meet the dietary requirement but also to raise awareness towards achieving nutritional and food security as well as environmental sustainability.

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Pulses are traditionally important constituents of our cropping system. Being leguminous in nature, these improve soil fertility by fixing nitrogen and making soil more porous due to tap root system[8].

Lentil is believed to be one of the very first crops that were domesticated and produced in the history of mankind. Till today, the importance of this crop is considered as similar among the vegetarian population of the world. The global production of lentil has reached nearly 5.0 million tonnes in 2014. Lentil is the second largest growing *rabi* pulse after chickpea in India. India was the largest producer of the lentil crop in the world until recently but Canada took over the lead and pushed India at the second place. About 80 percent of the production of lentil in India (2015-16) comes from Madhya Pradesh (30.94%), Uttar Pradesh (28.72%), Bihar (15.24%) and West Bengal (5.81%). But, the acreage has declined by 16.12% from 2014-15 to 2015-16 due to drought situation in Bihar and Uttar Pradesh. It has been reported that there is a scope of increasing area under lentil during the *rabi* season, as the cost per hectare of the crop is less with higher net return than the competing crops like gram and mustard under water deficit and resource poor conditions. Further, the lentil based cropping system is profitable and also have comparatively high productivity, hence, it is suitable for mostly un-exploited rice-fallows under water deficit conditions[6]. Lentil is valuable human food, mostly consumed as dry seeds containing protein, carbohydrate, vitamins and minerals etc. The nutritive value of the crop is given in the Table 1.Nutritional analysis indicates that lentil makes an excellent feed for livestock. Husk, dried leaves, stem, fruit walls and bran can be fed to livestock. Lentil residue (bran) contains about 10.2% moisture, 1.8% fat, 4.4% protein, 50% carbohydrate, 21.4% fiber, and 12.2% ash[3]. According to Muehlbauer *et al.*[3] when production of forage crops fall below the required level in the market, lentil residue commands an equal or better price than lentil seeds in some Middle Eastern countries. Green plants make important manure. Seeds are a source of commercial starch for textile and printing industries[2].

Table 1: Nutritive value of lentil as human food

Sl. No.	Elements	Nutritional value
1.	Protein	24-26%
2.	Carbohydrate	57-60%
3.	Fat	1.3%
4.	Fiber	3.2%
5.	Phosphorus	300 mg/100g
6.	Iron	7 mg/100g
7.	Vitamin C	10-15 mg/100g
8.	Calcium	69 mg/100g
9.	Calorific value	343
10.	Vitamin A	(450 IU) and Riboflavin

Source: Pulses in India Retrospect & Prospect

Among pulses, lentil is the third important pulse crop after arhar and gram. Keeping in view its importance, nutritional values and growing demand of pulses in the country, an attempt has been made (a) to analyze the growth and instability of area, production and productivity of lentil in major lentil growing states as well as for the country as a whole (b). to decompose the lentil production growth and (c) to analyze the comparative profitability in comparison to other major *rabi* crops grown in the respective states.

MATERIALS AND METHODS

The study is based on time series data concerning the area, production and productivity of lentil crop for the period from 2000-01 to 2015-16 was collected from various publications and websites of Directorate of Economics and Statistics,

Government of India and E-book on pulses, IIPR and Bihar through Figures. The exponential function $Y = AB^t$ has been used to compute the compound growth rates of area, production and productivity of the crop under study.

Compound growth rate(r) = (antilog 'b' -1)*100

Coefficient of Variation (CV in %) has been worked out to estimate the instability in area, production and productivity of lentil in the major pulses growing states.

Decomposition of production growth

In order to measure the relative contribution of area and yield to the total output change for individual crop, the component analysis model has been used[1,4,5,7,9,10,11]. The model is given as follows:

$$\Delta P = A_0\ \Delta Y + Y_0 \Delta\ A + \Delta A \Delta Y$$

Change in production= Yield effect + Area effect + Interaction effect

Thus, the total change in production can be decomposed into three effect viz. yield effect, area effect and the interaction effect due to change in yield and area.

RESULTS AND DISCUSSION

Growth analysis

It may be revealed from Table 2 that area under lentil has decreased in Bihar from (174.68 thousand hectares), Uttar Pradesh (620.20 thousand hectares), West Bengal (72.03 thousand hectares) and country as a whole (1443.33 thousand hectares) during TE-2003 to Bihar (152.26 thousand hectares), Uttar Pradesh (433.67 thousand hectares), West Bengal (66.83 thousand hectares) and India as whole (1433.67 thousand hectares), respectively during TE-2016, except the case of increase in area under Madhya Pradesh i.e. 485.43 thousand hectares to 512.03 thousand hectares from TE-2003 to TE-2016. During the last ten years, in fact, unfavourable climatic change had been noticed; resulting in scanty rainfall, incidence of disease-pest attack on the crop may be the reasons for decrease in area under lentil crop. The decrease in area has also been reflected in the form of negative growth rates except for Madhya Pradesh where positive compound growth rate (0.34%) per annum was recorded. The year to year fluctuation in area and production and variability in productivity of the crop is the major concern for the researcher as well as policy makers. Instability in area was assessed ranging from 5.32% to 13.25%. This may probably be due to mindset of cultivators, emphasizing on rice-wheat cropping system as the knowledge on modern inputs (high yielding variety of seeds), have been advocated to raise the productivity of rice and wheat during and after Green Revolution. Lack of knowledge on crop management and technological constraints such as the insufficient and untimely availability of HYVs of seeds has affected adversely the production of pulses. Now, under NFSM a special programme "Accelerated Pulse Production Program (A3P) was launched in the year 2010-11 with the objective to demonstrate plant nutrient and plant protection centric improved technologies of pulse crops. Through these programmes, efforts were made to demonstrate crop production technologies and build confidence among farmers regarding pulses production.

Table 2: Growth and instability in area under lentil crop in major lentil growing states

States	Bihar	Madhya Pradesh	Uttar Pradesh	West Bengal	India
Area ('000 ha)					
TE-2003	174.68	485.43	620.20	72.03	1443.33
TE-2016	152.56	512.03	433.67	66.83	1290.67
Share (%)					
TE-2003	12.10	33.63	42.97	4.99	100.00
TE-2016	11.82	39.67	33.60	5.18	100.00
Annual Compound Growth Rate (%) of area					
2000-01 to 2015-16	-0.35	0.34	-1.03	-0.35	-0.25
CV (%)	5.79	8.71	13.25	11.08	7.45

Table 3 revealed that there was increase in production of lentil in the country as a whole and major lentil growing states like Madhya Pradesh, Bihar and West Bengal except Uttar Pradesh. Relatively larger share of lentil production was observed in Madhya Pradesh (30.94%), followed by Uttar Pradesh (28.72%). Among the states under study, comparatively large compound growth rate was observed in Madhya Pradesh (1.09%), followed by 0.64% in West Bengal and at national level it was found only 0.23% annual growth in production in TE-2016. The growth in production may be due to implementation of various pulse production programmes by the government, adoption of high yielding varieties and disease resistant varieties of seeds and also growing demand of pulses.

Table 3: Growth and instability in production under lentil crop in major lentil growing states

States	Bihar	Madhya Pradesh	Uttar Pradesh	West Bengal	India
Production ('000 tonnes)					
TE-2003	154.87	209.30	452.67	49.73	920.00
TE-2016	158.85	322.53	299.33	60.60	979.00
Share (%)					
TE-2003	16.83	22.75	49.20	5.41	100.00
TE-2016	16.23	32.95	30.58	6.19	100.00
Annual Compound Growth Rate (%) of production					
2000-01 to 2015-16	0.36	1.09	-1.08	0.64	0.23
CV (%)	14.94	20.19	17.30	21.30	8.44

Though there is positive growth in production, the instability in production of lentil was worked out ranging from 8.37% to 21.30%. The fluctuation is probably high on account of fluctuations in climatic conditions and rising temperature as in spite of the fact that the crop is grown in *rabi* season. The adoption rate of pulses technology is miserably low among the cultivators mainly because of risky crops, low and unstable yields, poor infrastructure and non-availability of quality inputs in time (IIPR, 2007).The growth and instability in the productivity in lentil growing states as presented in Table 4 revealed that Bihar recorded the highest productivity (1040.11 kg/ha) during T-2016, followed by West Bengal (892.18 kg/ha). Compound growth rates of productivity of lentil in the entire major lentil growing states under investigation and the country as whole were found positive except negative in case of Uttar Pradesh probably due to prolonged dry period because there was no rain for the 3 months in the year 2015-16 in the state.

Table 4: Growth and instability in productivity under lentil crop in major lentil growing states

States	Bihar	Madhya Pradesh	Uttar Pradesh	West Bengal	India
Productivity (Kg/ ha)					
TE-2003	886.74	430.33	732.33	685.00	639.00
TE-2016	1040.11	629.09	690.14	892.18	744.33
Share (%)					
TE-2003	139.14	67.52	114.91	107.48	100.00
TE-2016	137.07	82.90	90.94	117.57	100.00
Annual Compound Growth Rate (%) of productivity					
2000-01 to 2015-16	0.71	0.75	-0.05	0.99	0.48
CV (%)	16.10	19.32	11.47	17.64	9.41

Decomposition analysis of production growth

In order to find out the contribution of area, production and productivity and the interaction effect in lentil production, the results of the decomposition analysis are presented in Table 5. It is clearly observed from the table that interaction effects on all the states under study were found very high and thus, the impact on production may probably be due to interaction effect i.e. high yielding varieties and technologies of crop management have been undertaken for lentil production in the major lentil growing states and at national level. The encouraging impact on lentil production is also reflected from the various pulses programmes launched by the government.

Table 5: Decomposition of production growth of lentil in major lentil growing states

Particulars	Bihar	Madhya Pradesh	Uttar Pradesh	West Bengal	India
2015-16 over 2000-01					
Area effect (%)	-0.41	-4.05	0.81	0.45	0.19
Yield effect (%)	-1.67	0.56	1.49	6.47	0.70
Interaction effect	102.09	103.49	97.70	93.08	99.11

Comparison with other competing crops

Farmers allocate their land and other resources among alternative crops on the basis of their comparative returns from different enterprises The net returns (over cost C_2 and A_2) from cultivation of lentil and other *rabi* crops in major lentil growing states have been calculated from the cost data of CACP and is shown in Table 6. Perusal of the table revealed that the net return from cultivation of lentil was observed comparatively higher in comparison to gram and mustard in Bihar except wheat during 2011-14. In Uttar Pradesh, the net return from lentil was found comparatively higher than gram during 2011-14 and in case of West Bengal, it was comparatively higher except mustard crop.

Table 6: Returns from lentil and other *rabi* crops in major lentil growing states

State	Crops	Net return over cost C_2		Net return over cost A_2	
		2000-03	**2011-14**	**2000-03**	**2011-14**
Bihar	Lentil	3489.28	11988.92	8817.62	23781.06
	Wheat	322.48	13154.67	6417.47	25186.41
	Gram	6811.80	9874.86	11906.55	20058.49
	Mustard	-	3978.33	-	15687.16
Madhya Pradesh	Lentil	3208.28	8588.10	-	19364.32
	Wheat	719.47	17646.83	-	37769.87
	Gram	4581.1	8973.49	-	23506.67
	Mustard	2555.91	18075.74	-	37170.63
Uttar Pradesh	Lentil	915.27	7664.04	-	21689.02
	Wheat	3356.82	6735.96	-	27931.38
	Gram	5324.18	1614.60	-	16149.47
	Mustard	1606.40	7344.52	-	28337.84
West Bengal	Lentil	-	483.11	-	16891.98
	Wheat	-	-5924.91	-	10657.07
	Gram	-	-	-	-
	Mustard	-258.51	3025.94	-	20113.62

Though the net returns are found to be by and large, remunerative, even though the cultivators use to abstain from cultivating lentil because of fear of risky crops, low and unstable yields on account of pest and diseases and animal attacks on the crop.

CONCLUSION

Lentil is one of the oldest growing crops having high nutritional values. The compound growth rate of area under lentil crop was found to be negative for almost states under study except for Uttar Pradesh, where positive compound growth rate was observed. Similarly, the growth of the crop production and productivity over the period of investigation was found to be positive in all the states under study except Uttar Pradesh due to prolonged dry season and for the last few years, its area, production and productivity have been registered negative. In decomposition analysis, the interaction effect for all the states and nation as a whole was estimated high resulted better productivity of the crop. Despite good returns associated with yield uncertainty, this crop does not compete with the other *rabi* crops grown in the state as evidenced under investigation. Though, the states under study in the country is the main producer of lentil crop, even though this crop fetches low earnings as compared to other competing crops such as wheat and mustard. The comparatively low return from this crop is subject to low productivity on account of susceptibility to disease and pest, marginal land under this crop as well as poor management. Now, the state governments and the policy makers of the region need to come forward to formulate appropriate policy decisions to augment the productivity through evolving new disease and pest resistant varieties, better management practices and good institutional supports. The earnest efforts towards this crop would not only boost the income of the cultivators but also help in narrowing the gap between demand and supply of the crop at state and national level.

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