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THE EFFECT OF DIFFERENT CONDENSED PHOSPHATES ON THE YIELD OF LOLIUM MULTIFLORUM AND THEIR EFFECT ON DIFFERENT INTERRELATIONS

I. Calancea

The condensed phosphates such as ammonium pyrophosphate, potasium metaphosphate, ammonium polyphosphates are among the newest achivements in the domain of fertilizers (5, 6).

Results of various experiments have shown that these fertilisers increase the yield in wheat, barley, maize, potato, sugar beet, been and others (2, 3, 5).

However, experiments in this field are few (3). In Lolium multiflorum the reactions of these forms of phosphorus were not ilustrated in many cases, because the experiments had beed carried out with salts of NH_4,K, and Ca, where the effect was combined.

The objective of this report is to present results of a series of greenhouse pot experiments.

Materials and methods

The experiments were carried out in greenhouse in Mitscherlich pots. The samples used in this study were taken from the surface horizon of a chernozem like soil, containing 4.5 per cent organic matter, and 1 ppm P_2O_5.

Each pot was filled with two kilograms soil and mixed with 1.5 kg of sand. All pots were treated with 150 mg N and 100 mg K_2O (the sources were NH_4NO_3 and K_2SO_4). Then four variants were established with the following treatments in 3 replicates: 0; 0.1 g P_2O_5/pot; 0.3 g P_2O_5/pot and 0.9 g P_2O_5/pot.

The simple phosphate and condensed phosphates sources taken in experiments were the following: (numbers 1-4 represented in Fig.1-7).

1. Sodium phosphate - $NaH_2PO_4 \cdot 2H_2O$ (P_2O_5 = 51.4 %)
2. Sodium tripolyphosphate - $Na_5P_3O_{10} \cdot 6H_2O$ (P_2O_5 = 44.54%)

3. Sodium trimetaphosphate - $Na_5P_3O_4 \cdot nH_2O$ (P_2O_5 = 69.16%)
4. Sodium polyphosphate - $Na_nP_nO_{3n+1}$ (P_2O_5 = 68.36%)

In each pot has been sown 0.3 g seed of Lolium multiflorum.

The soil in the pots was watered to 3/4 field capacity and maintained at this moisture level for a 7 week period.

The plants were harvested after 50 days growth. The plant samples were dried at 103-105°C; one gram of the matter resulted was ground and placed into crucibles. The samples were heated at 250°C for 1 hour and at 550°C for four hours in muffle furnace.

After the samples had been cooled, five milliliters of 6N HCl were added and the content was transfered into a flask where it was diluted to 100 cm^3 with distilled water. Then the samples were analysed for their content of ash, and prepared solutions were used for the total content of P_2O_5 and K_2O.

After the plants were harvested, samples of the soil were taken from the pot for chemical analysis by the usual chemical procedure as extractible P was determined by the Egner-Riehm procedure, and phosphates activity in soil by sodium p-nitrophenyl phosphate (1, 4).

Regression model was used to evaluate the effects of phosphates.

Results

In our pot trials the experimental data illustrated by means of linear regression and the correlation coefficient reveal evidently the fertilizing action of various forms of phosphate upon the yield of Lolium multiflorum, and on its content of ash, phosphorus, potassium, on phosphorus extractible from soil, phosphatase activity in soil, and the utilisation coefficient of phosphorus (fig.1-7).

Discussion and conclusion

a. Significant difference was found between the yield of Lolium multiflorum dry matter and treatments with sodium trimetaphosphate, sodium polyphosphate and sodium phosphate, sodium tripolyphosphate. In comparison with the simple phosphate, the condensed phosphate has an increased action in chernozem like soils.

b. Ash content of plant was highest in treatments with simple phosphate. This effect is probably due to several factors including reactions of the fertilizers with the soil and their effect on the calcium ion-activity, respectively on calcium uptake.

c. The total phosphorus content of Lolium multiflorum increased greater in variants with the condensed phosphorus.

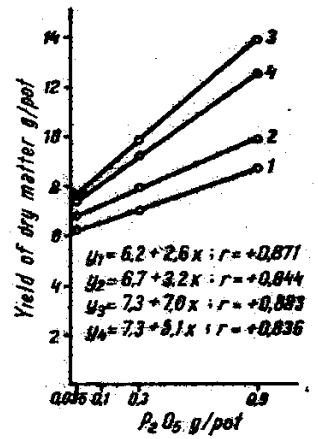

Fig.1. Effect of phosphorus fertilisers on yield of dry matter

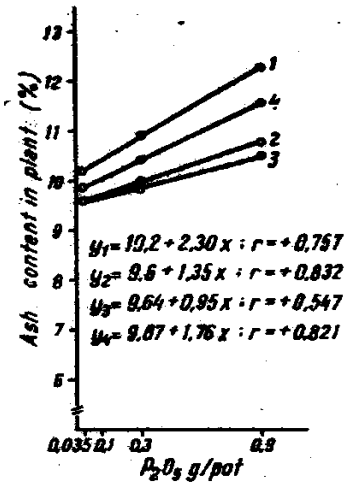

Fig.2. Effect of phosphorus fertilisers on ash content

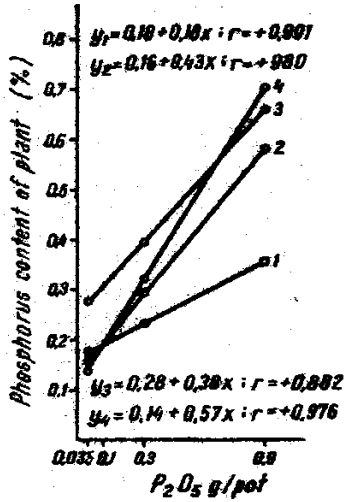

Fig.3. Effect of phosphorus fertilisers on phosphorus content of plants

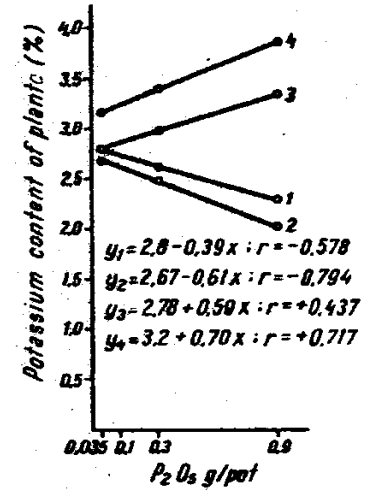

Fig.4. Effect of phosphorus fertilizers on Potassium content of plants

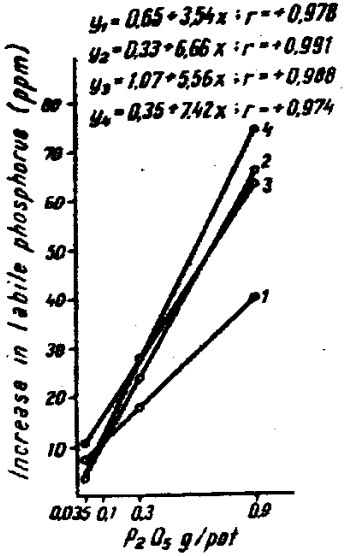

Fig.5. Effect of phosphorus fertilizers on phosphorus content in soil

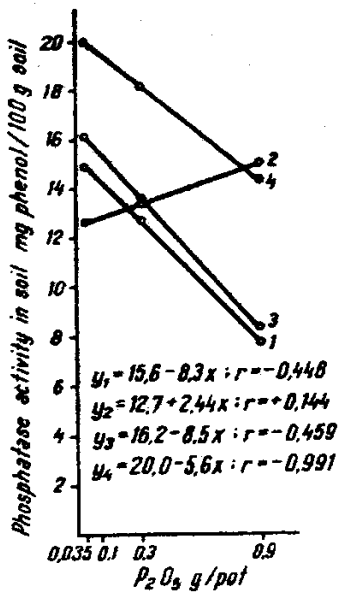

Fig.6. Effect of phosphorus fertilizers on phosphatase activity in soil

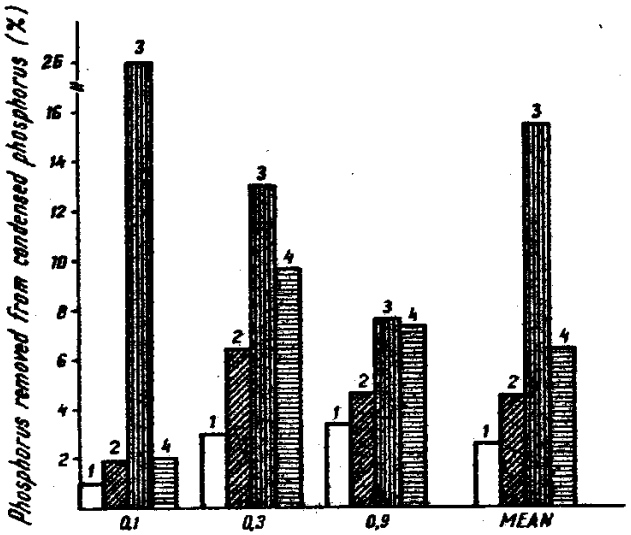

Fig.7. Phosphorus utilization coefficient from fertilizers

d. The total potassium content in plant increased without significance only in variatns with the trimetaphosphate and polyphosphate and decreased in variants with simple phosphate, tripolyphosphate. This problem requires further investigations.

e. The extractible phosphate from condensed phosphate remaining in soil under Lolium multiflorum in greater amouts than from simple phosphates. Though condensed phosphates are water-insoluble they are hidrolysed rapidly in the soil. The phosphate concentration, also plays a very distinct role too.

f. The results shown in figure 6 demonstrate that phosphatase activity in soil is inversely proportional to phosphate, biological available by Lolium multiflorum. By adding condensed phosphate, the phosphatase activity decreases. Inversely, the tripolyphosphate increases but not significantly.

g. The rate of uptake of phosphate from fertilizers by Lolium multiflorum was highest in the variant with condensed phosphate.

The results obtained show the importance of condensed phosphate on the yield of Lolium multiflorum and proves its use. Probably other plant species differ more in their reaction to the supply with these fertilizers.

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