

A.I. Lukashev,
N.N. Pryadko,
N.M. Tishkov and
V.Ya. Lefter, USSR

APPLICATION OF MINERAL FERTILIZER UNDER SUNFLOWER

Mineral fertilizer is an effective means of raising yields sunflower. They are a few factors of the direct action on a plant leading to a harvest increase.

For more than 40 years now the All-Union Research Institute of Oil Crops (VNIIMK) has been systematically studying the application of mineral fertilizers for sunflower.

The data collected for many years by the VNIIMK, its experimental stations and other research institutions in the country have shown that sunflower seed yield increases from the application of mineral fertilizers by 200-400 kg/ha, and the oil yield grows by 90-20 kg/ha. Still higher yield gains are obtained from mineral fertilizing only in separate cases in low-fertile soils during years with favourable weather conditions.

The following conclusions can be drawn on the basis of the vast quantity of generalized experimental data on the application of mineral fertilizers for sunflower:

Nitrogen and phosphorus fertilizers assure the highest seed yield gains in all kinds of leached, carbon and ordinary chernozems on which the bulk of sunflower crops grow in the USSR.

Of all unitary nitrogen and phosphoric fertilizers applied phosphoric fertilizers are the best. True it is considerably less effective than combined nitrogen-phosphoric fertilizer, but it raises seed yield substantially; therefore, farms sometimes practise the application of phosphoric alone, especially simultaneously with sowing.

Despite the fact that sunflower brings much potassium out of the soil, potassium fertilizer, applied both unilaterally and in a nitrogen-phosphorus mixture, does not raise seed yield in chernozem soil.

The explanation is that chernozem soil is rich in natural potassium easily assimilated by sunflower.

Under the broadcast method, the best results are yielded by fertilizing in autumn under ploughed field. Broadcast fertilizing in spring for the cultivation of full-ploughed land is inexpedient. In this case its effect is much less than that of autumn application under fall-ploughed land and in years with insufficient rainfall the seed yield does not increase from fertilizer at all. This results from the fact that when fertilizer is applied for the cultivation of fall-ploughed land the bulk is located in the soil surface layer beyond the active zone of the root system. This especially relates to phosphoric fertilizer as phosphoric acid is easily assimilated moves from the place of application to a small distance even under plentiful rainfall.

It was proved that middle ripening varieties respond much better to mineral fertilizer than the early ripening ones and fertilizers are more effective against the background of optimal plant density. Thinning of crops and excessive thickness of plant stand reduce fertilizer effect.

Experiments showed that complex fertilizer such as nitrophoska, diammonitrophoska, nitroammophoska, ammophos, diammophos, carboammophos, ammonium polyphosphate and others are no less effective than equivalent mixtures of ordinary fertilizer when broadcast in autumn for tilling fall-ploughed land or in spring by the local-band method. However highly concentrated complex fertilizers have substantial advantages with the equal cost of nutrients unit: they reduce waste of working time on stopping and loading aggregates with fertilizer and cut down

the cost of transport and loading-unloading operations.

Diverse forms of nitrogen fertilizer such as ammonium sulphate, ammonium nitrate and carbamide give approximately the same results when broadcast in autumn before ploughing. Carbamide is preferable in local-band fertilizing in spring and at sunflower top dressing during the period of vegetation.

Long-term studies of correlation of separate nutrient elements in fertilizers and their dosages have demonstrated that $N_{40-60}P_{60}$ gives good results. Such a fertilizer dosage is now common practice in the majority of regions in the USSR.

Fertilizer dosages greater than $N_{40-60}P_{60}$ give approximately the same or somewhat more gains in non-irrigated soil, but fertilizer cost and coefficient of employing nutrients sharply decrease.

The coefficient of using nutrients from fertilizer is also comparatively small when the ordinary dosages of $N_{40-60}P_{60}$ are broadcast for tilling fall-ploughed land. For nitrogen it is roughly 40-50% and for phosphorus 10-15%. Hence one of the most important tasks confronting our Institute in the application of chemicals is to devise methods facilitating a fuller use by sunflower of fertilizer nutrients.

D. N. Belevtsev of the VNIIMK Don Experimental Station proved that high fertilizer dosages ($N_{180}P_{240}$) are only justified on sunflower seed growing plots in soils distinguished by phosphorus deficiency. Fertilizing here is aimed at biologically enriching seeds with mineral nutrient elements, especially phosphorus, which make it possible to improve their sowing and yield qualities. This helps substantially increase the progeny's yield and oil content on production crops. This question is covered in D. N. Belevtsev's report.

The VNIIMK is now working to substantially increase seed yield gains on the fertilization

basis and raise the coefficient of using fertilizer nutrients by sunflower. The relevant investigations are aimed at discovering more effective fertilizer correlations than $N_{40-60}P_{60}$, mainly through increasing nitrogen dosages transferring a part of it for top dressing at the phase of maximum absorption of this element by plants, through adding common and high potassium dosages to NP, and through localizing the principal fertilizer in the zone of activity of the sunflower root system.

The results obtained are quite promising.

For example, the VNIIMK has elaborated methods of local-band fertilization in spring, before or simultaneously with cultivation of fall-ploughed land, or during sunflower sowing.

The methods are no less effective than fertilization in autumn before tilling fall-ploughed land and are sometimes even more effective than these. Among the studies methods of placing fertilizers the best results have been produced by their band application with a precise spatial orientation of fertilizer bands to seed rows. It would be expedient to place fertilizers in two or even better in four bands, (two bands from each side of a row); two bands 2-3 cm aside and 2-3 cm deeper than seeds, and two bands 10-12 cm aside from seeds and at a depth of 10-12 cm. With such placement of fertilizers higher dosages can be incorporated if necessary, together with the ordinary $N_{40-60}P_{60}$, without bearing that increased salt concentration in soil might produce a negative effect in the sunflower root system.

Positive results have been obtained when a correlation between nitrogen and phosphorus was changed in differently placed fertilizer bands and when the plants' nitrogen nourishment was differentiated.

The VNIIMK continues to study these and other problems of fertilizer application for sunflower.