

Growth Rates and Cropping Pattern Changes in Himachal Pradesh's Agriculture

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Introduction

Reliable estimation of trends in agricultural growth is more than a matter of more academic interest. The estimation of growth rates by crops for any region followed by the explanation on why they differ are crucial for an insight into agricultural development process. This study is an attempt to estimate and analyse the growth rates in area, productivity and output of major crops in Himachal Pradesh during the period 1960/61-1979/80 and also studies the impact of disparate growth rates of crops on the cropping pattern.

No doubt, high yielding varieties (HYVs) were introduced in 1965-66, but even in 1967-68 they accounted for only 2.59 percent of the area under foodgrains. In 1968-69 about 7 percent of wheat area; 1 percent of maize area and 5 percent of paddy area was covered under HYVs. Therefore, in order that the impact of HYVs area is felt on foodgrains output, a minimum coverage is necessary. We have chosen the cut off point as the year in which the coverage of HYVs rose to around 10 percent. We have, therefore, taken 1969-70 as the cut off point for examining the difference in agricultural growth performances. The period 1960-61 to 1979-80¹ has been chosen for analysis and divided into two equal sub-periods; from 1960-61 to 1969-70 and from 1970-71 to 1979-80. This periodization will also enable to see the extent to which the agricultural sector was a constraining in 1960's as compared to 1970's.

Growth of Crop Production

Table 1 gives the estimated trend growth rates for the major crops of Himachal Pradesh for three time periods under review.

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During period I (1960/61 – 1969/70) the trend growth rate of foodgrains output was 3.99 percent and declined to 0.13 percent in period II (1970/71–1979/80) apparently indicating deterioration in the food-grain output during the latter period. Taking a longer time span of period III (1960/61 – 1979/80) the trend of growth rate was 2.29 percent per annum. In absolute terms, the foodgrains output increased at a linear rate of 30.47 thousand tonnes; 1.77 thousand tonnes and 19.02 thousand tonnes during period I, II and III respectively.

The trend growth rate with respect to other pulses during the period 1960/61–1969/70 was negative (-1.24 percent) but was on path of recovery during 1970/71–1979/80 being 4.69 percent. However, the trend growth rate with respect to other pulses was negative (-1.77 percent). Similar results hold true in respect of absolute terms.

Gram and pulses have shown an improvement in their trend growth rate during period II as compared to that observed in period I as the magnitude of the negative growth rates diminished during period II. Further it is a matter of concern that rice, barley, millets, black gram output presents rather a dismal picture, having negative growth rates during period II as compared to that observed during period I. The trend growth rate of the output of the remaining crops, namely, wheat, maize, potato and cereals decelerated in 1970's as compared to 1960's though marginal, barring that of barley and millets where the decline has been substantial. Similar results also hold true in the absolute terms.

Is Growth Decelerating ?

The issue of acceleration or deceleration of growth has been discussed in the literature with the use of dummy variables or test of significance. The following test was applied to examine if the growth rates in the two periods are significantly different from each other:

$$t = \frac{b_1 - b_2}{\sqrt{(S.E. b_1)^2 + (S.E. b_2)^2}}$$

Where b_1 = regression coefficient of output for period I.

b_2 = regression coefficient of output for period II.

SE b_1 = Standard error of b_1

SE b_2 = standard error of b_2

The resulting estimates indicate that out of twelve pairs of estimated growth rates through the regression method, significant differences existed in six pair estimates in the two time periods.² These crops were maize, barley, millets, black gram, cereals and foodgrain.

The variation of output around the trend has been much higher than the estimated trend growth. This has been deliberately cited in terms of growth rates compared with maximum percentage or absolute deviations during the last five years (i. e., from 1975-76 to 1979-80).³ The problem of fluctuations of agricultural output is, therefore, still serious one for the Himachal Pradesh economy.

Changes in Cropping Pattern

During the 20 years period under review, the share of foodgrains in the gross cropped area has declined from 92.52 percent in the triennium 1960-63 to 85.70 percent in the triennium 1977-80, and correspondingly the share of non-foodgrains increased from 7.48 to 14.30 percent. However, the decline in the share of foodgrain has been much more pronounced during 1970's as compared to 1960's. Among the foodgrains, the share of cereals has declined sharply while that of pulses declined only marginally. Decadewise analysis reveals that the share of pulses during 1960's declined marginally but was on the path of recovery during 1970's. However, the entire decline in the share of cereals has been during 1970's. Within the cereals group, the relative share of wheat, millet, rice and barley during the period under review declined substantially, barring that of wheat where the decline has been marginal. Further, decadewise picture reveals that the decline was more pronounced during 1970's. Among the pulses group, the share of gram has improved from 1.95 percent in triennium 1969-73 to 3.27 percent in the triennium 1977-80. However, this improvement has been mostly during 1970's. The performance of black gram and other pulses has been in the opposite direction with relative share having declined from 2.96 to 2.51 and 3.21 to 1.84 percent respectively.

Vegetables accounted for 2.19 percent of the gross cropped area in the triennium 1960-63, but increased to 2.50 percent in the triennium 1967-70 and thereafter declined to 2.50 percent in the triennium 1977-80. The relative share of fruits alone improved perceptively from 0.43 to 8.19 percent. This improvement has been mostly during 1970's. Further more, this improvement has been equally shared between apples and other fruits. The share of oilseeds during the period under review increased from 2.18 percent in triennium 1960-63 to 2.59 percent in the triennium 1967-70 but declined to 2.17 percent by the end of triennium 1977-80. The condiments and spices, though nominal, have shown marginal improvement in their performances. The share of miscellaneous crops declined from 2.39 to 1.5 percent. The decline was more during 1970's though marginal, as compared to 1960's. This also holds true for the individual crops within the miscellaneous crops group.

The distribution of area under different crops in the state has moved in favour of horticultural crops at the expenses of grain crops. Because, they have high pay of avocations more particularly suitable to the hilly terrains and waste lands where food crops cannot be grown.⁴ Besides, this has helped to reduce soil erosion in the catchment of hydro-projects, increase employment potential of agro-based industries and proper utilisation of steep lands which otherwise cannot be put to agricultural uses.

The existence of fluctuations over time implies that we cannot generalise about the underlying trend on the basis of comparison between selected end points. No doubt, these estimates confirm the direction of change between these end points, but they also point to the danger of using such comparisons for any assessment of underlying trends. This can only be done on the basis of the time series as a whole. Accordingly, a linear time trend

was fitted to the proportion of area under different crops. The resulting estimates are reported in Col. 5 to 7 of Table II. These results (Col. 7, Table II) provide a clear evidence of a significant positive time trend in the proportion of area under maize, gram, other vegetables fruits (both apple and other fruits) and condiments and spices. On the other hand, proportion of area under rice, fibres, tea, drugs and fodder has significantly declined during the 20 years period under review. During period I, proportion of area under fodder and condiments and spices other than ginger has considerably declined. Likewise, during period II, fruits (both apple and other fruits and condiments and spices other than ginger has shown positive trend in the relative areas under these crops. It may, however, be noted that out of twenty five pairs of estimated trend values through regression method, significant differences existed in fourteen pair estimates in the two periods. These crops were maize, barley, millets, cereals, potatoes, vegetables, fruits (both apple and other fruits also) condiments and spices, oilseeds, tea, drugs and spices other than ginger.

Is Cropping Pattern Shifted ?

The changes in the cropping pattern can be classified into two types viz. (i) Shifts and (ii) Deviations.

When two or more cropping patterns are compared on arranging the acreage under the same crops of the patterns on an increasing or decreasing order and if they do not exhibit similarity between them 'shifts' is said to have occurred. On the other hand, when differences occur on account of changes within the cropping pattern due to difference in the allocation of land between the same set of crops, then they are taken as 'Deviations.'

There has not been much variations or shifts in the cropping pattern during the period reviewed. However, some deviations do occur as the farmers respond to change in seasonal conditions, price differential and other influencing variables. To test whether there is a shift in the cropping pattern, Kendall's Rank Correlation coefficient was computed. Ranks were assigned to each crop on the basis of its percentage to gross cropped area and correlation coefficient was worked out for each pair of years. All the correlation coefficients were very highly significant.⁶ This indicates that there has not been any shift in the cropping pattern between the years.

Further, the total change over the period 1960-61 through 1979-80 was examined by the test of concordance. The value of the concordance coefficients was computed to be 0.8952 and was significant at 0.01 level. During 1960's and 1970's, the value of the concordance coefficients was computed at 0.9749 and 0.9238 respectively and both these values are highly significant.⁵ Hence, it can be definitely said that there has been no shifts in the cropping patterns between the years or over a period of twenty years.

Growth Rates and their Effect on Cropping Pattern

The level of output growth rate, is jointly determined by the growth rate in area and

the growth rate in yield. Following this hypothesis that farmers are rational in their production behaviour and that they maximise their net returns, we can state that their input allocations are based on expectations relating to relative prices and relative yield from the concerned crops relative to substitutable crops. With this premise, in view, we attempt to examine the effect of growth rates in crop output on the cropping pattern.

The largest output growth rates during the period III was in barley (3.21 percent) followed by black gram (3.01 percent) and wheat (2.81 percent). Contributions to the output growth in these crops came solely from its yield growth. During period I the largest output growth was in barley (10.29 percent) followed by black gram (7.52 percent) and maize (5.34 percent). Here again, the output growth in these crops came solely from its yield growth. Likewise, during period II, largest output growth in other pulses (4.69 percent) followed by potato (1.37 percent) was also solely from its yield growth.

Though crops like potato, rice, barley, millets, other pulses and black gram recorded positive growth rates in their yield, the area under these crops did not show any increase. On the contrary, these suffered in their relative importance in the cropping pattern of the state.

Millets and other pulses recorded negative growth rates in their output, mainly due to the corresponding set backs in their area growth during twenty years period under study. It is to be noted that yield growth in these crops was quite low. In the absence of higher yield expectations from these crops, the area allocated to them both in actual and relative terms in the cropping patterns declined over the twenty years under study. Likewise, barley and millets recorded negative growth rates during period II, mainly, due to set backs in the area growth. However, in period I gram recorded negative growth rate following mainly corresponding negative growth rates in their yield. Even the application of component analysis reveals that despite the variations of component elements, the common feature that emerges from the decomposition analysis is that a significant portion of output growth is explained by yield increases.⁶

Conclusion

The process of development in Himachal Pradesh unmistakably reflects the increase of subsistence agriculture and hence the growing disparity in the farming conditions and farm income between the States. Due to the subsistence agriculture and lack of irrigation facilities,⁷ one crop cannot be substituted for the others. Hence, there has not been any shifts in the cropping pattern of the State between the years or over a period of twenty years. The main change that occurred in the cropping pattern of this State during the period 1960-1980 has been the perceptible improvement in the share of fruits. Because these are high pay of avocations more particularly suitable to the hilly terrains and waste lands where food crops cannot be grown. This improvement has been mainly during 1970's and have been equally shared between the apples and the other fruits.

Table I

Per Annum Trend Growth Rates of Different Groups in Himachal Pradesh-Periodwise

Crop	Period	Linear Function		Log Function		Growth rate (percent)
		Regression Coefficient (1000 tonnes)	't' value	Regression Coefficient	't' value	
1	2	3	4	5	6	7
Wheat	I	6.8927	1.7399	0.0285	1.5797	2.89
	II	0.7503	0.1099	0.0019	0.0925	0.19
	III	7.7309***	3.9442	0.0277***	4.0788	2.81
Rice	I	1.9278	1.4835	0.0187	1.3725	1.89
	II	-0.1606	0.0803	-0.0035	0.1855	-0.35
	III	1.0794*	1.8815	0.0098	1.7295	0.99
Maize	I	18.0333***	7.1256	0.0521***	6.8933	5.34
	II	4.8278	0.0808	0.0128	0.9268	1.29
	III	9.1933***	5.5925	0.0245***	5.5423	2.48
Barley	I	3.8048**	2.9930	0.0980***	3.3623	10.29
	II	-0.3381	1.1358	-0.0273	1.0836	-2.69
	III	1.0939**	2.1573	0.0316**	2.7086	3.29
Millets	I	0.2810	0.6254	0.0119	0.6458	1.98
	II	-2.3532**	2.3371	-0.0868*	2.0837	-8.31
	III	-0.4830	1.5544	-0.0259**	2.1177	-2.56
Black Gram	I	0.4587***	11.2383	0.0725***	9.0708	7.58
	II	-0.0060	0.0976	-0.0010	0.1180	-0.09
	III	0.2027***	5.9395	0.0297***	5.6812	3.01
Gram	I	-0.3987***	6.2465	-0.0778***	6.1582	-7.49
	II	-0.1553	0.2504	-0.0196	0.5286	-1.84
	III	0.2995	1.5739	0.0166	1.2601	1.67
Other Pulses	I	-0.0693	0.8435	-0.0125	0.9871	-1.24
	II	0.2058	1.3524	0.0459	3.9868	4.69
	III	-0.0919*	1.8880	-0.0179	1.4090	-1.77
Potatoes	I	3.1436	1.6106	0.0393	1.1826	4.01
	II	0.8014	0.7627	0.0136	0.8630	1.37
	III	1.4577***	2.6852	0.0239**	2.7218	2.42
Cereals	I	30.9796***	4.8465	0.0412***	4.7211	4.21
	II	1.7261	0.1999	0.0014	0.1589	0.14
	III	18.6140***	0.0696	0.0229***	6.0954	2.32
Pulses	I	-0.5064***	3.6867	-0.0203***	3.7379	-2.01
	II	0.0564	0.0862	-0.0015	0.0864	-0.15
	III	0.4113**	2.5684	0.0133**	1.4042	1.34
Foodgrains	I	30.4732***	4.7871	0.0392***	4.6628	3.99
	II	1.7726	0.1982	0.0023	0.0510	0.13
	III	19.0253***	6.1183	0.0226***	6.1588	2.29

*** Coefficient Significant at 0.01 level for a two tail test.

** Coefficient Significant at 0.05 level for a two tail test.

* Coefficient Significant at 0.10 level for a two tail test.

Table II
Cropping Pattern in Himachal Pradesh : 1960-61 to 1979-80

Crop	Proportion of Area in			Estimated Coefficients on Time in period		
	1960-63	1967-70	1977-80	I	II	III
1	2	3	4	5	6	7
Wheat	14.69	35.57	34.01	+0.066	-0.075	+0.009**
Maize	26.70	27.77	27.98	+0.174**	+0.035	+0.083***
Rice	11.89	10.93	9.82	-0.125***	-0.172	-0.1249
Barley	5.21	4.49	3.75	-0.037	-0.113*	-0.078***
Millets	7.91	95.19	2.52	-0.067	-0.376***	-0.202***
Cereals	84.40	84.40	78.08	+0.002	-0.768***	-0.322***
Black Gram	2.96	22.22	2.51	-0.067	-9.079	-0.012
Gram	1.59	2.00	3.27	+0.003	-0.012	+0.075**
Other pulses	3.21	2.77	1.84	-0.093	+0.004	-0.131**
Pulses	8.12	6.99	7.62	-0.157	-0.087	+0.189
Foodgrain	92.52	91.39	85.70	-0.155*	-0.855	-0.389
Potato	1.74	2.01	1.50	+0.060	-0.021***	-0.013***
Other Vegetables	0.45	0.49	0.62	+0.007*	-0.020	+0.047
Vegetables	2.19	2.50	2.12	+0.052***	-0.003	-0.009
Apples	0.15	0.87	4.13	+0.107***	+0.429***	+0.240***
Other Fruits	0.28	0.28	4.06	-0.001	+0.529***	+0.222***
Fruits	0.43	1.15	8.19	+0.107***	+0.958***	+0.457***
Ginger	0.18	0.19	0.25	+0.001	+0.004	+0.004
Other C & S	0.11	0.08	0.13	-0.004**	+0.007***	-0.0001
Condiments &						
Spices	0.29	0.27	0.38	-0.033**	+0.011***	+0.004**
Oilseeds	2.18	2.59	2.11	+0.054	-0.046***	-0.005***
Fibres	0.24	0.14	0.09	-0.002	-0.004***	-0.006**
Tea	0.49	0.46	9.34	+0.004	-0.017***	-0.007***
Drugs	0.51	0.56	0.39	-0.003*	-0.017***	-0.014***
Fodder	1.05	0.94	0.68	-0.022	-0.027***	-0.024

*** Coefficient is significant at 0.01 level for a two tail test.

** Coefficient is significant at 0.05 level for a two tail test.

* Coefficient is significant at 0.10 level for a two tail test.

Table III
Compound Growth Rates of Area : Yield : And Output of Major Groups in Himachal Pradesh : Cropwise
(Per cent per annum)

Crops	Period I			Period II			Period III					
	A	Y	O	A	Y	O	A	Y	O	A	Y	O
1	2	3	4	5	6	7	8	9	10			
Wheat	+1.07	+1.82	+0.85	+0.85	-0.66	+0.19	+0.88	+1.93	+2.91			
Rice	-2.20	+1.09	+1.89	-0.59	+0.24	-0.35	-0.26	+1.25	+0.99			
Maize	+1.53	+3.81	+5.34	+0.95	+0.34	+1.29	+1.21	+1.27	+2.48			
Barley	+0.08	+10.21	+10.29	-1.67	-1.02	-2.69	-0.87	+4.08	+3.21			
Millets	-0.37	+2.35	+1.98	-8.75	+0.42	-8.31	-3.84	+1.28	-2.56			
Black Gram	-2.34	+9.86	+7.52	-1.75	+1.66	-0.09	+0.43	+2.58	+3.01			
Gram	+0.99	-8.78	-7.49	+0.01	-1.95	-1.94	+3.82	-2.15	+1.67			
Other Pulses	+1.71	+0.53	-1.24	+1.18	+3.18	+4.69	-3.53	+1.76	-1.77			
Cereals	+0.89	+3.32	+4.21	+0.12	+0.02	+0.14	+0.50	+1.82	+2.32			
Pulses	-1.15	-0.86	-2.01	-0.15	NIL	-0.15	+0.16	+1.18	+1.34			
Foodgrain	+0.70	+3.29	+3.99	+0.10	+0.03	+0.13	+0.46	+1.83	+2.29			
Potato	+3.27	+0.74	+4.01	-0.30	+1.67	+1.37	-2.10	+4.52	+2.42			

A=Area, Y=Yield O=Output.

A significant portion of output growth is explained by yield increases. But the problem of fluctuation of agricultural output is still very serious for the Himachal Pradesh economy. Moreover, sharp deceleration in output growth rate has been observed during seventies in comparison to sixties. If the conclusion is accepted that agricultural growth in the period 1960-61 to 1969-70 was higher than in the period 1970-71 to 1979-80, then agricultural sector as a constraint to the planning for a higher growth is still a very serious problem.

It is, therefore, quite clear that agriculture in this State cannot register progress unless irrigation is provided over much wider areas and the new seeds are suitable and economical for adaptations under unirrigated and rainfed conditions. Assured water supply will not only increase the supply of foodgrains by bringing in more areas under BYVs but farmers too would adopt better cropping pattern thereby supplementing cash crops with the food crops.

Foot Notes and References

1. The geographic shape of Himachal Pradesh as it exists today came into being in 1966. The entire data used for the analysis in the paper relates to the new Himachal Pradesh.
2. Due to constraints of space, the results are not given in the paper. Interested readers can have the same from the author.
3. Maximum deviations from the trend during the last five years was -76.74, -29.19, +42.01, +10.57, +5.23, -7.24, -0.28, +24.28, +158.04, +6.87 and +158.72 thousand tonnes for Wheat, Rice, Maize, Barley, Millets, Blackgram, other pulses, potatoes, cereal, pulses and foodgrains respectively.
4. Equally important fact for more allocation of area under fruits was that world Bank has extended assistance for the establishment of an Apple Marketing and processing Project at a cost of Rs. 163.1 million. The Project envisages the establishment of 10 parking and grading, houses; five cold storages, one fruit processing plant and improvements of more than 400 Kms. of roads etc. Moreover, the state government keeping in view the roads plays a key role in the process of economic development, set up autonomous corporation by amalgamating the Himachal Government, Transport and Mandi Kulu Road Transport Corporation for maintaining and extending the net work of roads.
5. The value of Chi-square was worked out at 175.6, 166.3 and 322.3 respectively for the period I, II and III respectively.
6. Singh, D. V., "A component Analysis and Value Productivity Growth of Important Crops in Himachal Pradesh.", *Agricultural Situation in India*, Vol. 36, No. 6, Sept., 1981, pp. 479.
7. Only 9.5 percent of the gross area was irrigated during 1970's.