RESEARCH ARTICLE

GROWTH AND INSTABILITY OF POTATO CULTIVATION IN HIMACHAL PRADESH

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ABSTRACT

The paper analyses the growth and instability in terms of area, production and productivity of potato in Himachal Pradesh. The growth was examined by Compound growth rate and Simple growth rate. The study relates to 1997-98 and 2017-18 time periods. The area under potato registered positive growth rate throughout the period in Himachal Pradesh. Potato is a major crop cultivated in Himachal Pradesh. The share of potato area in Himachal Pradesh to other crop area increased from 69.98 to 86.30 per cent in 2017-18. With the introduction of short duration varieties, there was an increase in productivity. Trend and instability analysis in the area, production and productivity of tomato for a period of 20 years were carried out. The estimated trends in the area, production, and productivity of potato, using semi log function revealed that there was a significant increase in an area with a compound annual growth rate of 1.05 per cent, the significant increase in production by 2.60 per cent and a significant increase in productivity by 1.54 per cent. Cuddy-Della Valle index provides the best estimates and instability was found to be more in productivity (18.87 per cent).

INTRODUCTION

Agriculture is considered as backbone of the economy. This is because it contributes to economic development in at least four ways: product contribution i.e. making available food and raw materials; market contribution i.e. providing market for goods produced by other sectors; factor contribution i.e. making available labour and capital to the non-agricultural sector and it also leads to foreign exchange earnings from the export of agricultural items. Indian agriculture is mostly dependent on rainfall whose variability in time and place has adverse effect on agricultural output. Agriculture growth and instability has remained subject of intense debate in the agricultural economics. While the need for increasing agricultural production or growth is obvious, the increase in instability in agricultural production is considered adverse for several reasons. It raises the risk involved in farm production and affects farmers' income and decisions to adopt high paying technologies and make investments in farming. Instability in production affects price stability and the consumers, and it increases vulnerability of low income households to market. Instability in agricultural and food production is also important for food management and macroeconomic stability.

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Instability in agricultural production is on the rise due to several factors such as erratic rainfall pattern, low irrigation coverage, and increase in frequency and severity of natural disasters. Instability is a very essential characteristic of agriculture. Since agriculture is dependent on weather conditions, the area, production and yield of the crops are subject to significant variations over time. This study aims at studying the growth and instability in potato cultivation of Himachal Pradesh.

REVIEW OF LITERATURE

A general review of literature of the period shows that the researchers were very much interested in the growth and instability of potato cultivation. Harshita Tewari *et al.* (2017) conducted a study on growth and instability in area, production and productivity of wheat in Uttar Pradesh. Cuddy Della Valle Index and Decomposition analysis were done for the period 1990-91 to 2013-14. The highest productivity was found in western region and lowest in Bundelkhand region. Also, there was high instability in production and productivity as compared to area under wheat and yield effect was found to be the dominant in the growth of production. Ahmad *et al.* (2018) conducted a study on economic analysis of growth, instability and resource use efficiency of sugarcane cultivation in Uttar Pradesh, Uttrakhand and Gujarat based on secondary data from 2000-2001 to 2015-16 collected from various secondary sources.

The annual compound growth rates and instability indices were used as statistical tools, formula suggested by Cuddy-Della Valle, and resource use efficiency using Data Envelopment Approach (DEA) were computed. They concluded that the area under sugarcane was stable in the states like Uttar Pradesh, Uttrakhand and Gujarat. On the other hand the yield of sugarcane recorded almost stable in Uttar Pradesh, Uttrakhand and Tamil Nadu. Technical efficiency at national level in sugarcane production was found 66 per cent which indicated that the production of crop may further be raised by 34 per cent with the available technology. Potnuru *et al.* (2018) studied the growth performance of area, production and productivity of ginger in India based on time series data from 1997-98 to 2016-17 collected from various secondary sources. The performance of ginger was examined by estimating the growth rates and instability index of area, production and productivity of ginger. The results revealed that, compound growth rates for area, production and productivity for period of 20 years were found to be positive and significant at both 1 per cent and 5 per cent level of probability. The instability in ginger productivity exhibited less variation than area and production over the years.

Objective of the study: To analysis the growth and instability in area, production and productivity of potato cultivation.

Hypothesis of the study

Null Hypothesis H_0: There has been no instability in the area, production and productivity of potato crops over the years.

Alternative hypothesis H_1: There has been instability in the area, production and productivity of potato crops over the years.

DATA SOURCE AND METHODOLOGY

Study was carried out in districts of Una and Solan and these have been selected purposively for conducting the present empirical verification on the growth and instability of tomato cultivation in Himachal Pradesh. The study is based on primary data. The required primary data has been collected with the help of pre-tested schedule from 309 sample households of 20 villages during 2017-18 selected randomly from the ten development blocks of the two district, with the help of pre-tested schedule information, area, production, productivity and resource use efficiency have been recorded from the survey. The statistical tools have been analyzed through simple percentage, average method and bar diagram.

Compound Annual Growth Rate: (g) is used to analyze temporal changes in area, production and productivity of cash crops.

$$Y_t = ab^t e^{ut}$$

Where

Y_t = Dependent variable in period t (Area / Production / Productivity)
a = Intercept
b = Regression coefficient (1+g)
t = Years which takes values, 1, 2, ...n.
u_t = Disturbance term for the year t.

The equation will be transformed into log linear form for estimation purpose. The Compound Annual Growth Rate in percentage will be computed using the relationship (g) CAGR = Ending Value/ Beginning Value (1/ Total Number of year) - 1 (Veena, 1996). The instability in the growth is measured by eliminating the trend component from the series. To measure the instability in the growth of area, production and productivity of cash crops Cuddy and Della Valle Measure of Instability is used as

Instability Indices = C.V. $(1-R)^2$

Coefficient of Variation is calculated by using the formula

C.V. = S.D. /Mean X 100
S.D. = x^2/N

The agricultural instability can be measured by different methods, such as the coefficient of variation (CV), dispersion and Cuddy Della Valle Index (CDI) etc. The present study applies the Cuddy Della Valle Index for measuring the instability. Cuddy Della Valle index first de-trends the given series and gives a clear direction about the instability. The use of coefficient of variation as a measure to show the instability in any time series data has some limitation. 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. As against that, Cuddy-Della Valle index attempts to de-trend the CV by using coefficient of determination (R^2). Thus it is a better measure to capture instability in agricultural production. A low value of this index indicates the low instability in farm production and vice-versa. CDVI was originally developed by Cuddy and Valle (1978) for measuring the instability in time series data that is characterized by trend.

RESULTS AND DISCUSSION

Estimation Annual Compound Growth Rate in Area, Production and Productivity of Potato cultivation: Agricultural growth and instability is a very essential characteristic of agriculture. Since agriculture is dependent on weather conditions and the area, production and productivity of the crops are subject to significant variations over time. This study aims at studying the growth and instability in the cash crops of Cuddy Della Valle instability index has been calculated for all the crops. The entire study period from 1997-98 and 2017-18. Several fluctuations in the growth pattern of area, production and productivity of the crops were observed in the study. Also, different pattern of instability were observed in the area, production and productivity of the crops over the period. The table shows positive growth rate of potato under Rabi season crop has been worked out in 1.05 per cent hectare area among all the size of holdings between the period of 1997-98 to 2017-18. It has been observed that compound annual growth rate of potato crop area was positive among all the size of holdings. The table, further, indicates that the positive compound annual growth rate of potato crop has been worked out 1.50, 1.12, 1.01 and 0.67 per cent hectare area on the size of holdings marginal, small, medium and large between the period of 1997-98 to 2017-18. Similarly, the positive growth rate of potato production have been worked out 1.76 per cent M.T. production among all the size of holdings between the period of 1997-98 to 2017-18.

Table 1.1. Compound Annual Growth Rate in Area, Production and Productivity of Potato Cultivation

Particular	Marginal	Small	Medium	Large	All
Area	1.50	1.12	1.01	0.67	1.05
Production	3.07	2.59	2.70	2.16	2.60
Productivity	1.55	1.47	1.67	1.48	1.54

Table 1.2. Instability in Area, Production and Productivity of Potato cultivation

Particular	Size of Holdings				
	Marginal	Small	Medium	Large	All
Area	20.37	18.72	6.90	3.13	14.36
	(-0.196)**	(-1.151)	(-1.494)	(1.022)**	(80.998)**
Production	22.86	13.95	14.08	5.39	16.72
	(-2.374)*	(1.475)	(-0.441)	(-0.042)	(73.412)*
Productivity	22.18	18.94	10.97	5.75	18.87
	(-0.191)	(0.135)	(0.473)**	(0.308)	(0.666)

(i) Figures in parenthesis are the t values.
(ii) * significant at 1 percent level of probability.
(iii) ** significant at 5 percent level of probability.

Table 1.3. R^2 Value in Area, Production and Productivity of Potato cultivation

Particular	Marginal	Small	Medium	Large	All
Area	0.0124	0.1614	0.0064	0.1244	0.9842
	(0.888)	(0.124)**	(0.967)	(0.634)	(0.000)*
Production	0.1981	0.1452	0.0649	0.0105	.9727
	(0.019)**	(0.143)**	(0.661)	(0.965)	(0.000)*
Productivity	0.0162	0.0134	0.0696	0.0768	0.0380
	(0.849)	(0.893)	(0.638)	(0.748)	(0.506)

(i) Figures in parenthesis are the p-values.
(ii) * significant at 1 percent level of probability.
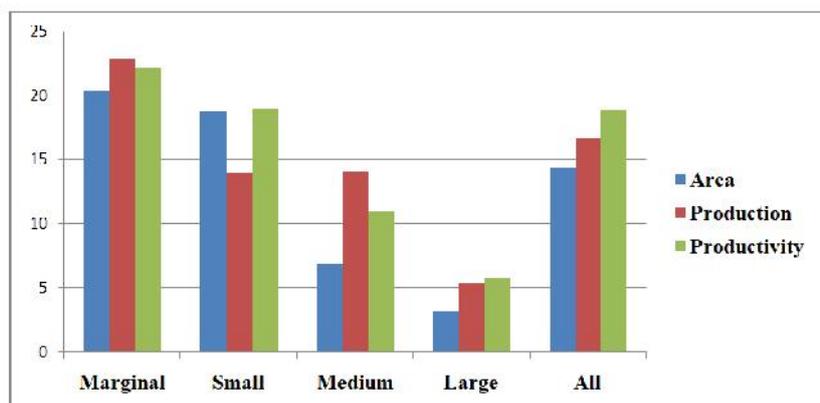(iii) ** significant at 5 percent level of probability.
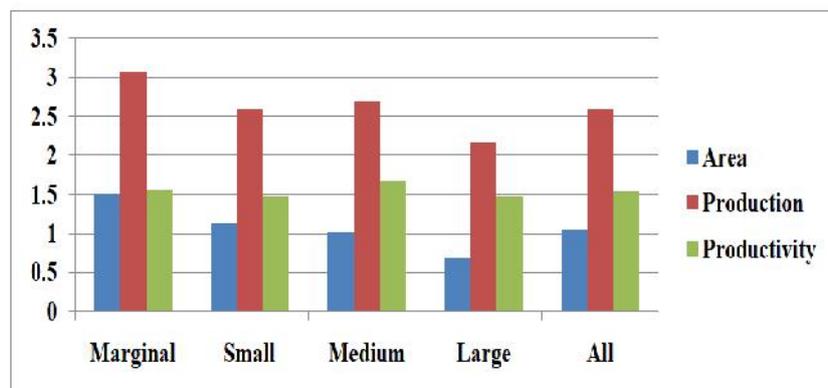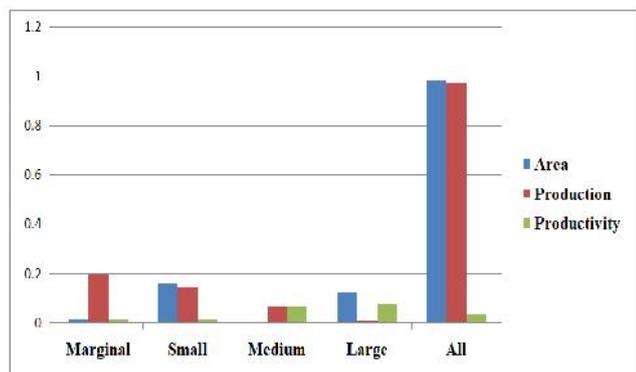

Figure 1.1.

Figure 1.2

Figure 1.3

It had been observed that compound annual growth rate of other crop production was positive among all the size of holdings. The table, further, indicates that the positive compound annual growth rate of all crops have been worked out 1.87, 1.83, 1.70 and 1.71 per cent M.T. production on the size of holdings marginal, small, medium and large between the period of 1997-98 to 2017-18. The compound annual growth rate productivity of potato cultivation has been worked out 1.54 percent per hectare among all the size of holdings between the period of 1997-98 to 2017-18. It had been observed that the compound annual growth rate of potato crop productivity was positive among all the size of holdings. The table, further, indicates that the positive compound annual growth rate of potato crop has been worked out 1.55, 1.47, 1.67 and 1.48 per cent per hectare on the size of holdings marginal, small, medium and large between the period of 1997-98 to 2017-18. The area, production and productivity compound annual growth rate data has been presented in figure 1.1.

Instability in Area, Production and Productivity of Potato cultivation (Cuddy-Della Valle Index): The present study applies the Cuddy Della Valle Index for measuring the instability. Cuddy Della Valle index first de-trends the given series and gives a clear direction about the instability. The result of instability in area of potato cultivation has been presented in Table-1.2. The instability in area of potato crop has been worked out 14.36 per cent hectare among all the size of holdings. The instability in area has been worked out at 20.37 per cent, 18.72 per cent, 6.90 per cent and 3.13 per cent hectare on the marginal, small, medium and large size of holdings. The instability in area has positive and that is more significant in the 5 per cent level of probability on the cultivation of potato for marginal and large size of holdings. The instability analysis in potato cultivation area shown that Cuddy-Della Valle index provides best estimates.

Similarly, the instability in production of potato crop has been worked out 16.72 per cent among all the size of holdings. The instability in production has been worked out at 22.86 per cent, 13.95 per cent, 14.08 per cent and 5.39 per cent on the marginal, small, medium and large size of holdings. The instability in production has positive and that is more significant in the 5 per cent level of probability on the cultivation of potato for marginal size of holding. The instability analysis in potato cultivation production shown that Cuddy-Della Valle index provides best estimates. The instability in productivity of potato crop has been worked out 18.87 per cent among all the size of holdings. The instability in productivity has been worked out at 22.18 per cent, 18.94 per

cent, 10.97 per cent and 5.75 per cent on the marginal, small, medium and large size of holdings. The instability in productivity has positive and that is more significant in the 5 per cent level of probability on the cultivation of potato for medium size of holding respectively. The instability analysis in potato cultivation productivity shown that Cuddy-Della Valle index provides best estimates. The area, production and productivity instability index data has been presented in figure 1.2.

Coefficient of determination (R^2): As against that, Cuddy-Della Valle index attempts to de-trend the CV by using coefficient of determination (R^2). Thus it is a better measure to capture instability in agricultural production. A low value of this index indicates the low instability in farm production and vice-versa. CDVI was originally developed by Cuddy and Valle for measuring the instability in time series data that is characterized by trend. The result of coefficient of determination (R^2) in area, production and productivity of potato cultivation has been presented in Table-1.3. The value of R^2 in area of potato cultivation has been presented in Table-1.3. The value of R^2 in area of potato cultivation has been worked out 0.9842 per cent hectare among all the size of holdings. The value of R^2 in area has been deduced as 0.0124 per cent, 0.1614 per cent, 0.0064 per cent and 0.1244 per cent hectare on the marginal, small, medium and large size of holdings. The coefficient of determination (R^2) in area has positive and that is more significant in the 5 per cent level of probability on the cultivation of potato for all size of holdings. This indicates that all the variables are considered and are best fitted to explain the R^2 values.

Similarly the value of R^2 in production of potato cultivation has been presented in Table-1.3. The value of R^2 in production of potato cultivation has been worked out 0.9727 per cent hectare among all the size of holdings. The value of R^2 in production has been deduced as 0.1981 per cent, 0.1452 per cent, 0.0649 per cent and 0.0105 per cent hectare on the marginal, small, medium and large size of holdings. The coefficient of determination (R^2) in production has positive and that is more significant in the 5 per cent level of probability on the cultivation of potato for all size of holdings. This indicates that all the variables are considered and are best fitted to explain the R^2 values. The value of R^2 in productivity of potato cultivation has been presented in Table-1.3. The value of R^2 in productivity of potato cultivation has been worked out 0.0380 per cent hectare among all the size of holdings. The value of R^2 in productivity has been deduced as 0.0162 per cent, 0.0134 per cent, 0.0696 per cent and 0.0768 per cent hectare on the marginal, small, medium and large size of holdings. The coefficient of determination (R^2) in productivity has positive and that is more significant in the 5 per cent level of probability on the cultivation of potato for all size of holdings. This indicates that all the variables are considered and are best fitted to explain the R^2 values. The area, production and productivity the value of R^2 data has been presented in figure 1.3.

Conclusion

Conducted a study on growth and instability in area, production and productivity of potato cultivation in Himachal Pradesh. A significant increase in an area with compound annual growth rate of 1.05 per cent, production by 2.60 per cent and productivity by 1.54 per cent.

Cuddy-Della Valle index provides the best estimates and instability was found to be more in productivity (18.87per cent). The value of R^2 in area, production and productivity of potato cultivation has been worked out 0.9842, 0.9727 and 0.0380 per cent hectare among all the size of holdings. The coefficient of determination (R^2) in production has positive and that is more significant in the 5 per cent level of probability on the cultivation of potato for all size of holdings. This indicates that all the variables are considered and are best fitted to explain the R^2 values.

Acknowledgement

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