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Comparative efficiency of P-Carriers in Saline Sodic Soil

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Abstract: The results indicated that grain and straw yields, P concentration in grain and P uptake by grain and straw was increased significantly over control by the application of different sources of phosphorus. All the sources remained at par with each other in all the characteristics studied. However a careful scrutiny of the data showed maximum grain straw yields, P concentration in grain and straw and P uptake by grain and straw were with TSP followed by SSP, N/P and DAP. TSP appears a better source of phosphorus in mildly saline sodic soil.
Key words: P-carriers, Saline sodic soils, wheat

Introduction

At present about 6.3 million hectares of land are salt-affected in Pakistan (Khan, 1993). Out of this about sixty percent (3.78 million hectare) of the salt-affected soils are saline sodic in nature (Muhammad, 1983). According to Latkovics (1977) sodic soils however often low in available phosphorus and plants seem more tolerant to sodicity where the phosphorus supply is held at higher level of availability than where phosphate is at medium or low level. The shortage of phosphorus supply for plants may be due not merely to the fact that the actual content is small, but also because of transformation of phosphorus into slowly soluble compounds. Moreover the nutrient application level is very low in Pakistan (World Bank, 1992) and the consumption of phosphorus hardly exceeds 21.6% (NFDC, 1994). Crops grown on these soils are affected from nutritional and ionic disorders (Feigin, 1985). It has been noted that grain yield of rice was increased by the application of P in saline sodic soils (Jalil *et al*., 1979). The yields of rice and wheat were not affected by P application in individual year in uncultivated sodic soil but over a period of 6 years the yield of fertilized plots was more than the corresponding control (Chhabra, 1985). Niazi *et al*., (1991) while comparing the different sources of phosphorus for rice and wheat production in sodic soils noted that SSP remained superior than other sources i.e. TSP, DAP, N/P but the results were non-significant. However fertilizer application increased the yield over control significantly. Munir *et al*. (1998) found that at ESP 40.7, SSP improved wheat yield significantly than DAP and N/P. Keeping all this in view a field study was undertaken to see the effect of P source on yield, P contents and P uptake of wheat in mildly saline sodic soil.

Materials and Methods

A field experiment was conducted at research farm of Soil Salinity Research Institute, Pindi Bhattain during 1998-99 in collaboration with Engro Chemical Pakistan Limited to see the effect of phosphorus sources on yield and chemical composition of wheat. The trail was conducted in light textured field (sandy loam), pH_s, 8.9, EC_e 6.0 d S m^{-1}, SAR 28.0 (m moles $l^{-1})^{½}$, total N 0.038%, available P 4.5 mg kg^{-1} and extractable K 100 mg kg^{-1}. The sources used were Diammonium phosphate (DAP), single super phosphate (SSP), triple super phosphoate (TSP) and nitrophos (N/P). The dose of fertilizer N and P_2O_5 was 140 and 110 kg ha^{-1} respectively. Wheat variety Inqulab 91 was sown in Randomized Complete Block Design with three replications. All cultural practices were applied to the crop. The crop was harvested at maturity. Grain and straw yields were recorded. Plant samples were analyzed for P contents and phosphorus uptake was calculated by the formula:

$$\text{P uptake (kg ha}^{-1}) = \frac{\text{\% P in grain/straw x grain/straw yield (kg ha}^{-1})}{100}$$

All the analyses were done according to the methods described in hand book No. 60 (U.S. Salinity Lab. Staff, 1954), except texture by Moodie *et al*. (1959), total N by Jackson (1962) and available P by Watanabe and Olsen (1965). All the data were statistically analyzed by using RCBD (Steel and Torrie, 1980).

Results and Discussion

Grain and Straw Yield: The results indicated that grain and straw yields (Table 1) were significantly increased over control by the application of fertilizers. The phosphorus sources remained non-significant with each other. Similar result were reported by Jalil *et al*. (1979) and Niazi *et al*. (1991). However, the careful scrutiny of the data showed that although P sources were non-significant but TSP produced the maximum grain and straw yield.

Phosphorus Concentration (%) in Grain and Straw: Phosphorus concentration in grain and straw is given in Table 1. The results revealed that P concentration in grain was increased significantly over control by the application of fertilizers. But in straw it remained non-signifcant. The P sources were found non-significant with each other like in grain and straw yield. However the highest P concentration was noted where TSP was applied and least in DAP treatment. Naizi *et al*. (1991) and Munir *et al*. (1998) held similar views.

Phosphorus uptake (kg ha^{-1}) by Grain and Straw: P uptake was increased significantly over control (Table 1) by application of fertilizer. The sources of phosphorus significantly differed in case of P uptake by grain while P uptake in straw was comparable. However TSP proved to

Table 1: Effect of phosphorus sources on yield and chemical composition of wheat

Treatment	Source	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Phosphorus concentration (%)		Phosphorus uptake (kg ha^{-1})	
				Grain	Straw	Grain	Straw
N-P_2O_5-K_2O							
0-0-0	-	1.38 b	3.83 b	0.27 c	0.07^{NS}	8.84 c	2.82 b
140-110-0	DAP	5.34 a	13.20 a	0.31 abc	0.10	16.73 b	13.22 a
140-110-0	SSP	5.56 a	14.02 a	0.34 ab	0.13	19.13 a	18.44 a
140-110-0	TSP	5.67 a	14.96 a	0.35 a	0.14	19.90 a	21.49 a
140-110-0	N/P	5.54 a	14.45 a	0.33 ab	0.14	18.34 ab	15.91 a

be the superior source of P followed by SSP, Nitrophos and least by DAP. Niazi *et al.* (1991) found SSP as superior source in highly sodic soils having ESP of 41 but in the present study TSP was found superior source in mildly saline sodic soils. As SSP contains gypsum 46% in addition to P so it performed better in sodic soil, where as TSP has high concentration of phosphorus so it performed better in mildly saline soidc soil. DAP has high pH and did not offer relief, comparable to acidic fertilizers, to plants in calcareous saline sodic soils, so it was found least efficient chemical influencing P uptake by wheat plants.

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