

GROWTH AND TREND IN AREA, PRODUCTION AND PRODUCTIVITY OF WHEAT IN HARYANA

R.C. Hasija, L.S. Kaushik, K.S. Suhag and D.R. Aneja

Department of Mathematics and Statistics,
CCS Haryana Agricultural University, Hisar - 125 004, India

ABSTRACT

In the present study Haryana state has been divided into two Agro-climatic zones i.e. eastern zone and western zone. The required data for this study (1966-67 to 1998-99) were taken from various issues of Statistical Abstract of Haryana. The Compound Growth Rates (CGR) and trends of area, production and productivity were worked out for all the three periods 1966-67 to 76-77; 1977-78 to 1988-89 and 1988-89 to 1998-99 respectively and for both the zones and different forms of models were fitted. The analysis indicated that the area, production and productivity of wheat crop have increased significantly through 1966-67 to 1998-99. The improvement in the yield will be helpful for further increasing the area of wheat in the state.

In Haryana percentage of area under wheat to the total food grains increased from 21.04 per cent in 1966-67 to 49.12 per cent in 1998-1999 and in terms of production the percentage increased from 41.06 to 68.45. The increase in relative importance of wheat in the cropping pattern of Haryana is primarily due to the extension of irrigation facilities and increase in relative profitability due to higher yield per hectare in relation to other competing crops. During the last thirty four years the per hectare yield of wheat has increased from 14.25 quintals in 1966-67 to 36.60 quintals in 1998-1999. On the other hand, no such significant increase in the yield of other *rabi* crops has been achieved in Haryana this crop is grown as a main crop because wheat is the staple food of the population of the state. Thus, keeping in view the above mentioned facts, the present study was undertaken to work out the growth rates and trend of area, production and productivity of wheat in the state.

For the present study Haryana State was divided into two Agro-climatic zones i.e., eastern and western zones. The Eastern zone comprising Ambala, Panchkula, Karnal, Kurukshetra, Kaithal, Panipat and Yamunagar districts and Western zone comprising Hisar, Sirsa, Bhiwani, Gurgaon, Faridabad, Jind, Rohtak, Mahendergarh, Sonapat, Rewari,

Jhajjar and Fatehabad districts. To fulfill the objective of the study, the required data pertaining to the period 1966-67 to 1998-99 were taken from various issues of Statistical Abstract of Haryana and Indian Agriculture in Brief. This time series data of thirty three years was divided into three periods i.e. period I (1966-67 to 1976-77), period II (1977-78 to 1987-88) and period III (1988-89 to 1998-99) depending upon the availability of data for the State as a whole. The compound growth rates and trends of area, production and productivity were worked out for all the three periods and for both the zones by using all the below given forms of the model and the best one was selected for fulfilling the objectives of the study.

Model	Function Form
Linear	$Y = b_0 + b_1 t$
Quadratic	$Y = b_0 + b_1 t + b_2 t^2$
Compound Growth	$Y = b_0 b_1^t$ $Y = e^{b_0 + b_1 t}$
Logarithmic	$Y = b_0 + b_1 \log t$
Cubic	$Y = b_0 + b_1 t + b_2 t^2 + b_3 t^3$
S	$Y = e^{b_0 + b_1/t}$
Exponential	$Y = b_0 e^{b_1 t}$
Inverse	$Y = b_0 + b_1/t$
Power	$Y = b_0 t^{b_1}$

Where,

- Y = Acreage/production/productivity of wheat
 bo = The intercept (Constant)
 b₁, b₂, b₃ = The regression coefficient
 t = The time variable in years (1, 2, ..., 33)

For exponential function again 'bo' is the intercept/constant and $b_1 = 1 + r$, where 'r' is the compound growth rate i.e. $r = (b - 1) \times 100$.

The compound growth rates (C.G.Rs) of area, production and productivity of wheat from 1966-67 to 1998-99 for both the zones (eastern and western) and under three periods are presented in Table 1. The compound growth rate shows that during this period of more than three decades (33 years) the area, production and productivity have increased significantly in both the zones and in all the three periods. In eastern zone, the area increased at an average annual growth rate of 6.23, 2.42 and 0.28 per cent, under period I, II and III, respectively, while in western zone, the area had increased with an annual compound growth rates of 5.94, 3.22 and 2.21 per cent respectively under the three periods. This clearly revealed that the area under wheat had increased more under period I as compared to period II and III in both the zones. The coefficient of determination (R^2) explained about 36 to 93 per cent variation in the area under all the three period in eastern zone, while it ranged between 82 to 88 per cent in western zone.

In case of production almost similar trend was observed across zones and periods. The highest increase in production growth was under period I in eastern zone (10.04%) followed by period I in western zone (8.00%) and being significant at 1 per cent level of probability. The figures under period II are also positively significant in both the zones. Though, eastern zone under period III has positive

compound growth rate of 1.40 per cent but it was non-significant. The coefficient of determination (R^2) explained about 28 to 88 per cent variation in the production of wheat under all the three periods in eastern zone, while it ranged between 64 to 94 per cent in western zone.

Table 1 further revealed that the compound growth rate for yield had also increased significantly except under period I in western zone and period III in eastern zone where they are positive but non-significant. On an average the yield of wheat during the study period increased significantly at an annual compound growth rate of 3.59 and 3.43 per cent in eastern zone under period I and II, while in case of western zone it increased by 3.82 and 2.77 per cent under period II and III respectively. The coefficient of determination (R^2) explained about 33, 72 and 25 per cent variation in the yield of wheat in eastern zone under period I, II and III respectively, while in case of western zone, it explained about 20, 87 and 75 per cent variation in the yield. Thus, from the above discussion, it may be concluded that the higher growth rates in area, production and productivity of wheat may be attributed to the availability of good quality seeds of high yielding varieties, expansion of irrigation facilities, use of higher doses of fertilizer and increase in relative profitability of the crop.

The trend analysis for area, production and productivity of wheat across zones are given in Table 2. All the ten form of models as mentioned in methodology were fitted separately for area, production and yield of wheat for both the zones. Out of these, the best fitted regression model was considered for the analysis. It is clear from the table that the cubic form of model turned out to be better for area, production and productivity in both the zones except in one case i.e. in eastern zone in case of area, power function turned out as best fit. The table somewhat indicates

Table 1. Zonewise compound growth rates (CGR) of area, production and productivity of wheat crop in Haryana

Particulars	Eastern zone			Western zone		
	Period I	Period II	Period III	Period I	Period II	Period III
For Area						
1. bo value (Constant)	276.5981	494.5351	643.2228	431.3296	838.3285	1102.2330
2. b ₁ value	1.0623	1.0242	1.0028	1.0594	1.0322	1.0221
3. C.G.R. (%)	6.2306**	2.4168*	1.2784	5.9352*	3.2241*	2.2149*
4. S.E. of C.G.R.	2.8286	0.5158	0.8331	2.1351	1.1770	0.6419
5. R ²	0.7522	0.9300	0.3609	0.8282	0.8202	0.8776
For Production						
1. bo value (Constant)	404.2734	1006.7855	2109.0405	639.8636	1568.0825	3265.3481
2. b ₁ value	1.0050	1.0593	1.0140	1.0801	1.0720	1.0504
3. C.G.R. (%)	10.0453**	5.9269**	1.4022	8.0050**	7.2009**	5.0418*
4. S.E. of C.G.R.	6.6439	1.7415	1.7345	4.7311	1.4560	1.4469
5. R ²	0.5969	0.8784	0.2819	0.6454	0.9392	0.8825
For Productivity						
1. bo value (Constant)	1461.5857	2035.8089	3298.8613	1483.4757	1870.4568	2962.2017
2. b ₁ value	1.0359	1.0343	1.0095	1.0195	1.0385	1.0276
3. C.G.R. (%)	3.5909*	3.4274*	0.9453	1.9537	3.8525*	2.7657*
4. S.E. of C.G.R.	3.9766	1.6598	1.2812	3.0371	1.1820	1.2530
5. R ²	0.3322	0.7221	0.2458	0.1990	0.8667	0.7470

* Significant at 5 per cent level of probability. Period I (1966-67 to 1976-77), Period II (1977-78 to 1987-88), Period III (1988-89 to 1998-99)

** Significant at 1 per cent level of probability.

Table 2. Trends in area, production and productivity of wheat in Haryana

Particulars	Model	Equation	R ²
EASTERN ZONE			
Area	Power	$Y = 251.225 t^{0.2892}$	0.9521
Production	Cubic	$Y = 534.720 + 3.9166 t + 4.7597 t^2 - 0.0946 t^3$	0.9442
Productivity	Cubic	$Y = 1614.50 + 0.3620 t + 4.2093 t^2 - 0.0911 t^3$	0.8970
WESTERN ZONE			
Area	Cubic	$Y = 362.882 + 51.5501 t - 1.0094 t^2 + 0.0117 t^3$	0.9730
Production	Cubic	$Y = 693.806 + 24.4029 t + 5.3339 t^2 - 0.0509 t^3$	0.9851
Productivity	Cubic	$Y = 1609.42 - 27.8690 t + 5.6862 t^2 - 0.0814 t^3$	0.9550

increasing trend in area, production and productivity of wheat over the study period. The coefficient of multiple determination (R²) explained about 95, 94 and 90 per cent variation in area, production and productivity in eastern zone and for the western zone the figures are 97, 98 and 95 per cent respectively for area, production and productivity.

CONCLUSIONS

The compound growth rate as well as

trend analysis indicated that the area, production and productivity of wheat crop have increased significantly through 1966-67 to 1998-99. This might be attributed to the availability of good quality seeds of high yielding varieties, expansion of irrigation facilities and increase in the relative profitability of the crop. The improvement in the yield will be helpful for further increasing the area of wheat in the state.

REFERENCES

- Rai, Lajpat *et al.* (2001). *Ann. Biol.*, 17: 213-218.
 Pandey, U.K. *et al.* (1997). *Indian J. Econ.*, 52: 459-460.
 Suhag, K.S. *et al.* (1999). *Agric. Situat. India*, 56(3): 121-128.
 Sirohi, A.S. *et al.* (1983). *Agric. Situat. India*, 38(5): 293-299.