WHEAT RESPONSE TO APPLIED PHOSPHORUS ON ACID VERTISOL

COMPORTAMENTUL GRÂULUI FAȚĂ DE FERTILIZAREA CU FOSFOR PE UN SOL VERTIC ACID

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Abstract: *Efficient use of adequate level of nitrogen (N), phosphorus (P) and potassium (K) is essential and important part of the sustainable agricultural production. P deficiency has been identified as one of the main limiting factors of crop production in various soils all over the world.*

The study was conducted to evaluate the response of wheat crop to phosphorus fertilization on acid vertisoil. Phosphorus was applied at the rate of 0, 30, 60, 90, 120 and 150 kg P_2O_5 ha^{-1} along with a basal dose of N and K_2O, at the rate of 80–60 kg ha^{-1}, respectively

The experiment was to design a RCBD with four replications. Wheat variety „KG 56" was sown at the test.

The data of 1000–grain weight, grain and straw yield was recorded and grain and straw samples were collected and analysed for P–concentration. The results showed that 1000–grain weight, grain and straw yields significantly increased with each level of P_2O_5 application up to 120 kg ha^{-1} and yield at 150 kg P_2O_5 ha^{-1} remained at par with 120 kg P_2O_5 ha^{-1}. Phosphorus concentration in grain and straw by wheat also significantly increased in all the treatments except control.

Rezime: *Koriscenje optimalnog nivoa azota (N), fosfora (P) i kalijuma (K) je veoma znacajno u okviru poljoprivredne proizvodnje. Deficit P je identifikovan kao granicni pokazatelj u okviru proizvodnje na raznim zemljistima iz celog sveta. Cilj ovog rada je da nadje resenje kako djubrenje sa fosforom kod psenice ima na raznim kiselim zemljistima. Fosfor je koriscen u dozi od 0,30,60,90,120 i 150 kg P2O5/ha, pored kontrolne doze H i K2O, odnosno kolicina od 80-60kg/ha. Ogled je u varijanti RCBD sa 4 ponovljanja i koristila se sorta KG56 za dotican ogled. Masa 1000 zrna, proizvodnja zrna i slame bila je registrovana i vrsila se analiza zrna i slame imajuci u vidu koncentraciju P.Rezultati su pokazali da masa 1000 zrna, proizvodnja zrna i slame znacajno se povecava sa svakom dozom P2O5 upotrebljenim do 120 kg/ha i proizvodnja kod 150 kg/ha, ali ona ostane ista od 120 kg/ha P2O5. Koncentracija fosfora u zrnu i slama se znacajno povecavala u svim varijantama u kojima se vrsili tretmani za suzbijanje.*

Key words: *wheat, phosphorus, acid soil, yield.*
Kljucne reci: *psenica, fosfor, kiselo zemljiste, proizvodnja*

INTRODUCTION

Phosphorus (P) is an essential nutrient required by plants for normal growth and development (MENGEL and KIRKBY, 2001). P deficiency has been identified as one of the main limiting factors of crop production in various soils all over the world.

P deficiency depresses plant growth (BENNETT, 1993). The leaf area of the plant is significantly reduced, while the chlorophyll content is usually not affected or even increased, making the darker green color of leaves a typical symptom for P deficiency (MARSCHNER, 1995). From an agronomic perspective, the strong reduction in the formation of reproductive organs under P deficiency makes adequate P supply to plants an important condition to achieve sufficient crop yields.

In soils, P occurs in inorganic and organic forms. Apatite, the most common primary P mineral, is dissolved in the presence of H^+ (HEDLEY et al., 1994). Orthophosphate in solution

can then precipitate with Ca, Al or Fe to subsequently form various secondary P minerals, be sorbed on surfaces in a rapid exothermic followed by a slow endothermic reaction, or taken up by soil organisms and plants (FROSSARD et al., 1995; HAYNES and MOKOLOBATE, 2001).

The P deficiency in acid soils is in connection with their more acid reaction, relatively heavier texture and more intensive P fixation capacity (EFIMOV et al., 2001; PETOŠIĆ et al., 2003). Phosphatic fertilizers are applied to increase the production of crops, but a major significant portion of phosphorus retained in the soil throught its fixation. In winter wheat, response to plant nutrients is different between growing seasons. Several researches (GYÔRI et al., 1996; ELKINA, 2001) have concluded that the observed differences during nutrient accumulation are dependent on the geografic location and site.

This study was carried out with the objective to determine the optimum level of phosphorus for improving wheat yield.

MATERIAL AND METHODS

A field experiment was conducted to see the effect of different rates of phosphorus on wheat yield on acid vertisoil soil type. Phosphorus was applied at the rate of 0, 30, 60, 90, 120 and 150 kg P_2O_5 ha^{-1} along with a basal dose of N and K_2O, at the rate of 80–60 kg ha^{-1}, respectively. Half quantity on N was applied at sowing (October) and the remaining part was top–dressed during spring. P + K treatments were applied at sowing. The experiment was design a RCBD with four replications. Wheat variety „KG 56“ was sown at the test. All the management practices were carried out as and when required. The harvest was performed at full maturity stage by using the experimental small trail combine “Sampro”.

The data of 1000–grain weight, grain and straw yields of wheat were recorded at the time of harvesting. Straw samples were oven–dried at 60–70^{0}C to constant weight. The dried straw and grain samples were ground in an electrical mill and analyzed, using the standard chemical methods (total P by vanadat–molybdate method.

The data were subjected to statistical analysis by using ANOVA technique *Mead* (1996). The treatment means were compared by using Duncan Multiple Range (DMR) test at 5% probability level (DUNCAN, 1955).

RESULTS AND DISCUSSION

In general, 1000–grain weight, grain and straw yields and P concentration (%) in grain and straw of wheat increased with increasing of the rate of P application.

Table 1.

Effect of different rates of phosphorus application on 1000–grain weight (g), grain and straw yield (t ha^{-1}) and P concentration (%) in grain and straw of wheat

Variant of experiment (P_2O_5 kg ha^{-1})	Grain yield	Straw yield	1000–grain weight	P concentration (%)	
				Grain	Straw
O	3.21 e	3.52 d	40.8 e	0.214 d	0.078 d
30	3.46 d	3.66 d	42.8 d	0.232 c	0.086 cd
60	3.83 c	4.07 c	44.5 c	0.237 c	0.095 bc
90	4.52 b	4.68 b	45.5 b	0.250 b	0.099 b
120	4.74 a	4.92 a	46.7 a	0.276 a	0.115 a
150	4.81 a	5.00 a	46.9 a	0.282 a	0.120 a

Table 1 indicated that all the five parameters were increased significantly with increasing rates of P application. The maximum 1000–grain weight was recorded in T5 (120 kg P_2O_5 ha^{-1}, which remain at par with T6 (150 kg P_2O_5 ha^{-1}) and minimum in control where no phosphorus was applied. Similarly maximum grain and straw yields were recorded at 120 kg P_2O_5 ha^{-1} rate which were statistically at par with 150 kg P_2O_5 ha^{-1} and minimum in control. All others treatments differed significantly from each other in case of 1000–grain weight, grain and straw yields. Similar results, were reported by GYÔRI et al. (1996); *ARDELL et al*. (2002); HARBISON et al. (2003).

The phosphorus concentration in grain and straw of wheat increased significantly with increasing rates of P application and maximum P concentration in grain and straw of wheat was noted in the treatment where 150 kg P_2O_5 ha^{-1} was applied and it was non significant with 120 kg P_2O_5 ha^{-1}, while minimum P concentration in grain and straw of wheat was observed in control. Phosphorus concentrations in plants is related to P extraction power of roots from soil. Normally plant roots have wider contact with soil and feed well to above ground part. This is true for extensive root system which absorbed P from soil in which P in solution is available, resultantly more P concentration in grain and straw of wheat was observed with the increasing rates of P application.

The yield response to P is considered close to its maximum a critical soil P level beyond which there would be no response to P fertilizer (GEORGE, 2000). Wheat cultivars responded significantly to the highest P rate indicating that the soil P was under the critical level even at the highest fertilizer rate in this study.

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