A Forecast of Wheat Production in the Punjab for 1973-74

by

B.A. AZHAR, M. GHAFFAR CHAUDHRY and

M. SHAFIQUE*

In an earlier article [1, Pp. 407-15] the authors developed a statistical model for forecasting wheat production. Among the equations developed, it was found out that equation (2.2) for irrigated districts and equation (3.2) for barani districts could be useful in forecasting wheat production in the Punjab. While the forecasting procedure was elaborated in detail, it was not possible to forecast wheat production for 1973-74 because data on the explanatory variables underlying the model were not then available. As these are now available, this paper is an attempt to forecast wheat production for 1973-74. For comparison, the paper also includes a forecast for 1972-73 based on the model. Before discussing the forecast itself, however, a brief review of the underlying equations and data used in the study would be desirable.

According to equation (2.2), wheat production (Pw) in the irrigated districts is determined by the equation:

$$P_w = -113.59 + 0.55\,x_1 + 0.64\,x_2 + 0.02\,x_3 - 6.34\,x_4$$

Equation (3.2) for barani districts states that the determinants of wheat production can be represented by:

$$P_w = -43.79 + 0.46\,x_1 + 0.21\,x_2 + 0.03\,x_3 + 3.79\,x_4$$

where

x_1 is the area under Mexi-Pak wheat (in thousand acres),

x_2 represents area under local wheat varieties (in thousand acres),

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*Dr. Azhar is Joint Economic Advisor, Ministry of Finance, Planning & Development, Government of Pakistan and is an Honorary Research Advisor, PIDE; Mr. Ghaffar Chaudhry and Mr. M. Shafique are Research Economist and Research Assistant respectively at PIDE. While the authors assume full responsibility of the ideas expressed in this note, they appreciate the help of the Planning Unit, Ministry of Food and Agriculture and Director of Land Records Punjab, Lahore for providing the necessary data required for this study.

x_3 designates total nutrient tons of fertilizer applied to total wheat acreage. We assume that fertilizer applied equals fertilizer purchased during the October to January period.

x_4 is the total rainfall (in inches) during the month of November, December and January.

The coefficients of the explanatory variables are the parametric estimates corresponding to each explanatory variable.

The forecasting of wheat production involves the use of data at the disaggregated district level. While the rainfall data for 1972-73 and 1973-74 were available by month and by district, we had to resort to some manipulation of the data for the remaining explanatory variables. For instance, the fertilizer data for January 1974 were available in an aggregated form and a district-wise statement was not published. Therefore, the January 1974 data were disaggregated according to the pattern of distribution of January 1973. Similarly, the first available estimate of wheat area for 1973-74 does not distinguish between areas under Mexi-Pak and local varieties. The total wheat area was disaggregated using 1972-73 proportions of area under Mexi-Pak and local varieties. These were minor adjustments and should not significantly distort the results. With these adjustments, the district-wise position of inputs applied to wheat crop during 1972-73 and 1973-74 has been tabulated in the appendix in tables A-I and A-II.

Using the values for x_1, x_2, x_3 and x_4 provided in tables A-I and A-II in the equations, forecasts for wheat production for 1972-73 and 1973-74 are obtained. The detailed output estimates based on this exercise are presented in tables B-1 and B-2. The wheat production forecast for the Punjab is given in the following table:

TABLE 1

Forecast of Wheat Production in the Punjab 1972-73

(Production in 000 tons)

Year	Barani Areas	Irrigated Areas	Total
1972-73			
Our Model	426.49	5344.25	5770.74
Official Final Wheat Estimate	—	—	5603.00
1973-74			
Our Model	469.87	5531.06	6000.93
Official Wheat Production Target	—	—	6500.00

Sources: (*i*) Appendix Tables A-I and A-II
(*ii*) [2, P. 5]

It can be seen from the above table that the forecasts of our model were 5.77 and 6.00 million tons of wheat for 1972-73 and 1973-74 respectively. The prediction exceeded the final wheat estimate during 1972-73, but is less than

wheat production target of 6.5 million tons for 1973-74. The difference between the forecast and the final wheat estimate for 1972-73 is insignificant and may be ignored, the difference for 1973-74 is attributed to the following factors.

Generally target is fixed on the basis of the conditions in previous years. The assumed conditions, however, may vary as in the case of fertilizer application. The target of wheat production for 1973-74 was based on the 1972-73 fertilizer application to wheat after allowing for a normal increase. However, the consumption of fertilizer fell from 98 thousand nutrient tons in 1972-73 to 87 thousand nutrient tons in 1973-74 due to a sharp rise in fertilizer prices. Since fertilizer is an important input, total wheat output is likely to decline.

The accuracy of our forecast may be tested by incorporating the fertilizer consumption data of 1972-73 instead of 1973-74. The use of this data will raise the forecast to 6.3 millions tons of wheat for 1973-74. If allowance is made for a normal annual increase in fertilizer consumption, which amounts to 18.3 per cent per annum [2, p. 8], the forecast would approximate the target set for 1973-74.

It should be noted that our model does encompass the increased production of wheat resulting from greater acreage under wheat in the flood affected areas, but it does not consider the possible productivity increases in the flooded areas. We believe, however, that such productivity gains will be relatively small as the flood affected area was a small proportion of the total area under wheat.

REFERENCES

1. Azhar, B.A, M. Ghaffar Chaudhry, and M. Shafique, "A Model for Forecasting Wheat Production in the Punjab", *The Pakistan Development Review*, Vol. XII, No. 4, Winter 1973.

2. Punjab, Planning and Development Board, *Report on Economic Situation in the Punjab*, January 1974 (Lahore).

APPENDIX TABLE A-1

District-wise Statement of Inputs Applied to Wheat Crop During 1972-73

District (1)	Area under Mexi-Pak (x_1) in 000 acres (2)	Area under local varieties (x_2) in 000 acres (3)	Fertilizer (x_3) in N. Tons (4)	Rain-fall (x_4) in inches (5)
Campbellpur	57	571	454	2.31
Rawalpindi	55	273	470	5.93
Jhelum	35	312	241	3.65
Mianwali	242	261	1405	0.79
Gujrat	352	181	2513	3.52
Sargodha	411	303	5071	0.92
Lyallpur	848	26	14696	0.32
Jhang	442	112	3830	0.21
Sialkot	333	190	3257	1.98
Gujranwala	559	43	6114	2.26
Sheikhupura	425	101	5465	1.58
Lahore	456	39	9172	1.00
Sahiwal	784	151	14019	0.22
Multan	792	358	17643	0.09
Muzaffargarh	152	545	2116	0.13
D.G. Khan	31	292	1153	0.13
Bahawalpur	68	233	3156	0.00
Bahawal Nagar	53	317	1989	0.15
Rahim Yar Khan	145	242	5037	0.00

Sources: Cols. 1-2. Planning Unit, (Agriculture Wing) Ministry of Food and Agricutlure, (Islamabad).
Col. 2. Agricultural Supply Organization, Punjab, (Lahore).
Col. 4. Director of Land Records, Punjab, (Lahore).

APPENDIX TABLE A-II

District-wise Statement of Inputs Applied to Wheat Crop During 1973-74

District	Area under Mexi-Pak (x_1) in 000 acres	Area under local varieties (x_2) in 000 acres	Fertilizer (x_3) in N. Tons	Rain-fall (x_4) in inches
(1)	(2)	(3)	(4)	(5)
Campbellpur	63	632	313	0.83
Rawalpindi	59	290	414	1.71
Jhelum	40	358	181	2.00
Mianwali	270	291	2378	0.16
Gujrat	382	196	1905	3.10
Sargodha	452	334	5294	0.18
Lyallpur	883	27	11774	0.64
Jhang	496	126	5624	0.28
Sialkot	444	253	4244	2.63
Gujranwala	619	48	3520	1.99
Sheikhupura	457	108	3146	1.62
Lahore	494	42	4445	1.40
Sahiwal	812	156	10138	1.01
Multan	833	377	15151	0.08
Muzaffargarh	167	600	4324	0.12
D.G. Khan	34	318	1470	0.11
Bahawalpur	70	240	4582	0.00
Bahawal Nagar	59	351	1822	0.56
Rahim Yar Khan	163	273	3271	0.00

Sources: Cols. 1-2. Planning Unit, (Agriculture Wing), Ministry of Food and Agriculture, (Islamabad).
Col. 3. Agricultural Supply Organization Punjab, (Lahore).
4. Director of Land Records, Punjab (Lahore).

APPENDIX TABLE B-I

Determination of Wheat Production in the Punjab for 1972-73

Districts	Product of coefficients and values of explanatory variables 1972-73					Wheat output 1972-73 000 tons
	a_0	$a_1(x_1)$	$a_2(x_2)$	$a_3(x_3)$	$a_4(x_4)$	
A. **Barani Districts***						
Campbellpur	— 43.79	26.22	119.91	13.62	8.75	124.71
Rawalpindi	— 43.79	25.30	57.33	14.10	22.47	75.41
Jhelum	— 43.79	16.10	65.52	7.23	13.83	58.89
Mianwali	— 43.79	111.32	54.81	42.15	2.99	167.48
B. **Irrigated Districts****						
Gujrat	—113.59	193.60	115.84	50.26	— 22.42	223.69
Sargodha	—113.59	226.05	193.92	101.42	— 5.86	401.94
Lyallpur	—113.59	466.40	16.64	293.92	— 2.04	661.33
Jhang	—113.59	243.10	71.68	76.60	— 1.34	276.45
Sialkot	—113.59	183.15	121.60	65.14	— 12.61	243.69
Gujranwala	—113.59	307.45	27.52	122.28	— 14.40	329.26
Sheikhupura	—113.59	233.75	64.64	109.30	— 10.06	284.04
Lahore	—113.59	250.80	24.96	183.44	— 6.37	339.24
Sahiwal	—113.59	431.20	96.64	280.38	— 1.40	693.23
Multan	—113.59	435.60	229.12	352.86	— 0.57	903.42
Muzaffargarh	—113.59	83.60	348.80	42.32	— 0.83	360.30
D.G. Khan	—113.59	17.05	186.88	23.06	— 0.83	112.57
Bahawalpur	—113.59	37.40	149.12	63.12	— 0.00	136.05
Bahawal Nagar	—113.59	29.15	202.88	39.78	— 0.96	157.26
Rahim Yar Khan	—113.59	79.75	154.88	100.74	— 0.00	221.78
Total: (A+B)	—1879.01	3396.99	2302.69	1981.72	— 31.65	5770.74

* The determining equation is $-43.79+0.46\,x_1+0.21x_2+0.03x_3+3.79x_4$

**The determining equation is $-113.59+0.55\,x_1+0.64x_2+0.02x_3+6.37x_4$

Source:—Calculations based on data in Appendix table A-I.

APPENDIX TABLE B-II

Determination of Wheat Production in the Punjab for 1973-74

Districts	Product of coefficients and values of explanatory variables 1973-74					Wheat output 1973-74 000 tons
	a_0	$a_1(x_1)$	$a_2(x_2)$	$a_3(x_3)$	$a_4(x_4)$	
A. Barani Districts*						
Campbellpur	— 43.79	28.98	132.72	9.39	3.15	130.45
Rawalpindi	— 43.79	27.14	60.90	12.42	6.48	63.15
Jhelum	— 43.79	18.40	75.18	5.43	7.58	62.80
Mianwali	— 43.79	124.20	61.11	71.34	0.61	213.47
B. Irrigated Districts**						
Gujrat	— 113.59	210.10	125.44	38.10	— 19.75	240.30
Sargodha	— 113.59	248.60	213.76	105.88	— 1.15	453.50
Lyallpur	— 113.59	485.65	17.28	235.48	— 4.08	620.74
Jhang	— 113.59	272.80	80.64	112.48	— 1.78	350.55
Sialkot	— 113.59	244.20	161.92	84.88	— 16.75	360.66
Gujranwala	— 113.59	340.45	30.72	70.40	— 12.68	315.30
Sheikhupura	— 113.59	251.35	69.12	62.92	— 10.32	259.48
Lahore	— 113.59	271.70	26.88	88.90	— 8.92	264.97
Sahiwal	— 113.59	446.60	99.84	202.76	— 6.43	629.18
Multan	— 113.59	458.15	241.28	303.02	— 0.51	888.35
Muzaffargarh	— 113.59	91.85	384.00	86.48	— 0.76	447.98
D.G. Khan	— 113.59	18.70	203.52	29.40	— 0.70	137.33
Bahawalpur	— 113.59	38.50	153.60	91.64	0.00	170.15
Bahawal Nagar	— 113.59	32.45	224.64	36.44	— 3.57	176.37
Rahim Yar Khan	— 113.59	89.65	174.72	65.42	— 0.00	216.20
Total: (A+B)	—1879.01	3699.47	2537.27	1712.78	— 69.58	6000.93

* The determining equation is $-43.79+0.46x_1+0.21x_2+0.03x_3+3.79x_4$

**The determining equation is $-113.59+0.55x_1+0.64x_2+0.02x_3+6.37x_4$

Source:—Calculations based on data in Appendix table A-II.