TRENDS AND DECOMPOSITION OF MAJOR FOOD CROPS IN HIMACHAL PRADESH: A CASE STUDY OF KINNAUR DISTRICT

Lokesh
Ph. D. Research Scholar
Department of Economics
H. P. University Shimla, (India)

The present paper attempts to examine the growth performance of major crops and identification of factor which contribute to output of these crops in Kinnaur district over period 1980-81 to 2015-16. This paper attempted to identify these factors by application of decomposition analysis with reference to area, yield and interaction between them. The study highlight declining trend in area and yield of all crops is mainly attributable to the shifting of area in favour of fruits, and off-season vegetables which have become attractive and more remunerative alternatives for increasing income and generating employment in the temperate regions. The decomposition analysis brought out that area effect was major source of increase in output during period I. Interaction and yield effect contributed towards output for pulses and cereals in during the same period. In period II contribution of yield dominated the output of rice, pulses and foodgrains. For wheat, maize, barley and cereals area contributed most of the increase in output. In period III area contribution was more for wheat, maize, barley and cereals. Most of the increase in output of pulses and foodgrains in period III was contributed by interaction effect. In case of rice increase in output was brought about by yield effect alone. However there are significant variations in the relative shares of these components in different time periods.

Keywords: Area, Growth, Output, Yield, and Decomposition

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I
BACKGROUND

Agriculture is one of the important economic and livelihood activities in the state of Himachal-both from the perspective of number of people involved in it as well as the contribution to the gross domestic product of the state is concerned. In the year 2017-18 agriculture contributes 9 per cent of total gross state domestic product and provides employment to 62 per cent of the total workers of the state economy (Economic Survey, 2018-19). In Himachal Pradesh 89.96 per cent population resides in rural area which manifests the rural character of the state economy. The state is also suitable for cultivation of horticulture and off-season vegetable which can further add to the state domestic product. Due to this particular suitability for horticulture and off-season vegetables state has experienced shifting of land in favour of these crops.

Kinnaur lies nestled in Western Himalayan region having altitude of 681 meters to 2350 meters which is high hills temperate zone of Himachal Pradesh suitable for the cultivation of agriculture and horticulture crops. According to the census 2011 36.82 per cent of the people were engaged in agriculture sector. Sloppy and small size of farm in the district makes it difficult to increase irrigation facility equally throughout the district. Total area under crops in 2016-17 was 9502 hectare (Statistical Summary, district, Kinaur 2017-18). Major crops grown in the districts are wheat, maize, barley, potato and pulses. The climatic conditions are such that the area is suitable especially for apple, pears, almond, walnut, apricot and pinus gerardiana popularly known as chilgoza (locally known as neoza, noosa in Kinnaur) production. In the year 2017-18 total area under horticulture crops was 12717.64 hectare and production was 113524.685 metric tons. Out of the total area (640.1, 000 hectare) cultivable land is only 7.07 thousand hectare and net area sown is 7.55 thousand hectares and gross cropped area is 9.02 thousand hectare in 2017-18. Net irrigated area is 4.8 thousand hectare and gross cropped area is 5.7 thousand hectare. 2.7 thousand hectare area is rainfed

(Statistical Summary, district Kinnaur, 2017-18). One of the important district of the Himachal Pradesh having the area of 11.50 per cent of the total geographical area of the state and account for the 1.22 per cent population of the sate (Statistical Year Book H.P., 2017-18).

The paper is organized in six sections. The first section provides background of the district. The second section provides objectives, data and methodology. Cropping pattern changes, area under crops and yield of the crops is presented in third section. The trends in agricultural growth in area yield and output in Kinnaur is presented in the fourth section. The fifth section discusses sources of output growth through decomposition analysis. Concluding remarks are made in the last section of the study.

II
OBJECTIVES, DATA AND METHODOLOGY

The objectives of the paper are:

1. To estimate the growth trends of area, output and yield of major crops district and;

2. To measure the relative contribution of area and yield to the change in output.

Data and Methodology

The study is based on secondary sources of data obtained from published documents of Government of Himachal Pradesh, Directorate of Land Records, Directorate of Agriculture and Directorate of Economics and Statistics, Himachal Pradesh. The triennium average has been computed in order to minimize the impact of inter-annual fluctuations in the area, output and yield important crops. The district has a diversified cropping pattern in different regions depending upon agro-climatic conditions and hence all the important crops have been selected for the present analysis. The selection of crops for the study is dictated by the availability of data. The present study is conducted for whole district for the period 1980-81 to 2015-16. The entire study is split into two sub periods, period I: 1980-81 to 1997-98: period II 1999-99 to 2015-15 and overall period: 1980-81 to 2015-16.

Growth Trend: Pace of Agriculture development of a region can be ascertained through measuring growth in area, output and productivity. In the present analysis, compound growth rates of area, output and yield of the major crops for each period is measured. If the time-series data are available at discrete points of time (as is usual in economic time series) it is than possible to determine growth rate by using the compound interest rate formula:

$Y = \log a + t \log b$

r = [(antilog b-1) *100] = Compound growth rate (in per cent)

This may be expressed in percentage term by multiplying r by 100.

Where, r = Compound growth rate (CGR)

Y = time series data of area/ production / yield of crop concerned in the year

a = intercept

b = 1+ r / 100

r = refers to percentage rate of compound growth rate of area/ production/ yield crop per annum

t = time period in year

To test whether 'r' differs from zero significantly, its standard error has been calculated using

$$SE(r) = \frac{100}{Log_{10}^{e}} \sqrt{\frac{\sum_{t=1}^{n} \log Y_{t2} - \frac{(\sum_{t=1}^{n} \log Y_t)^n}{n} - (\log B)^2 \sum_{t=1}^{n} (t-\bar{t})^2}{(n-2)\sum_{t=1}^{n} (t-\bar{t})^2}}$$

Where 't' follows student's t-distribution with (n-2) degrees of freedom.

Decomposition Analysis: In order to have a broad spectrum of the relative contribution of area and yield decomposition technique is employed as under:

$$P = A * Y$$

$$(P + \Delta P) = (A + \Delta A) * (Y + \Delta Y)$$

$$\Delta P = \Delta A\, Y + \Delta Y\, A + \Delta A\, \Delta Y$$

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

Where,

ΔP = Change in output between 1980-81 and 1997- 98

ΔA = Change in area between 1980-81 and 1997-98

ΔY = Change in yield between 1980-81 and 1997-98

III

Cropping Pattern of Major Crops

The Table 1 clearly manifests that there has been substantial decline in the area cultivated under wheat, maize barley and increase in the area under pulses and marginal increase in the area of rice. In the year 1980-81 around 96.61 per cent of the gross cropped area in the district was under cereals which have drastically dropped to 20.60 per cent in 2015-16. This area has been either diverted towards pulses, off-season vegetables either towards horticulture crops. Form the table it can be observed that the area share of pulses has increased from 2.70 per cent in 1980-81 to 14.61 per cent in 2015-16. It can be found that there has a change in cropping pattern towards the production of pulses, off-season vegetables and horticulture crops and these are the major drivers of growth during the recent times.

TABLE 1. RELATIVE SHARES OF MAJOR CROPS IN GROSS CROPPED AREA

(per cent)

Crops	1980-81	1990-91	2000-01	2010-11	2015-16
Rice	0.32	0.31	0.34	0.18	0.53
Wheat	14.24	10.96	4.07	1.70	1.62
Maize	1.76	5.71	4.40	2.42	0.78
Barley	24.48	18.50	14.90	9.41	6.53
Cereals	96.61	74.14	50.41	28.79	20.60
Pulses	2.70	9.91	13.79	15.68	14.61
Foodgrains	99.31	84.06	64.19	44.47	33.64

Source: Compiled from various issues of *Annual Season and Crop Reports of Himachal Pradesh*.

Area under Major Crops

Area cultivated of all the major crops has declined drastically over the study period except for the pulses (Table 2). The average area under rice, wheat, maize barley, cereals and foodgrains has witnessed substantial decrease during the period 1999-2016 to the 1980-98. Over the period of time highest decline was observed in the case of wheat (68.07 per cent) followed by barley (39.01 per cent) and least decline was found for rice (7.69 per cent) cultivated area. Major gainer was pulses which has registered 121.17 per cent increase in cultivated area. It can be concluded that people of the district has shifted their focus in favour of more remunerative crops like as pulses and horticulture due the suitability of the climatic conditions.

TABLE 2. AVERAGE AREA UNDER MAJOR CROPS IN KINNAUR DISTRICT

Crops	1980-98	1999-2016	Percent change
Rice	26	24	-7.69
Wheat	1090	348	-68.07
Maize	467	297	-36.40
Barley	1876	1144	-39.01
Cereals	7294	3958	-45.73
Pulses	718	1588	121.17
Foodgrains	8012	5231	-34.71

Source: Compiled from various issues of *Annual Season and Crop Reports of Himachal Pradesh*.

Note: Area presented in 000 hectare.

Yield Performance of Major Crops

Over the period of study yield of the major crops, grown in the district has registered whopping increase (Table 3). Among these pulses is a relatively major gainer in terms of yield during the period as compared to other crops. Wheat stands out as the best performing crop in terms of increase in yield among the cereals. The average yield level of wheat has increased remarkably 930 per hectare kg during 1980-98 to 1540 per hectare kg during 1999-2016.

TABLE 3. AVERAGE YIELD OF MAJOR CROPS IN KINNAUR DISTRICT

Crops	1980-98	1999-2016	Per cent change
Rice	1190	1390	16.87
Wheat	930	1540	65.59
Maize	1690	2060	21.89
Barley	1210	1560	28.93
Cereals	760	1150	51.32
Pulses	290	550	89.65
Foodgrains	720	950	31.94

Source: Compiled from various issues of *Annual Season and Crop Reports of Himachal Pradesh*

Growth Performance of the District

The growth rates of major crops in Kinnaur district over period of time are presented in Table 4. The results of analysis exhibits a declining trend in area under almost all crops barring maize and pulses which recorded significant increase area under these crops in period I. Pulses recorded as high as 9.16 per cent increase in area in this period. This may be due to diversion of area towards pulse production because of the suitable climate for crop. Yield performance of the crops in this period was marginal or negative in case of majority crops. Highest decline was found in the case of pulses to the magnitude of 9.53 per cent during period I. The cumulative effect of substantial decline in yield and area reduced the output during the same period except for maize which registered increase in output at the rate of 3.06 per cent. During period II substantial decrease was found in area of all major crops, pulses being only exception where area recorded significant growth in area. Yield rates performed substantially well for pulses and registered very high significant growth of the magnitude of 6.75 per cent, moderate and significant for remaining crops. Output performance of all crops was substantially horrible because of whopping decline in output.

IV

TABLE 4. GROWTH RATES OF AREA, OUTPUT AND YIELD OF MAJOR FOOD CROPS IN KINNAUR DISTRICT

Compound growth rates (per cent per annum)									
Crops	Period I 1980-81 to 1997-98			Period II 1998-99 to 2015-16			Period III 1980-81 to 2015-16		
	A	Y	o	A	Y	o	A	Y	O
Rice	-0.06	-1.01	-0.96	-10.25	1.81*	-8.75	-2.58	0.89**	-1.61
Wheat	-4.33	-1.02	-5.35	-8.43	-1.03	-9.45	-6.44	2.05***	-4.55
Maize	1.46***	1.51***	3.06***	-9.41	1.46	-8.06	-3.39	1.34***	-2.10
Barley	-2.31	1.53**	-0.82	-5.40	2.59**	-3.00	-3.03	1.80**	-1.33
Cereals	-4.06	0.56	-3.53	-2.89	1.65**	-1.25	-3.53	2.45***	-1.23
Pulses	9.16***	-9.53	-0.36	1.87**	6.75***	8.61***	5.64***	5.47*	11.42***
Foodgrains	-2.59	0.49	-2.24	-3.45	2.78**	-0.67	-2.43	2.11***	-0.37

Notes: 1. ***, **, * indicates statistically significant at the 1, 5 and 10 per cent confidence levels respectively.

2. 'A' refers to area, 'Y' refers to yield and 'O' refers to output.

Source: Basic data obtained from *Annual Season and Crop Reports of Himachal Pradesh*, various publications.

During the period pulses being the only exception which registered very high significant growth of output at the rate of 8.61 per cent. Period III is just replica of period II where decline in area under is substantially high barring the pulses which recorded 5.64 per cent significant growth in area. Yield performance of all the crops was highly significant and positive and highest growth was found in case of pulses. Output growth of this period for all the crops remained negative except for pulses where output increased highly significantly at the rate of 11.42 per cent during this period. The declining trend in area and production could be mainly attributable to the shifting of area in favour of fruits, and off-season vegetables which have become attractive and more remunerative alternatives for increasing income and generating employment in the temperate regions of the district. This could also be attributed to inappropriate government policy along with the unfavorable climatic conditions which force people to divert their land for more suitable crops which can earn high returns.

Components of Change in Major Food Crops

The relative contribution of area, yield and their interaction to change in output of crops is presented in Table 5. There are significant variations in the relative contribution of different components in the district during all the periods under study. The period wise decomposition of output of crops revealed that growth in production during period I was mainly due to area expansion in favour majority crops barring cereals and pulses. In case of pulses it is interaction effect which made immense contribution toward the output and in case of cereals it yield effect which contribute maximum in output.

V

TABLE 5. COMPONENTS OF CHANGE IN AVERAGE PRODUCTION OF MAJOR FOOD CROPS IN KINNAUR DISTRICT

(per cent)

Crops	Effect	Period I 1980-81 to 1997-98	Period II 1998-99 to 2015-16	Period III 1980-81 to 2015-16
Rice	Area	366.03	-64.73	-148.44
	Yield	-333.03	224.64	400.78
	Interaction	67.35	-59.90	-152.34
Wheat	Area	90.75	94.72	101.17
	Yield	17.01	19.50	-9.72
	Interaction	-7.76	-14.23	8.55
Maize	Area	77.43	109.84	117.85
	Yield	14.61	-52.72	-65.26
	Interaction	7.96	42.88	47.41
Barley	Area	163.54	99.03	3318.55
	Yield	-93.05	2.21	-3659.41
	Interaction	29.51	-1.23	440.86
Cereals	Area	19.10	233.89	149.24
	Yield	82.07	-218.53	-134.58
	Interaction	-1.17	84.64	85.34
Pulses	Area	-558.50	3.27	7.36
	Yield	153.54	80.60	19.43
	Interaction	504.96	16.13	73.21
Foodgrains	Area	159.34	-646.59	380.20
	Yield	-96.88	1242.03	-802.64
	Interaction	37.53	-495.44	522.44

Source: Basic data obtained from *Annual Season and Crop Reports of Himachal Pradesh*, various publications.

Interaction effect contributed immensely towards increased output in the range of 504.96 per cent to 7.96 per cent during period I. Against this, the yield effect has contributed in case of rice, pulses and foodgrains in period II, while for wheat, maize, barley and cereals growth in output was once again contributed by area expansion. The area effect has contributed in the range of 233.89 per cent to 94.72 per cent. In case of rice and foodgrains it is yield effect which dominated the output in this period. During period III, area expansion along with the interaction effect contributed immensely towards the growth of output in case of

wheat, maize, barley, cereals and foodgrains. For the rice it is yield effect which contributed substantially to the growth of output. In case of pulses highest contribution was made by interaction effect alone towards crop output.

VI

CONCLUSIONS

The foregoing analysis clearly demonstrated the declining trend in area for all crops is mainly attributable to the shifting of area in favour of fruits, and off-season vegetables which have become attractive and more remunerative alternatives for increasing income and generating employment in the temperate regions of the Kinnaur. It is worth mentioning that a small shift in crop pattern to a suitable crop area can lead to prodigious increase in output and income of the farmers. Decreasing trend in yield is attributable to failure introduce reforms in the form of using of high yielding varieties, increased use of fertilizers, modern farm practices coupled with biological packages and state intervention in the farm sector in Kinnaur district over the period of time.

The decomposition analysis examined the relative share of the major components, viz., area, yield and interaction of area and yield which contributes in crop output. The analysis brought out that area effect was major source of increase in output during period I except for cereals and pulses where most of the increase in crop output was either contributed by yield effect or either by interaction effect. In period II contribution of yield was more for rice, pulses and foodgrains and for crops wheat, maize and barley it is area again which contributed towards crop output in the district. Most of the increase in case of output of pulses and foodgrains was brought about by interaction effect alone during period III. During the same period area contributed most of the increase in output of wheat, maize, barley and cereals. In case of rice it is yield effect which dominated the crop output during the period III. The increased role of area in crop output clearly indicates the failure to adopt the reforms in agriculture sector, more attention towards horticulture crops and harsh climatic conditions not suitable for these crops.

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