EFFECT OF HIGH LEVELS OF NITROGEN AND PHOSPHORUS ON THE YIELD OF WHEAT

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The effects of high levels of N and P on the yield of wheat (*Triticum vulgare*) varieties Maxipak-65 and C-273 were studied on a sandy loam soil. Both the varieties responded to the addition of N and P fertilizers. Addition of 90 lbs of N per acre increased the yield significantly in both the vaieties. However, increasing the N rate beyond 90 lbs. did not improve the yield over control. The addition of P along with N further improved the yield as compared to N alone, suggesting that N is utilized more efficiently by the plant when sufficient P is present in the tissues.

INTRODUCTION

The main yield components of wheat are tillering, number of spikes per plant, number of grains per spike and grain weight. These characters are genetically controlled but their expression is largely determined by the environmental factors including available mineral nutrients in the soil. As regards these nutrients, deficiency of nitrogen in our soils has generally been recognised. However, the works of Wahab and Iqbal (1962), Ghandi, *et al* (1963) and Larson (1964) showed that better acre-yields cannot be obtained in wheat unless phosphorus is supplied with nitrogen, particularly in the case of the newly introduced Mexican wheat having higher nutrient requirements. Therefore, it was contemplated in this study to investigate the effect of high levels of nitrogen alone and in combination with phosphorus on the yield of Mexipak-65 and C273.

MATERIALS AND METHODS

Wheat cultivars Mexipak-65 and C273 selected for this study, were seeded in rows 6-inches apart at a seed rate of 40 seers per acre. The design was randomized block with 4 replications.

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Nitrogen was applied at the rate of 90, 165, 240 pounds per acre alone as well as in combination with 120, 220 and 320 pounds of P_2O_5, respectively. The nitrogen source was ammonium sulphate and it was applied in two equal doses with the first and second irrigations. P_2O_5 was provided in the form of superphosphate seven days before seeding. Three irrigations and twe hoeings were given, while an additional irrigation was also given to Mexipak. The crop was harvested during the third week of April. The data were recorded on the net plot basis and then calculated on an acre basis and was analysed by the analysis of variance method. Treatment effects were compared by Duncan's Multiple Range test.

RESULTS AND DISCUSSION

The analysis of variance for yield presented in Table 1 shows that the differences for varieties and fertilizer levels were highly significant.

On an average, Mexipak yielded ten maunds per acre more than C273 which is attributable to its inherent high yielding potential (Table 2).

TABLE 1: *Analysis of variance for grain yield.*

Source of variation	D.F.	S.S.	M.S.	F	S.E.
Replications	3	18.91			
Varieties	1	1469.55	1469.55	70.99**	0.860
Manures	6	480.25	80.04	3.87**	1.608
V x M	6	10.28	1.71	0.08 N.S.	
Error I	39	807.57	20.70		
Total	55				

** = Highly significant at 1 per cent.
N.S. = Non-significanc.

TABLE 2. *Average grain yields/acre of C273 and Mexipak under different levels of nitrogen and phosphorus.*

Treatments	Av. yield of grains/acre		+Increase over control (mds/acre)	
	Mexipak	C273	Mexipak	C273
Control	37.5	28.3	—	—
90 lb. N.	42.3	33.4	+4.8	+5.1
165 lb. N.	39.7	29.1	+2.2	+0.8
240 lb. N.	41.1	29.4	+3.6	+1.1
90 lb. N+120 lb. P_2O_5	44.9	34.4	+7.4	+6.1
165 lb. N+220 lb. P_2O_5	46.8	36.7	+9.3	+8.4
240 lb. N+320 lb. P_2O_5	44.3	33.4	+6.8	+5.1

Application of fertilizer increased the yield over the control. Ninety pounds nitrogen increased the yield of both the varieties by about 5 maunds per acre. Increasing the nitrogen rate from 165 to 240 pounds did not improve the yield over the 90 pound-nitrogen level. The nitrogen rates between 90 to 165 pounds were not tested in this study, but warrant an investigation.

When 120 pounds P_2O_5 preceded 90-pound nitrogen level, the yields of Mexipak and C273 further increased by 2½ and 1 maund per acre, respectively over the 90 pounds nitrogen alone. Similarly, it was also observed that when phosphorus preceded 165 and 240 pounds nitrogen levels, there was a considerable increase in the yield of both the wheat varieties over the 165 and 240 pounds nitrogen application levels alone. These results suggest that phosphorus is not only needed for higher grain yield of wheat but also is involved in efficient utilization of N-P fertilizers.

Increase in yield over the control due to the nitrogen application was attributable to relatively greater tillering and heavier grain weight. This effect was intensified when nitrogen was preceded by phosphorus; thus, confirming the results reported earlier by Wahab and Iqbal (1962), Larson (1964), Wahab (1965), Khan (1965) and Sabir (1966).

High levels of nitrogen and phosphorus were used in this study primarily to investigate the maximum production potential of these high yielding wheat varieties, irrespective of the economics of fertilizer application. However, it is evident from these results that both nitrogen and phosphorus are required for obtaining high grain yield. Consequently, more systematic investigations involving single and combined applications of these two fertilizers are needed to find the economical dose and optimum ratio of NP application.

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