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Fluctuation in Growth of Area, Yield Production of Barly in Himachal Pradesh

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ABSTRACT

Agriculture growth with stability has been a matter of concern in the strategy of agricultural development in the state in recent years. This paper examines the growth rates of area, production and yield of Barley in twelve districts of Himachal Pradesh. The study is based on secondary data which covers the period of thirty years, from 1978-88 to 2017-18 and period further divided in two sub-periods, first period from 1987-88 to 2002-03 and second period from (2003-04 to 2017-18). The study reveals that during the whole study period production and productively of Barley has been decreased and more than fifty percent distinct shows the negative growth rate in area, output and in yield. The study further reveals that the fluctuations in area and productivity both are the major causes for the fluctuation in production..

1. Introduction

Agriculture has been a way of life and continuous to be the single most important livelihood of the masses. Agricultural policy focus in India across decades has been on self-sufficiency and self-reliance in food grains production. Considerable progress has been made on this front. Food grains production rose from 52 million tones in 1951-52 to 268 million tones in 2017-18 (Agricultural Statistics 2017). Agriculture is main occupation of the people of the Himachal Pradesh and has an important place in the economy of the state. Himachal Pradesh is the only state in the country whose 89.96 percent population lives in rural areas. Therefore dependency on agriculture/horticulture is ominent as it provides direct employment to about 62 percent of total workers of the state. Himachal Pradesh located in attitudes ranging from 450 meters (1,476 ft) to 6,500 meters (21,325 ft) above sea level, Himachal Pradesh is a rather hilly state occupying less than 2 per cent of total geographical area and inhabited by a little more than 1.5 per cent of total population of the country. State accounts for 1.69 per cent of total area in the country and about 0.41 per cent of the net cultivated area. The state produces on average 0.91 per cent of country's food grain output. The share has declined from 0.91 per cent in 1980-81 to 0.65 percent in 2014-15 (RBI, 2015-16). The share in the net sown area in the corresponding period has also declined marginally from 10.27 per cent to 9.78 per cent of total geographical area. The agricultural productivity per hectare is less than national average. This means that the agricultural growth performance in the state has lagged behind the average for the country as whole. Foodgrain production, which was 16.34 lakh metric tonnes during 2014-15 decreased to 16.07 lakh metric tones during 2016-17, and was expected to maintain the level of 2017-18 (Economic Survey 2017-18).

The analysis of the performance of major crop groups since early 1980s shows that the value productivity of traditional crops in Himachal has either declined or stagnated. As a result the agricultural sector has recently failed to meet the requirement of the state. Yield rates of crops, particularly, food crops, are low and possess little growth potential (Kaushik, 1993). The 'new' economic policy advocated withdrawal of the state form the economic sphere, leaving it to the logic of market forces. Small landholders cultivate most of the land in Himachal Pradesh and often have to borrow from various sources for investment in cultivation of crops. There has been general stagnation in the agricultural sector over the last decade or so. The share of the agriculture sector in the gross state domestic product also declined significantly from 47.35 per cent in 1980-81 to 10.00 per cent in 2017-18 (Economic Survey 2017-18)

The declining share of agriculture did not affect the importance of this sector as the state's economic growth still was being determined by the trend in agricultural production. It was the major contributor to the domestic product and had an overall impact on other sectors via input linkages, employment and trade. Some recent studies carried out by economists in different parts of the state provide us with abundant evidence of growing cost of cultivation in Himachal Pradesh (Sharma, 2005; Chand 1996; Chauhan 2002). The diversification of agriculture towards selective high value cash crops including fruits and off-season vegetables, compatible with the comparative advantage of the region, is suggested as a viable solution to stabilize and raise farm income, increase employment opportunities, and conserve and enhance the natural resources, principally land and water (Vyas, 1996). Himachal Pradesh has made tremendous progress in agricultural diversification through fruits and off-season vegetables cultivation. The process of crop diversification to high values crops has gained further momentum in the last one and a half decade, and is spreading to many new areas in the low and mid-hill districts. The area under fruits, which was 792 hectares in 1950-51 with total production of 1200 tones increased to 229202 hectares during 2016-17. The total fruit production in 2016-17 was 6.12 lakh tones. Apple, the dominant fruit crop, constitutes about 49 per cent of the total area under fruit crops and 85 per cent of the total fruit production in the state. Growing of off-season vegetables had also picked up in the state. During 2005-06, 9.30 lakh tones of vegetables were produced, as against 8.32 lakh tones in 2004-

05 and increased to 11.32 tones in 2017-18 (Economic Survey, 2017-18).

The biotechnology policy for Himachal Pradesh was formulated in June, 2001 with a mission "Impetus to economic development of the State through promoting diversified farming of high value cash crops, conservation and commercial exploitation of bio resources and promoting entrepreneurship in biotechnology based industries in the State". The micro level experiences further show that diversification through high value a crop are not only economically beneficial but ameliorates stress on natural resource base (Chand, 1996).

The reasons for such a diverse record may be varied but the regional heterogeneity; peculiar agro-climatic conditions in the state, low use of non-conventional inputs, subsistence farming and relatively small irrigation potential are the most important factors limiting the growth in output and productivity. However, as noted above, hills have inherent potential for agricultural diversification because they have comparative advantage in production of many location specific commodities of high value (Chand, 1995).

2. Data and Methodology

The present study is based upon the time series secondary data collected from various published sources of Himachal Government agencies. The basic data used for the analytical purpose of the study relates to area, output and yield of different crops, and rainfall besides many other agricultural variables. The information pertaining to these above mentioned variables was obtained from various issues of the Annual Season and Crop Reports published by the Directorate of Land Records and the Statistical Outline of Himachal Pradesh published by the Directorate of Economics and Statistics, Shimla, Government of Himachal Pradesh. These publications contain statistical information of different economic variables on district level.

3. Period of Analysis

To estimate the growth, instability, equity and sustainability of agricultural sector in Himachal Pradesh, the study broadly covers the period of thirty years, from 1987-88 to 2017-18. The time period has been further divided into two sub-periods (i) first period from (1987-88 to 2002-03), (ii) second period from (2003-04 to 2017-18). The purpose of dividing the period into two sub-periods is to examine growth, stability and equity in barley during each of these sub-periods.

4. Methodology for Computing Growth Rates

Growth rates are usually computed by fitting functions of time, to time series data on variables such as area, production and productivity etc. The growth rates may be simple arithmetic or compound geometric, and they may be expressed in absolute or percentage terms.

The simplest method of computing arithmetic growth rate of a variable, say production, is to divide the difference in output in the initial period and the final period by the total number of periods i.e. the growth rate, b, is determined as:

Where Y_1 and Y_T are outputs in the initial period and the final period respectively, and T is the total number of periods.

If data are available for all the intervening periods, the percent growth rate (GRp) in the t^{th} period is defined as:

$$GR_{pt} = \frac{Y_t - Y_{t-1}}{Y_{t-1}} \times 100$$

Where t = 1, 2, ---, T.

The average annual growth rate may then be obtained by using appropriate method of obtaining mean, e.g., we may find the arithmetic mean, the geometric mean or the harmonic mean of these growth rates.

Alternatively, we may fit a linear regression by the method of Ordinary Least Squares to the given set of data on production for all the periods. The fitted regression is then used to obtain the average annual growth rate for the whole period. In order to discuss this a little more in detail, we regress.

$$Y_t = \alpha + \beta_t + u_t$$

Where Yt is the production in period't', t is the trend variable and ut is the disturbance term in the model; t = 1, 2, . . ., T. The coefficient

$$\beta = \frac{\delta Y_t}{\delta t}$$

is, in fact, the marginal rate of change in output with respect to time t, and this may be interpreted as the annual growth rate, or constant absolute change in Y per unit of time. Least squares estimate value of β provides the estimated annual growth rate.

5. Results and Analysis

The crop production is determined by agro-climatic factors such as soil type, temperature and rainfall pattern. Besides the agro-climatic factors, other factors such as relative prices of crops expansion of irrigation facility, provision of technological inputs, institutional facility are also responsible for crop production it was observed that. In general there was decadal decrease in the concerned aspects influencing the acreages, productivity and production of Barley crop grown in the respective districts. It is therefore expected that, there should have been corresponding changes in area, productivity and production of crops under consideration, unless certain environmental factors had caused the distortion in these parameters.

Barely ranks fourth after rice, wheat and maize in terms of area and output in Himachal Pradesh. The crop is mainly grown in Kangra, Mandi, Kullu, Shimla and Sirmour districts. Table 1.1 presents the growth rates in area, yield and production of barley and the results of chow-test. Table 1.1 shows that during Period III, area under the crop declined at

the rate of 1.75 per cent per annum, while the yield of the crop increased at 1.66 per cent per annum. The area contraction offset the yield increase and caused the output to decline at the rate of 0.09 per cent, which was, however statistically non-significant. At the district level also due to deceleration in area, majority of the districts witnessed negative output growth rates except Kinnaur, Lahaul-Spiti, Mandi and Solan, which recorded non-significant positive growth rates. Per hectare yield was found to be negative in Kullu and Shimla districts. The growth rate of Bilaspur, Hamirpur, Kangra, Kinnaur, Lahaul-Spiti and Sirmour recorded positive and statistically significant growth during this period. The sub-periods analysis shows, that the area of barley decreased at the rate of 2.71 per cent per annum, which was statistically significant, while the productivity of the crop increased at the rate of 0.96 per cent per annum for the state as a whole. The area contraction more than offset the productivity increase and caused the production to decline at the rate of 1.75 per cent per annum, which is statistically non-significant. The eight districts exhibited negative growth in area, which was statistically significant. The eleven districts showed positive growth in yield, out of which Kangra and Mandi indicated the significant rates. The output growths of seven districts were positive and only one district i.e. Una showed a significant level. In the subsequent period, area under Barely in the state has been reported to decline at a rate of 1.03 per cent per annum, which is statistically significant. The decline in the area coupled with a negative growth in yield to the tune of 1.24 per cent, resulted in negative growth in the output at the rate of 2.27 per cent per year in the state. The eleven districts recorded the negative growth in area, out of them growth rates for ten districts were statistically significant. Only district Kullu recorded positive and significant growth rate in area. The similar growth trends were to be observed in output. Growth rates of output for nine districts were negative, out of which four districts Bilaspur, Hamirpur, Solan and Una growth rates were statistically significant. But there was a significant improvement in the rates of yield in majority of the districts, which contributed to the increase in output of the crop in turn. The eight districts exhibited positive growth in yield, whereas three districts recorded the negative growth rate, which were statistically significant.

Table 1.1 District Wise Growth Rates in Area, Output and Yield of Barley in Himachal Pradesh.

District	Period I (1987-88 to 2002-03)			Period 2 (2003-04 to 2017-18)			Period 3 (1987-88 to 2017-18)			Chow Test (F - Ratios)		
	Area	Output	Yield	Area	Output	Yield	Area	Output	Yield	Area	Output	Yield
Bilaspur	0.31	0.94	0.63	-8.77**	-7.42***	1.35	-4.16***	-2.37***	1.79*	2.59	0.56	0.10
Chamba	-3.29***	-1.81	1.48	-0.30	-2.75	-2.45*	-1.97***	-1.79***	0.18	3.03	0.15	1.75
Hamirpur	-0.84	0.42	1.26	-9.91***	-9.77***	0.14	-3.77***	-2.87***	0.90**	22.17*	14.12*	0.25
Kangra	-3.14***	0.25	3.40**	-1.30**	0.60	1.90*	-2.50***	-0.72*	1.78***	3.03	1.31	1.36
Kinnaur	-2.67***	-0.87	1.80	-3.21***	-0.67	2.54	-2.23***	0.08	2.31***	3.97*	0.15	0.03
Kullu	-3.55***	-3.09***	0.46	4.31*	1.14	-3.17***	-0.97	-1.63***	-0.66	7.55*	1.43	3.97*
Lahul-Spiti	-3.01***	5.08	8.09	-1.53**	-1.21	0.32	-2.76***	2.26	5.02**	3.51*	2.08	0.32
Mandi	-1.89**	0.98	2.87*	-1.58***	4.31	5.89	-1.31***	1.06	2.37	0.81	1.06	1.33
Shimla	-3.77***	-5.74**	-1.97	-2.21***	-2.30	-0.09	-2.38***	-2.53***	-0.15	3.70*	1.45	0.55
Sirmaur	-1.98***	-1.16	0.82	-2.90***	-1.06	1.84	-1.57***	-0.22	1.35**	2.45	0.17	0.04
Solan	1.20	3.98	2.78	-2.02**	-6.55**	-4.53**	-0.30	1.22	1.52	4.30*	3.21	2.57
Una	15.78**	16.91**	1.13	-37.34***	-36.79***	0.55	-11.80***	-9.89**	1.91	11.16*	8.22*	0.03
Himachal Pradesh	-2.71***	-1.75	0.96	-1.03***	-2.27	-1.24	-1.75***	-0.09	1.66	10.25*	0.44	0.52

Note: ***, **, * indicate statistically significant at the 1, 5 and 10 percent confidence levels respectively.
Source: Basic data obtained from Annual Season and crop Reports of Himachal Pradesh, various issues from 1987-88 to 2017-18-06, Directorate of Land Records, Government of Himachal Pradesh.

The analysis of the chow-test indicated that there had been a major change in the growth of area in the state between the two sub-periods. The growth functions of area were statistically different in seven districts. The F-ratios for productivity were found to be non-significant in all districts barring Kullu, Hamirpur and Una districts witnessed change in the pace of growth in production.

The area and output of barley during the period under study (1987-88 to 2017-18), exhibited deceleration. The contraction in the area under barley was due to diversion of the area to wheat and other cash crops. Barley is Un-remunerative and low yielding crop grown in dry-land areas especially in hill slopes. This was the worst affected crop during the two periods both in area and output. The slow growth rate of per hectare yield was due to lack of high yielding variety seeds for the crop.

6. Conclusion

The adverse trend in state's area growth for barley (-1.75), which emerged during the overall period (1987-88 to 2017-18) was most likely due to the diversion of area from these crops to more remunerative crops like wheat, maize and apple which showed a fairly high growth rates in area during Period I and Period II. At the same time an undesirable trend of decline in barley output during Period III emerged. Though the decrease in output growth had been marginal and statistically non-significant yet it certainly provides a cause of concern. In view of fixity of land resources, the growth in crop output, especially in hill areas would almost solely be dependent on improvements in the yield per hectare in future. Yield growth rates of barley moved down ahead significantly during the overall period under study. Occurrence of good monsoons must have played a supporting role in the emergence of this trend. Yet, the pace of growth in overall yields per hectare for barley achieved in the entire study period was fairly moderate at 1.66 per cent. The output growth rate has negative during period III.Simultaneous deceleration in area growth was recorded in the case of barley. Significant deceleration in yield growth in the case of barley under study between the two periods needs attention despite moderate increase in the area under these crops, and points towards unsustainability.

The results of district-wise performance brings out that in terms of the overall performance of barley during Period II in Lahaul-Spiti, Hamirpur, Kullu and Kinnaur recorded positive growth (though insignificant), whereas the remaining districts experienced negative growth. Rates of growth in output of barley in these districts exceeded the state average (1.75 per cent). The negative rate of growth in barley production in Bilaspur, Chamba, Hamirpur, Kangra, Shimla, Sirmour and Mandi was attributable to deceleration in area and yield growth of wheat and barley in these districts. Thus, growth performance of barley was not uniform between different regions of the state. These variations stem mainly from the differences in the physical and climatic conditions. It is interesting to note that in the tribal areas of Kinnaur, Lahaul-Spiti and parts of Chamba, where technology has failed to find a place mainly due to difficult hilly terrain and cold and harsh weather, per hectare yield are contributing towards the decline in output. Reason for this could be decreases poorer infrastructural facilities available in these areas.

To sum up the performance of Himachal Pradesh agriculture revealed that it was a downward movement in yield growth in the majority of the crops, which was instrumental in inducting the transition toward unsustainable growth path. From the policy perspective, it is more important to understand the factors that led to the process of fluctuation of growth rate of agricultural development. These factors operate at different levels viz., growth, stability, and efficiency and equity levels.

In order to improve the growth with stability in production, the important steps needed are:

I. Fluctuation in area and productivity has to be controlled to bring in stability in the output of Barley.
II. Technological change is at the heart of a high growth-strategy. and there is need to evolve new HYVs of crops (especially minor crops like barley).
III. Agricultural commodity prices should be raised to world levels in accordance with corresponding import and export parity prices to prevent an uneconomic resource transfer from agriculture to other sectors of the economy.

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