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MEANS AND WAYS OF RAISING THE USE OF PHOSPHORUS FERTILIZED BY SUNFLOWER

Water-soluble phosphorus fertilizer incorporated into the soil undergo complicated transformaticns resulting in its phosphorus losing mobility and accessibility for plants to a considerable extent. In this connection the coefficient of using phosphorus fertilizer is small as doses of its application as a rule exceed 50-100% the phosphorus output with the yield. This necessitates elaboration of more effective methods of phosphorus application.

With this aim in view, soil sorption and phosphate-ion migration have been studied in ten diverse soils of the Krasnodar Territory using a radioactive indicator method, and dependence of its consumption by sunflower on the spatial location of fertilizer in the arable soil layer has been established.

The results of studies showed that soils rather intensively consume phosphate-ions from fertilizer.

The bulk (50-70%) of phosphorus applied is taken up in the first minutes of interaction and a balance is established on the third-eighth day. A group composition of sorptioned phosphates is different is and largely determined by the physico-chemical properties of the soil and doses of fertilizer applied. Phosphorus in fertilizer most heavily retrograded in gray forest-steppe, brown forest soils and in yellow earth. In chernozem of steppe zones this process was much weaker (Tables 1 and 2).

Table 1 contains data on relative composition of mobile phosphates determined according to F. Chirikov's method (0.5 H acetacedic extracts) in total sorptioned quantity depending upon the doses of phosphorus fertilizer appli-

Table 1.

Mobile Phosphate Content in Total Sorptioned Quantity at Different Doses of Phosphorus Fertilizer

Soil	% at P_2O_5, mg/g of soil		
	0.43	4.26	21.30
Carbonaceous chernozem	40.6	70.3	70.4
Leached chernozem	45.4	58.6	60.0
Light gray forest soil	45.2	52.5	59.3
Gray forest-steppe soil	10.1	29.6	42.0
Brown forest soil	17.1	46.5	62.0
	40.2	69.3	89.8

Table 2

Loose Phosphate Content in Total Sorptioned Quantity Depending on Phosphorus Fertilizer Doses Applied

Soil	% at P_2O_5, mg/g of soil		
	0.43	4.26	21.30
Carbonate chernozem	5.1	40.6	45.0
Leached chernozem	5.2	35.9	40.3
Light gray forest	1.3	18.7	44.0
Gray forest-steppe	1.3	9.1	26.2
Brown forest	2.7	19.6	38.7
	14.9	48.5	37.7

cation. All soils studied showed an increased proportion of mobile phosphates in their total sorptioned quantity, resulting from the increased doses of fertilizer application. A similar pattern is in evidence in Table 2 which presents dependence of the proportion of loosely tied phosphates determined by the Chang-Jackson method, on the doses of fertilizers applied.

These data are a theoretical prerequisite for a greater efficacy of the local methods of incorporating phosphoric fertilizers into the soils in question. It is these methods alone that make it possible to practically concentrate phosphate-ions in the soil corresponding to 3-5 and more mg of P_2O_5 per 1 gram of soil to diminish retrogradation of phosphoric fertilizer applied.

However, owing to the insignificant phosphate migration in soil, phosphorus consumption by plants from regionally applied phosphoric fertilizer largely depends, on their location (depth of incorporation, displacement in row-spacing). Studies of intensity of 32 P absorption from spotted phosphates prove that the closer fertilizer is to seeds, the quicker and in larger quantities do sunflower plants absorb phosphorus from it. Fig. 1 shows the dependence of the 32 P content in sunflower on the depth of fertilizer band location, and Fig. 1B represents its dependence on the band distance in row-spacing.

The data cited make it clear that sunflower is better provided with phosphorus in leached chernozem under unstable moistening conditions if fertilizer has been incorporated to the depth of 10 cm from the surface. Differences in the phosphorus supply are especially considerable during the first stage of the plants' growth and development when the physiological role of phosphorus is very important.

It was established that the band placing

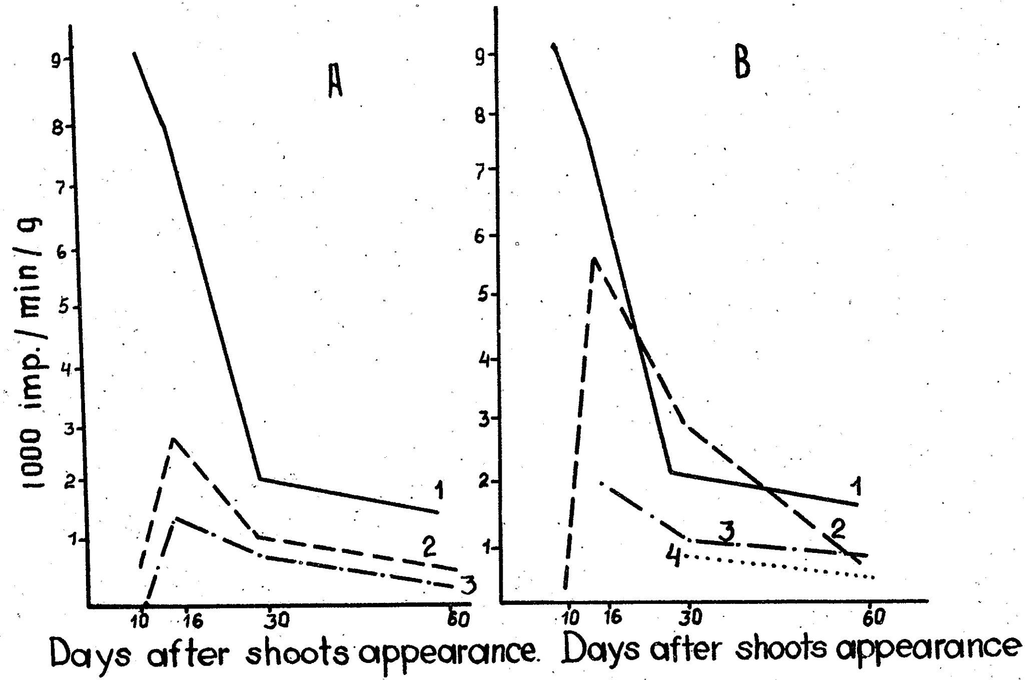

Fig. 1. Dynamics of ^{32}P content in sunflower depending on placement of phosphoric fertilizers in regard to plant root system: A – depending on placement depth (1 – 10 cm; 2 – 20 cm; 3 – 30 cm);
B – depending on remove in interrow 10 cm of placement depth (1 – 10 cm; 2 – 10 cm; 3 – 20 cm; 4 – 35 cm)

of phosphorus fertilizer at an optimal depth can raise the coefficient of phosphorus use 80% over the random fertilization and further mixing with the arable layer. This made it possible to obtain practically the same yield gain from the local pre-sowing incorporation of $N_{20}P_{30}$ by the plant feeding cultivator as from the basic fertilizer ($N_{40}P_{60}$ random fertilization before ploughing in autumn).

Local fertilization makes it possible to combine incorporation process with other requisite technological operations (pre-sowing cultivation, sowing). The most optimal placing of fertilizers and consequently their higher efficiency can be achieved when they are incorporated sowing. It has been found that sunflower consumes much during phosphorus from fertilizer applied at the $N_{20}P_{30}$ dose by two bands from both sides of the seeds simultaneously with sowing on leached chernozem. Fertilizer bands were located 1.5-2.0 cm deeper and aside from seeds. Higher fertilizer concentration makes no negative effect on seed germination such placing, while phosphorus was detected in plants when cotyledonous leaves appeared.

Thus the optimal ways of raising the efficacy of phosphoric fertilizers are local incorporation, optimal placing relative to the plant root system, and the possible reduction of application doses and a combination of technological operations.