

Assessment of Crop Production Dynamics in Punjab

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ABSTRACT

The structural transformation brings changes to new technology in the form of high-yielding seeds, fertilizers and pesticides and the adoption of modern and improved farm practices since mid-1960s. However, after the mid-1980s, the growth rate of the agricultural economy started decelerating. Results revealed that during overall period, the growth rate in area, production and yield was negative for field crops except for rice and wheat. For fruits and vegetables, the growth rate in area, production and yield were positive for almost all the periods, the area effect was higher for food grains and the yield effect was higher in fruits. The state was found to be less diversified.

Key words: Compound growth rate, Decomposition, Instability index, Food grains, Fruits, Vegetables.

ARTICLE INFO

Received on	:	14.01.2023
Accepted	:	12.03.2023
Published online	:	30.03.2023



INTRODUCTION

The state of Punjab has achieved progressive growth in agriculture. Although it comprises only 1.54 per cent of geographical area but contributes 13-14 per cent towards food grain production of the country (Singh *et al.*, 2012). This was due to adoption of modern methods of production and agriculture transformation to commercial activity, state being the epicenter of Green Revolution. The state witnessed tremendous increase in production of food grains and within years earned the title of granary of India. The economy of Punjab has remained a symbol of economic prosperity and a role model of agricultural development among the Indian states for more than three decades since the ushering in Green Revolution. Investment on modern technology and physical infrastructure has enhanced farmers access the inputs and resulted in higher output market which automatically flourished the farm economy (Gulati, 2017). The Green Revolution in Punjab did not sustain for a long time as it started losing its charm and was followed by a series of crisis especially in its economy and environment. The farmers in Punjab are facing severe problem with stagnation in production due to vast cereal-based mono-cropping mainly rice-wheat instead of adopting multiple cropping and abandoning other crops like pulses, mustard, vegetables and so on (Dutta, 2012).

MATERIALS AND METHODS

The secondary data with respect to area, production and productivity were collected from Statistical Abstract of Punjab, Handbook of Punjab, www.indiastat.com and www.rbi.org on area, production and yield during the three decades from 1989-90 to 2018-19 of major agricultural crops. The data was worked out by using compound annual growth

rate, the magnitude of instability for each crop on area, production and yield through Coefficient of Variation and also the percentage contribution of area, yield and their interaction towards the production of food grains, vegetables and fruits the technique of decomposition has been adopted used (Roy *et al.*, 2015).

RESULTS AND DISCUSSION

Field crops

The compound growth rate and instability index under area, production and yield of major field crops such as rice, maize, pulses, oilseeds and sugarcane during the studied periods have been shown in Table 1.

Rice

The area under rice has increased from 2024 to 3103 thousand hectares in 1989-90 to 2018-19. The production and yield also increased from 6535 to 12821 thousand tonnes and 3229 to 4132 kg/ha. The compound growth rates in area, production and yield have been positive and significant except the yield in overall period it was non-significant. The instability has declined in terms of area, production and yield during the second period mainly due to assured irrigation facilities in the state and increase in area under the crop in non-paddy growing areas.

Wheat

The area, production and yield has followed the increasing trend with area 3260 to 3520 thousand hectares, production from 12100 to 18261 thousand tonnes and yield from 3700 to 5188 kg/ha during 1989-90 to 2018-19. The compound growth of area in the third period was recorded to be negative but significant, in production growth rate declined marginally in second period due to largely being ascribed to rise in

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temperature during the months of January to March adversely affecting the grain formation and recovered in the third period and in case of yield the growth rate was positive in all the periods except in second period it was negative and non-significant. The instability of area has declined, while production and yield has increased due to the adoption of high yield varieties.

Pulses

The area and production of pulses in the state have declined drastically from 230 to only 29.5 thousand hectares and 165 to 27.7 thousand tonnes from 1989-91 to 2018-19 respectively. Whereas, yield has increased from 750 to 938 kg/ha in the same period. The compound growth rate of area was registered as negative except in the third decade due to shifting of cultivated land towards food grains, growth of production was negative in all periods except in third period. However, yield has shown positive growth in the last two periods. The instability in terms of area and production was observed to be increase, less instable in the second period, while for yield it has slightly declined over the study period.

Oilseeds

The area and production of oilseeds has declined from 114 to 39.7 thousand hectares and 105 to 59.5 thousand tonnes and yield has increased from 950 to 1499 kg/ha from 1989-90 to

2018-19. The compound growth rate in area and production was recorded negative except in the first decade but all are significant due to no assured market price or procurement has erratic caused pattern in area under oilseeds leading to ups and downs in production, while the compound growth rate of yield were positive and significant. The instability has followed declining trend in terms of area, production and yield in decades under the study period.

Sugarcane

The area under sugarcane was slightly declined from 99 to 95 thousand hectares and production and yield have increased from 5590 to 7773 thousand tonnes and 58901 to 81828 kg/ha from 1989-90 to 2018-19. The growth rate for area and production was found to be negative for the overall period of study but for yield it was positive. The fluctuating trends have been the result of pending payments issues by the sugar mills in the state causing changes in area under the crop and affecting the production. The instability in area, production and yield though high for the overall period but was found to be declined over the decades.

Cotton

The area and production of cotton has declined from 689 to 268 thousand hectares, 1900 to 1222 thousand bales during 1989-90 to 2018-19 due to severe attack of American Bollworm

Table 1: Compound growth rate and instability index of area, production and yield of major agricultural crops in Punjab during the three decades 1989-90 to 2018-19

(per cent per annum)

Period I (1989-90 to 1989-99)						
Crops	CAGR			Instability index		
	Area	Production	Yield	Area	Production	Yield
Rice	2.09***	2.05**	9.75*	3.91	5.19	60.58
Wheat	0.12*	1.52**	1.41**	1.31	4.25	3.75
Pulses	-10.68***	-11.04***	-0.66*	15.99	31.75	9.08
Oilseeds	4.85**	6.60*	1.49*	21.10	28.76	11.66
Sugarcane	2.94*	3.32*	0.13*	24.13	26.79	5.11
Cotton	-0.43	-9.67**	-9.18**	10.57	24.47	22.42
Period II (1999-00 to 2008-09)						
Rice	0.51**	2.60***	2.07***	2.14	3.34	2.16
Wheat	0.41***	-0.14*	-0.56	0.66	4.55	4.31
Pulses	-10.32***	-7.95***	2.65***	5.97	38.21	5.77
Oilseeds	-5.37***	-2.82**	2.69**	10.96	10.96	8.51
Sugarcane	-4.29**	-5.15**	-0.90*	18.8	19.78	5.10
Cotton	2.06*	12.14***	9.87***	3.97	15.73	13.36
Period III (2009-10 to 2018-19)						
Rice	1.07***	1.98***	0.89**	1.46	4.26	3.48
Wheat	-0.03*	1.05*	1.08*	0.26	6.00	5.85
Pulses	5.10*	5.92*	0.77*	40.36	38.24	5.77
Oilseeds	-4.42***	-3.48***	0.98**	3.65	6.93	4.54
Sugarcane	4.41***	8.08***	3.51***	7.32	9.80	4.48
Cotton	-8.40***	-8.72**	-0.35***	8.74	22.64	18.04
Overall (1989-90 to 2018-19)						
Rice	1.07***	2.37***	0.10	3.51	5.06	43.57
Wheat	0.32***	1.23***	0.90***	1.31	5.36	5.17
Pulses	-6.98***	-6.24*	0.73***	46.08	70.28	7.71
Oilseeds	-5.92***	-5.05***	0.90***	25.52	36.22	10.87
Sugarcane	-1.05**	-0.11*	0.92***	22.83	24.98	9.10
Cotton	-2.51***	-0.46*	2.11***	15.01	33.24	26.34

Note: ***, ** and * indicate the significance of CAGR at 1, 5 and 10 per cent level of significance respectively.

during 1990's. However, introduction of Bt cotton helped in complete reversal of the fall in yield so, from 2000's the yield has increased from 556 to 775 kg/ha in 2003-04 to 2018-19. The compound growth rate of area has negative but significant for all except in second period it was recorded positive and in terms of production and yield followed the same trend where first and third period was negative but significant whereas, second and overall period has positive with significant. The instability in area, production and yield were less in second and third decades of the study period.

Fruits and Vegetables

The compound growth rate and instability index under area, production and yield of some fruits and vegetables such as potato, cauliflower, kinnow and guava during the studied periods have been shown in Table 2.

Potato

Potato has emerged as the major vegetable being grown in the state and most of this crop is grown under contract cultivation. The area under potato increased from 58600 hectares in 1999-00 to 102966 hectares in 2018-19. Production has increased from 178733 to 2716330 metric tonnes. Yield has also increased from 58600 to 102966 MT/ha. It is evident from Table 2 that potato has registered positive growth rate in area and production and all are significant, whereas, in case of yield registered negative growth in first and overall period observed but significant. The instability of area has decreased due to good harvest response, storage availability and hassle-free marketing, while in production it has increased over the study period. Yield has shown the lowest instability in the second period.

Cauliflower

The area, production and yield has shown tremendous increase from 5500 to 19588 hectares, 8960 to 363305 metric tonnes and 1629.09 to 18547.32 MT/ha in 1999-00 to 2018-19. The compound growth rate of area was all positive and significant and found highest in the second period, in case of production and yield it has positive and significant over the

study period. The instability of area and production has shown increasing trend over the period study and the yield has depicted highest instability in the second period due to marketing problems.

Kinnow

Punjab is the largest producer of kinnow. It is grown in some of the districts like Hoshiarpur, Faridkot, Bathinda etc. in the state. The area, production and yield under kinnow has increased from 11424 to 53045 hectares, 17305 to 1246821 metric tonnes and 1514.74 to 23504.97 MT/ha from 1999-00 to 2018-19. The compound growth rate of area, production has remained positive and significant throughout the study period whereas in terms of yield it was positive and significant in second and overall period, where the lowest growth rate was observed in the second period. The instability index for area, production and yield has declined due to good demand response and some availability of processing for the crops.

Guava

It is the second largest major fruit grown in Punjab. The area, production and yield has increased from 3148 to 9142 hectares, 59815 to 206106 metric tonnes and 17305 to 22544.96 MT/ha during 1989-90 to 2018-19. The compound growth rate in area was positive and significant for over the study period and in production it has positive growth but non-significant in the second period. In case of yield all are registered positive but significant only in the overall period due to high infestation by the disease i.e., guava wilt has drastically declined the production. The instability in production has declined over the study period. Whereas, in area and yield the instability was higher in the first and overall period.

Contribution of area, yield and their interaction

With the help of additive decomposition model, the percentage contribution of area, yield and their interaction on production of food grains, vegetables and fruits has been analysed in the Table 3 and 4. Data present in Table 3 revealed that the effect of area, yield and their interaction to the

Table 2: Compound growth rate and instability index of area, production and yield of vegetables and fruits in Punjab during 1999-00 to 2018-19.

(per cent per annum)

Period I (1990-00 to 2008-09)						
Crops	CAGR			Instability index		
	Area	Production	Yield	Area	Production	Yield
Potato	4.79***	1.33***	-3.30***	5.51	2.08	6.44
Cauliflower	3.45***	6.96***	3.39***	3.90	4.04	6.98
Kinnow	15.39***	18.23***	2.46	2.26	9.54	8.61
Guava	9.65***	11.28***	1.37	10.23	10.84	11.42
Period II (2009-10 to 2018-19)						
Potato	2.57***	2.96***	0.38*	1.76	3.28	2.82
Cauliflower	11.25***	38.04***	24.08*	4.75	33.06	34.14
Kinnow	3.34***	4.43***	1.05***	2.17	2.25	2.72
Guava	1.25***	3.51	2.20	3.01	20.04	19.62
Overall (1999-00 to 2018-19)						
Potato	3.02***	1.63***	-1.35***	5.00	3.39	7.85
Cauliflower	7.18***	26.45***	17.98***	12.92	47.40	47.99
Kinnow	9.94***	12.86***	3.13***	13.62	15.94	7.39
Guava	3.38***	5.25***	1.70**	12.88	20.13	17.02

Note: ***, ** and * indicate the significance of CAGR at 1,5 and 10 per cent level of significance respectively.

Table 3: Contribution of area, yield and their interaction in the production of food grains in Punjab during 1970-71 to 2019-20

Particulars	Variable	Period I (1970-80)	Period II (1980-90)	Period III (1990-00)	Period IV (2000-10)	Period V (2010-20)	Overall (1970-20)
Food grains	Area effect	34.36	26.83	32.85	55.11	18.40	22.01
	Yield effect	53.90	63.03	60.94	43.35	80.53	46.42
	Interaction effect	11.72	10.13	6.19	1.53	1.05	31.55

production of food grains during the five decades and divided into periods viz. 1970-71 to 1979-80 (Period I), 1980-81 to 1989-90 (Period II), 1990-91 to 1999-00 (Period III), 2000-01 to 2009-10 (Period IV), 2010-11 to 2019-20 (Period V) and 1980-81 to 2019-20 (overall period). The contribution of yield effect to food grains production was found to be offsetting the area effect and interaction effect in almost all the periods except in the fourth period. It can be mainly attributed to the increase in area under high-yielding varieties and fertilizers usage which have a great impact on yield.

The values are percentage share of column total, production thousand-hectare, area thousand tonnes, and yield in kg/ha. Data present in Table 4 depicted that in case of vegetables, the yield effect and interaction effect have negative contribution to the production in first and second period. The area effect has positive but declining contribution in all the periods. In case of fruits, the area effect was offsetting the yield and interaction effect in all the periods except in the overall period, where yield effect was high.

Table 4: Contribution of area, yield and their interaction of vegetables and fruits in Punjab during three decades 1990-91 to 2019-20

Particular	Factor	Period I (1990-91 to 1999-00)	Period II (2000-01 to 2009-10)	Period III (2010-11 to 2019-20)	Overall period (1990-91 to 2019-20)
Vegetables	Area effect	102.86	101.30	94.62	74.96
	Yield effect	-1.65	-0.26	3.53	7.40
	Interaction effect	-1.21	-1.04	1.83	17.63
Fruits	Area effect	232.91	77.57	75.99	15.59
	Yield effect	-300.28	2.05	17.10	58.56
	Interaction effect	167.36	20.36	6.90	25.83

The values are percentage share of column total, production in thousand tonnes, area in thousand hectare and yield in kg/ha.

Crop diversification in Punjab

Punjab has shown a decline in crop diversity since wheat and rice are the only two main dominant bowls of cereal crops cultivated as these are procured by government agencies at

minimum support prices. So, farmers have been cultivating their areas just for these two crops, resulting in mono-culture highly practiced in the state. Fig. 1 concluded there is low diversification of crops which tends to fall slightly from 1986-96 to 2006-16.

CONCLUSIONS

The result reveals the growth rate of area, production and yield has positive growth only in rice and wheat. The instability in pulses, oilseeds, sugarcane and cotton was much higher in comparison to rice and wheat. The growth rate of vegetables and fruits for area and production was all positive and significant, under yield potato has negative growth. The instability was found to be increased in all the periods in terms of area, production and yield except in potato it has declined widely in terms of area and yield during the second period. The contribution of area effect was more in terms of food grains almost in all the periods and in case of vegetables and fruits the area effect was found to be contributed more in all the periods except for fruits the yield effect was higher in the overall period. Simpson's index has pointed towards a low level of diversification in Punjab agriculture.

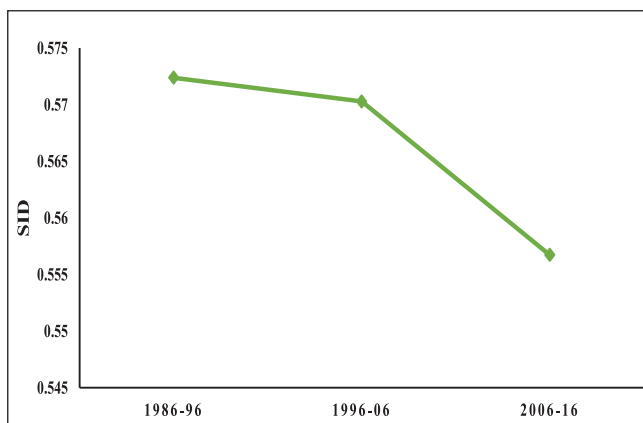


Fig. 1: Simpson's Index of Crop Diversification in Punjab, 1986-96 to 2006-16

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Citation:

Ralte Rohlpuii, Kaur Arjinder, Kataria Poonam and Priscilla Laishram . 2023. Assessment of Crop Production Dynamics in Punjab. *Journal of AgriSearch* **10**(1): 71-75