P. G. Semikhnenko,
A.N. Riger, USSR

SUNFLOWER CULTIVATION AT A MINIMUM NUMBER OF TREATMENTS IN SPRING AND SUMMER

Much attention is now being paid to reducing the number of soil tillages to the minimum. Agronomists and economists are proving the expediency of this direction.

It has been graphically demonstrated that rejection of some methods of soil tillage, their replacement by less energy-consuming ones, application of herbicides, and combination of several technological operations into one do not diminish the yield but raise it in certain conditions. The task is to comprehensively study the conditions for possible transition to minimum soil tillages in order to boost crop yields.

In recent years the All-Union Research Institute of Oil Crops has been studying the possibility of reducing the number of soil tillages during sunflower growing in chernozem soils in diverse natural zones.

It has been found that the arable layer of leached, slightly leached and ordinary chernozem soils does not become ever compact during winter and early in spring but assumes an optimal structure it timely plaughed in fall. In spring the volume weight in the upper part of the arable layer is 0.9-1.0 g/cm^3 and the lower part - 1.0-1.2 g/cm^3. Neither does the arable layer of chernozem soils become compact during the whole of sunflower vegetation. Thus the volume weight is maximally 1.25-1.30 g/cm^3 in leached chernozems, and 1.10-1.15 g/cm^3 in slightly leached and ordinary chernozems. Sunflower develops well and has high productivity when the chernozem soil volume weight ranges from 1.0 to 1.3 g/cm^3. Owing to this it is inexpedient to till the soil in the pre-sowing period and to con-

duct inter-row cultivation during tending crop in order to mellow and better the soil structure. What is more, during intensified soil tillage for sunflower nearly 25-30% of field acreage becomes compact before sowing under tractor wheels, which subsequently complicates soil tillage for winter crops, sunflower being their predecessor in crop rotation.

An important factor in the system of pre-sowing tillage is preservation of soil water reserves. Experiments showed that mellowing of ploughed field early in spring by harrowing and cultivation does not help preserve soil water, in chernozem soils, which means that these methods do not provide for the fulfilment of the tasks set. The arable layer moisture and water reserves in deeper horizons (1-2 metres) were at one and the same level at different combinations of pre-sowing tillage methods.

Thus when the fall-ploughed field is not tilled 15-25 days before sowing this does not bring about an increase in moisture losses owing to physical evaporation. It has also been established, that frequent and deep inter-row harrowings do not help better preserve soil moisture in sunflower crops as well.

Moisture differences have been observed just in the very upper, 0-5 cm layer. Mellowing fall-ploughed land early in spring makes it excessively porous in this layer, increases its cloddiness and therefore causes its quicker drying. This results in delayed germination and appearance of weed seedlings. All experiments showed that in spring 150-600% more weeds germinated and were killed by pre-sowing cultivation on untilled fall-ploughed land than with intensive pre-sowing tillage. Elimination of early spring soil treatments (harrowing, early cultivation) leads to an earlier emergence of weeds and consequently makes it possible to sow sunflower in time and maximally kill weeds before sowing. It also enables one to conduct all operations to mellow the soil and prevent the arable layer from becoming over compact.

In all experiments sunflower yields were similar, both with the intensified pre-sowing tillage (3-4 tractor passes before sowing) and with minimum soil tillage (one tractor pass) (Table 1).

Thus experimental data suggest that one pre-sowing cultivation can be recommended in chernozem soils for preparing fall-ploughed land for sunflower in spring. Early cultivation and simultaneous harrowing in one aggregate is only expedient on cloddy land and on land with hibernating, rootstock weeds or with windfallen grain of winter crops.

In studying sunflower tending methods we have found that the optimal depth of inter-row cultivation is 6-8 and 8-10 cm with this depth it is possible to completely cut out weeds with a minimum damage for sunflower root system. Deeper soil tillage is not expedient and can result in yield decrease. The number of inter-row cultivations is dependent on crop weedness. One or twc inter-row cultivations gave the best results when only mechanical methods of tending crops were applied. The incorporation of effective herbicides (in our experiments it was trephlane in dosages recommended by the VNIIMK herbicides laboratory) makes it possible to conduct only one cultivation or no cultivation at all in sunflower crops (Table 2).

The results obtained show that sunflower can be grown with 2-3 tractor passes (pre-sowing cultivation, sowing and one inter-row cultivation or none at all) when effective herbicides are applied. Without herbicides the number of tractor passes can be reduced to 5 or 6 (pre-sowing cultivation; sowing, harrowing before and after seedlings and 1-2 inter-row cultivations).

The VNIIMK recommendations to reduce soil treatment measures before sowing and during sunflower tending are used on a wide scale. Sunflower growing with the minimum number of treatments allows to apply surface tilling and exclude ploughing during the preparation of soil for winter crops after sunflower in the south of the country.

Table 1

The Sunflower Seeds Yield at Diverse Intensified Pre-Sowing Soil Tillage, c/ha

Experimental stations and years of experiments	Soil tillage numbers before sowing			
	1	2	3	4
VNIIMK 1966-1969	28.7	28.6	28.4	27.9
The VNIIMK Armavir experimental station 1969-1971	20.5	20.2	20.2	20.2
The VNIIMK Belgorod experimental station 1969-1973	20.2	20.1	20.1	19.6
The Voroshilovgrad experimental station 1972-1974	19.3	19.1	18.9	19.0
The Donetsk experimental station 1969-1971	17.9	17.8	17.6	18.1
The Kirovograd experimental station 1969-1971	22.1	22.3	21.8	21.2
The VNIIMK Moldav experimental station 1966-1969	23.8	23.4	23.9	22.7

Table 2

Sunflower Seed Yield at Different Number of Inter-Row Cultivations c/ha (sowings were tilled by trephlane)

Experimental stations and years of experiments	Number of inter-row cultivations		
	none	one	two
VNIIMK 1970-1973	27.5	27.8	27.8
The VNIIMK Armavir experimental station 1969-1971	19.7	20.1	19.3
The Voroshilovgrad experimental station 1972-1974	18.7	18.5	17.9
The Donetsk experimental station 1969-1971	19.8	18.6	18.4
The VNIIMK Don experimental station 1971-1974	23.6	24.0	23.7
The Kirovograd experimental station 1969-1971	24.1	23.4	22.9