AN ANALYSIS OF THE RELATIVE CONTRIBUTION OF AREA AND YIELD TO TOTAL PRODUCTION OF WHEAT AND MAIZE IN PAKISTAN

Khurshid Ali Qureshi, Buland Akhtar, Muhammad Aslam, Aman Ullah & Amjad Hussain
Directorate of Crop Production & Water Management, University of Agriculture, Faisalabad

Evidence from this inquiry concludes that yield enhancement contributed more than 100% change in the total wheat production during the period 1967/70-1971/74 due to the green revolution impact, while the contribution of area was negative. Thereafter, the contribution of yield to total wheat production has been on the decline till 1975/78-1979/82 due to alternating good and bad wheat harvests, whereas during the periods 1979/82-1983/86 and 1983/86-1987/90 a slight yield upsurge occurred due to technological improvements. Area under maize has increased very gradually and there has not been any significant jump in area as research failed to produce suitable high yielding varieties.

INTRODUCTION

Out of the total area of 11,770 thousand hectares under food grains in Pakistan, about 7,755 thousand hectares are under wheat. Out of 19,988 thousand tonnes of food grains, about 15,000 thousand tonnes are shared by wheat. Taking the perspective since independence, it is noteworthy that the development of wheat sector has been regular and steady. The area expansion shows a clear rising trend i.e. from 3,954 thousand hectares in 1947 to 7,555 thousand hectares in 1990.

Yield per hectare was virtually stagnant at around 800 kg per hectare till the mid 1960's. In 1967-68, following the introduction of high yielding varieties, the yield jumped up by 20% (1073 kg per hectare) and since then with wider use of seed technologies, increased use of fertilizers and groundwater development, the yield increased gradually in the next 22 years to 1943 kg per hectare in 1990 (Anonymous, 1991).

Maize is the third major food grain crop of the whole world after wheat and rice. It is grown for grain and forage purposes. In Pakistan it is grown all over the country both under irrigated and barani conditions, but is concentrated in the NWFP and Punjab provinces. In the NWFP, it covers 25.0% of the total cropped area and accounts for 3.8% of the total food grain production. Yields have shown year to year fluctuations. A substantial part of the crop is grown under rainfed conditions which explains part of the reason for this instability. Whereas in the Punjab province, it occupies 17.45% of the total cropped area and accounts for only 2.3% of the total food grain production (Anonymous, 1990).

In Pakistan, total production of wheat and maize crops has been increasing due to area expansion as well as productivity increase. As to whether the overall total

production of these crops has increased more due to area expansion or due to yield enhancement, the present study depicts a relative scenario of their contribution. It will help guide the planners and the policy makers to consider the important factors responsible for increasing wheat and maize production in the country.

MATERIALS AND METHODS

Area, production and yield data of these crops were taken from Economic Survey, 1991, Government of Pakistan, Finance Division, Economic Advisor's Wing, Islamabad. The following procedure was adopted for calculating contribution of area and yield to total production of wheat and maize (Andersen, 1982).

a. Period refers to a four-year average, e.g. 1947/1950, area is the average area for years 1947, 1948, 1949 and 1950.

b. Percentage change in area is computed using the following formula:

$$\left[\frac{\overline{X}_{t1}}{\overline{X}_{t0}} - 1\right] \times 100$$

where

$\overline{X}_{t1}$ = Average area for time 't_1' which is the period in column (2) in the Tables given in the text.

$\overline{X}_{t0}$ = Average area for time 't0' which is the period in column (1) in the Tables given in the text.

c. Percentage change in production is computed using the same formula as in area except that average production is used instead of area.

d. Percentage change in yield is computed using the same formula as in area except that average yield is used instead of area. Yield per hectare ($\overline{Y}$) is computed dividing production by area so that the four year average is computed as weighted average:

$$\frac{\Sigma^4 P_t \quad t = 1}{\Sigma^4 X_t \quad t = 1} = \overline{Y}$$

where

P_t = Production in year t

X_t = Area in year t

t = Year 1 to year 4

e. The percentage contribution of area to change in total production is computed using the formula:

$$\frac{\Delta \log x}{\Delta \log p} \times 100$$

where

$\Delta \log x$ = log area t_1 - log area t_0

Δ log p = Log production t_1 - log production t_0

f. Computed using the formula in e/, but log of yield is used instead of log of area.

RESULTS AND DISCUSSION

Evidence from this inquiry concludes the fact that during the time period (1967/70-1971/74) more than 100% change in total wheat production had been contributed through yield enhancement, while the contribution of area was negative. The yield enhancement during this period is clearly ascribed to the impact of green revolution. The percentage contribution of yield to total wheat production has been on the decline during the period 1975/78-1979/82 owing to alternating good and bad wheat harvests caused mostly through severity of rainfall, floods, drought, high prices of inputs and artificial shortages of crucial inputs. During the periods 1979/82-1983/86 and

1983/86-1987/90, a slight upsurge occurred due to technological improvements (Table 1).

Area under maize crop has been increasing very gradually since inception of Pakistan and there has not been any signifi-

Table 1. Contribution of area and yield to total production of wheat, 1947-1990

Crop/Period		Percentage change in			Percentage contribution to change in total production	
t_0	t_1	Area b/	Production c/	Yield d/		
(1)	(2)	(3)	(4)	(5)	Area e/	Yield f/
1947/1950	1951/1954	(-)2.3	(-)19.7	(-)17.7	11	89
1951/1954	1955/1958	15.4	18.4	2.7	85	15
1955/1958	1959/1962	2.8	9.9	7.8	26	74
1959/1962	1963/1966	7.0	6.8	1.2	83	17
1963/1966	1967/1970	16.8	57.6	35.8	34	66
1967/1970	1971/1974	(-)2.7	10.5	13.6	(-)27	127
1971/1974	1975/1978	7.8	21.9	12.8	38	62
1975/1978	1979/1982	11.6	26.6	13.4	54	46
1979/1982	1983/1986	4.1	5.9	1.8	40	60
1983/1986	1987/1990	3.5	16.4	12.8	20	80

Table 2. Contribution of area and yield to total production of maize, 1947-90

Crop/Period		Percentage change in			Percentage contribution to change in total production	
t_0	t_1	Area b/	Production c/	Yield d/		
(1)	(2)	(3)	(4)	(5)	Area e/	Yield f/
1947/1950	1951/1954	7.87	2.87	(-)4.00	267	(-)167
1951/1954	1955/1958	6.20	18.15	10.41	36	64
1955/1958	1959/1962	8.41	2.63	(-)4.71	322	(-)222
1959/1962	1963/1966	9.92	14.12	3.96	71	29
1963/1966	1967/1970	20.65	37.73	85.71	80	20
1967/1970	1971/1974	1.71	(-)2.62	(-)41.53	63	37
1971/1974	1975/1978	(-)0.15	8.95	9.64	(-)18	118
1975/1978	1979/1982	17.60	18.60	0.8	82	18
1979/1982	1983/1986	7.60	10.10	2.38	111	(-)11
1983/1986	1987/1990	6.56	(-)14.27	(-)19.37	34	66

cant jump in area as research failed to produce suitable high yielding varieties (Anonymous, 1988). The area under maize has doubled since independence, but the share of this crop in total cultivated area has changed little.

It may safely be concluded that the change in total production during the various time periods has largely been contributed by the change in area, whereas the effect of yield in changing total production has been very nominal. The total maize production during the pre-green revolution period has been increasing solely because of an increase in area. During green revolution in the country, the time period from mid-sixties to the end of seventies, yield contributed significantly to change in total production, but thereafter, yields stagnated and continuously declined to the point that the effect of yield to change in total production became negative (Table 2).

For the achievement of increased production, Pakistan would need to go by an appropriate production technology. Since land is inevitably fixed in supply, further area expansion for the purpose of increasing production may not be possible. A resort thus shall have to be made to the most important single factor of productivity enhancement thereby giving due regard to the performance of the yester years.

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