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Effect of Increasing Levels of N and P on the Uptake of Nitrogen and Yield of Wheat*

by

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In recent years there has been a tendency to use high levels of fertilizers to secure high yields of crops. Without knowing the actual requirement of a crop in a given area, indescriminate use of fertilizers may result in its waste, loss of yield and reduction in the margin of profit. In heavy soils of Udaipur, nitrogen is a limiting factor. While determining its actual requirement, it was thought necessary to study if application of phosphate has any influence on the nitrogen nutrition and yield of wheat. With this end in view, a field experiment consisting of different levels of N and P was laid out.

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Materials and Methods: Five levels of N (0, 20, 40, 60 and 80 kg/ha) and four levels of P (0, 20, 40 and 60 kg P_2O_5/ha), making thereby, a combination of 20 treatments were tried in a randomised block design replicated three times. The entire quanity of phosphatic fertilizer through single superphosphate ($16\%P_2O_5$) and half of the required quantity of ammonium sulphate (20 % N) were mixed together and drilled in plots as per treatments before sowing. The remaining quantity of N was applied at the time of first irrigation. Wheat (NP 718) was planted in rows 22·86 cm apart at the rate of 91·29 kg/ha. A total of five irrigations (including the pre-sowing) were applied. Weeds were controlled by spraying 2 kg sodium salt (80%) of 2, 4-D per hectare.

The soil of the farm is sandy clay loam and poor in N and available P. The pH of the soil was 8·3. Dry matter and uptake of N at various stages of crop growth, and grain and straw yield at harvest were used as criteria for treatment evaluation.

Results: The data pertaining to various yield contributing factors as influenced by increasing levels of N and P are presented in Table 1. Increasing levels of N did not show any beneficial effect on the height of tillers and grain straw ratio, but all other factors were significantly affected by N application over control. The application of graded levels of N from 20 to 80 kg/ha significantly increaased grain and straw yield over control. Increases in grain yield over control were 30·4, 37·2, 37·9 and 59·8 per cent respectively. The corresponding increases in straw yield were 24·3, 35·5, 66·1 and 74·4 per cent respectively. The application of 60 Kg N/ha appeared to be the best level as increase in the level beyond this conferred no additional advantage, while a decrease in the level from this point significantly decreased the grain and straw production.

Application of P at different levels had no effect on yield contributing factors including yield of grain and straw.

It is evident from Table 2 that the application of increasing levels of N in conjunction with higher levels of P upto 40 Kg/ha significantly increased the grain and straw yield. The maximum yield of grain, however, was obtained by application of 80 Kg N/ha and 40 Kg P/ha, though the yield was not significantly higher to that obtained under 60 Kg N/ha and 40 Kg P/ha. The straw yield, however, remained significantly higher in the former treatment. Higher levels of P, on the other hand beyond 40 Kg P/ha did not show any beneficial effect, in fact the yields were comparatively depressed.

TABLE 1. *Effect of N and P_2O_5 on various yield contributory factors*

Levels	Height of tillers (cm)	Fertile tillers (No.)	Grain weight (gm)	Grain straw ratio	grain yield q/ha	Straw yield q/ha
N 0	73·69	3·66	4·69	1·65	18·95	31·45
N 20	82·10	4·00	5·08	1·58	24·72	39·12
N 40	81·77	4·33	5·63	1·65	26·00	42·62
N 60	82·29	5·66	5·95	1·74	29·93	52·25
N 80	85·70	4·91	6·78	1·64	30·29	54·87
SEm ±	2·90	0·22	0·29	0·12	0·67	0·93
L. S. D. 5%	...	0·66	0·82	...	1·89	2·72
P 0	79·04	3·86	5·25	1·63	24·91	42·75
P 20	81·36	4·26	5·70	1·65	26·25	45·25
P 40	81·02	4·53	5·86	1·67	26·78	44·75
P 60	83·01	4·60	5·70	1·65	25·99	43·25
SEm ±	2·59	0·21	0·25	0·10	0·66	0·82
LSD 5%	...	...	...	...	...	...

TABLE 2. *Combined effect of N and P on grain and straw yields (q/ha)*

(i) Grain yield:

Treatments	P_{20}	P_{40}	P_{60}	SEm ±	L. S. D. 5%
N_{20}	27·16	26·42	25·50	1·33	3·81
N_{40}	24·25	28·50	28·83		
N_{60}	29·00	30·50	28·83		
N_{80}	29·58	33·50	29·08		
(ii) Straw yield:					
N_{20}	42·00	38·00	39·50	1·84	5·25
N_{40}	40·25	45·75	46·50		
N_{60}	53·50	54·25	50·75		
N_{80}	53·75	62·00	48·00		

The uptake of N continued to rise with advance in age of the crop (Fig. 1). The maximum uptake was evidenced between 60 and 90 days of growth, a stage corresponding to elongation of stem (grand growth period), however, uptake during the preceding as well as preceding stages were comparatively very much lower. Against each level of applied N, uptake between 30 and 60 days of growth were approximately the same as that of between 90 and 120 days of growth. Increasing levels of N increased its uptake at each stage of growth, however, the difference in uptake beyond 60 Kg N/ha were appreciably low.

Uptake of N increased progressively with age irrespective of P application (Fig. 2) and followed the same trend as exhibited by N. Increasing the application of P did not affect the N uptake and whatever the differences were observed, were found to be too small.

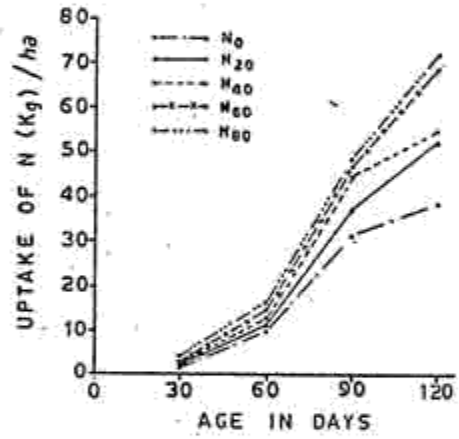

FIG. 1. EFFECT OF N ON ITS UPTAKE.

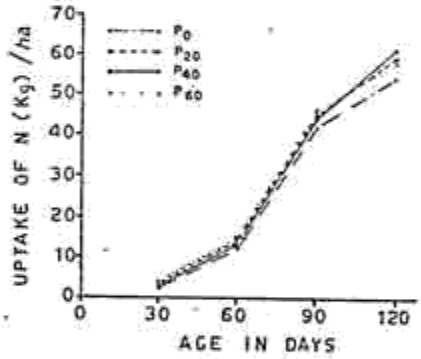

FIG. 2. EFFECT OF P_2O_5 ON N UPTAKE.

The total uptake of N increased with increase in the level of N application (Table 3). Though the additional uptake of N over control against increasing level of N increased, however, recovery per cent decreased with increase in N application. The increase in grain yield over control corresponded to the additional uptake of N. The response in terms of additional yield over control per Kg of N applied decreased with increasing levels. There was a sharp decrease in response beyond 60 Kg N though a response of 14·1 Kg grain per Kg N was obtained at 80 Kg N/ha.

The maximum recovery went upto 68 per cent of applied N at 20 Kg/ha which dropped down to 42·16 per cent at 80 Kg N/ha. It is further evidenced that the additional uptake beyond 60 Kg N/ha was only 2·62 Kg against an additional dose of 20 Kg N/ha, the corresponding increase in yield over 60 Kg N/ha was only 0·36 Q/ha. It is, therefore, evident that application of N beyond 60 Kg/ha was not beneficial.

TABLE 3. *Percent recovery of N influenced by increasing levels of application*

Levels of N applied	N uptake (Kg/ha)	Additional uptake over control (Kg/ha)	N recovery per cent	Additional yield over control (q/ha)	Additional yield in Kg/Kg of N applied
0	39·24	...	...	...	...
20	52·85	13·61	68·05	5·77	28·8
40	54·75	15·51	38·77	7·05	17·6
60	70·35	31·11	51·85	10·98	18·3
80	72·97	33·73	42·16	11·34	14·1

Discussion: It was noted that every increase in the level of N application, tended to increase the grain and straw production, over its preceding level. This seems to have been brought about by adequate supply and availability of N as is evident by its greater uptake. These findings are in close agreement to those of Carpenter *et al.*, (1952), Russell *et al.*, (1958), Singh (1961, 1963), Homes *et al.*, (1957), Singh (1958) and Singh and Prasad (1966).

Although correlation co-efficient of +0·95 and regression equation, $Y = 2052{\cdot}90 + 12{\cdot}79\ x + 0{\cdot}014\ x^2$ show that grain yield was positively correlated with the levels of N, yet no additional advantage could be secured beyond 60 Kg N/ha as is evident from a very low response in terms of grain yield in Kg/Kg N applied over 60 Kg/ha (Table 3). This lack of response is indicative of incapability of the variety in question to assimilate larger quantity of N and reflect the same on the yield of grain despite greater uptake of N. However, the increased absorbed N brought about rank growth resulting into lodging as is evident by greater production of straw under 80 Kg N/ha. Lack of response beyond 60 Kg N/ha was also reported by Singh (1954), Malkani and Srivastava (1958) and Modgal and Das (1963).

Application of P had no effect on grain and straw production. This may be due to reversion of applied P in clay soils of this area and a consequent slow rate of availability. Similar observations were also made by Jain *et al.*, (1958), and Relwani (1962).

Application of P at 20 Kg/ha or at 60 Kg/ha at all levels of N did not show any effect, however, 40 Kg P/ha with 80 Kg N/ha increased the yield significantly. This indicates that the availability of P increases only when a high level of N has been applied together with P. Similar observations have been recorded by Gupta (1963), Mallik *et al.*, (1965) and Singh (1961).

In the present case recovery percentage of added N dropped with increase in N application. This is explained by the fact that plants depend for their N supply on the added fertilizer in a N deficient soil, while on a a rich soil, plants derive mostly from the soil reserve. Nitrogen was a limiting factor in this case as is evident from a high recovery of 68·05 per cent from a 20 Kg N/ha level but the same dropped to 42·16 per cent when the soil became rich by an application of 80 Kg N/ha. The findings are in close conformity with those of Jordan *et al.*, (1950) and Singh (1963).

Summary: The results obtained from a field experiment consisting of graded levels of N and P_2O_5 showed that the application of 60 Kg N/ha proved the best level and an increase beyond this conferred no advantage for wheat NP 718.

Application of P_2O_5 had no beneficial effect on grain and straw yield as well as on N uptake. However, if a higher level beyond 60 Kg N/ha is envisaged, an application of 40 Kg P_2O_5/ha may be considered to balance the fertilization.

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Studies on the Biology of *Athalia proxima* Klug (Tenthredinidae ; Hymenoptera)

by

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Introduction : *Athalia proxima* Klug., the mustard saw fly causes extensive damage to the *Cruciferous* crops, the larvae of which make irregular holes in the leaves and skeletonise them. Besides feeding on leaves, the female does indirect damage by injuring leaf tissues while inserting the eggs with her saw like ovipositor. Sometimes due to severe infestation resowing becomes a necessary event. The distribution of the pest has been reported from U. S. A. (Klug, 1816), East Indies (Cameron, 1876), Pakistan (Lefroy, 1907), Jahre (Marstatt, 1913), Malaya (Susainathan, 1924), Rangoon, Burma and Sumatra (Ghosh, 1924), and Formosa (Benson, 1932). In India this insect has been noted in erstwhile Bombay State and Bengal as early as 1894 by Middleton. Later on it was recorded from Assam (Mc Swiney, 1919), Bihar (Dutt, 1919), Hilly districts of South India (Ayyar, 1932), Delhi (Isaac, 1934), Bengal (Hedayetullah, 1939), Uttar Pradesh (Lal, 1946),

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