METHOD OF NITROGEN FERTILIZATION AND YIELD OF SUNFLOWER HYBRID NS-H-26-RM

RAJKOVIC, Z., VREBALOV, T., AND BOGDANOVIC, D*

INTRODUCTION

Nitrogen is important for the yields of all agricultural crops. In the case of the sunflower, however, it is necessary to be careful and precise in the application of N fertilizers because an inadequate, i.e., excessive application of N may affect the crop depressively by encouraging disease attacks. Besides determining the optimal dosages of N fertilizers, it is equally important to determine the best method of application, both to secure the highest effect of N on sunflowers and to cut production costs by reducing the number of applications. The objective of this study was to examine different methods of N application on a highly fertile soil which had been found not to be in danger of N leaching outside the active zone of the root system (Upasena, 1977; Uddin, 1977).

MATERIAL AND METHODS

Field experiments were conducted in 1977, 1978, and 1979 on chernozem soil of favorable physical and chemical properties and high fertility. The soil had been found to possess a high index of available N. It had also been examined for the downward movement of N and for the optimal dosages of N fertilizers without running risks of inciting intensive disease attacks (Rajkovic and Bogdanovic,

* Institute of Field and Vegetable Crops, Novi Sad, Yugoslavia

1976; Rajkovic, 1978; Jocic and Saric, 1978). The design of Latin squares was used. The experimental hybrid was NS-H-26-RM, planted at the density of 57000 plants/ha (70 × 25 cm). All variants were fertilized with 100 kg/ha of P_2O_5 and K_2O, while the N fertilization was as follows: (1) without N fertilizers, (2) 60 kg/ha applied in fall, (3) 40 kg/ha aplied in fall and 20 kg/ha in spring, and (4) 20 kg/ha applied in fall, 20 kg/ha in spring, and 20 kg/ha top-dressed. Besides following the accumulation of dry matter per stages of development, fresh soil samples were analysed each 15 days for the content of mineral N ($NH_4 + NO_3$) in 10 cm soil layers to the depth of 50 cm. The distribution of $NH_4 + NO_3$ — N to the depth of 200 cm (per 20 cm soil layers) was determined before planting, in July, and after harvest by Bremner's method (1965).

RESULTS AND DISCUSSION

Table 1 lists the yields of seed, Table 2 the contents of oil and the degree of damage caused by diseases.

TABLE 1

Seed yields (q/ha)

Treatment	1977	1978	1979	1977/79
$N_0P_{100}K_{100}$	39.4	41.0	45.7	42.0
$N_{60/1x}P_{100}K_{100}$	41.8	41.8	45.6	43.1
$N_{60/2x}P_{100}K_{100}$	40.8	43.0	46.1	43.3
$N_{60/3x}P_{100}K_{100}$	39.8	41.3	46.2	42.4
LSD 0.05	4.8	4.8	3.9	

High seed yields were obtained in all experimental years (40 – 46 q/ha). The application of N did not bring any worth-while yield increases, which confirmed a high index of available N in the soil. For this reason, no large differences could be observed either between the methods of N fertilization or between the other examined characters. It is clear that the N fertilization did not affect the contents and yields of oil. The last indicator —degree of damage caused by diseases— also indicated the absence of the effect of N fertilizers.

TABLE 2

Oil contents, oil yields, and percentages of plants destroyed by diseases

Treatment	Oil %	Oil yield q/ha	% of plants destroyed by diseases
$N_0P_{100}K_{100}$	51.4	19.3	7
$N_{60/1x}P_{100}K_{100}$	51.1	19.6	7
$N_{60/2x}P_{100}K_{100}$	50.0	19.3	6
$N_{60/3x}P_{100}K_{100}$	51.2	19.3	7

The above results may be explained by the ability of sunflowers to use reserve N from the soil on one side, and by the ability of the soil to provide sunflowers with available N throughout the vegetation, even at the stages of a very intensive N assimilation, on the other. Figure 1 illustrates the reaction of sunflowers to the omission of N. It may be seen that sunflower yield decreases were lower than those observed in other crops. After 12 years without N fertilization, sunflower yield was reduced by 20-25% in relation to the variant with NPK fertilization. The other crops suffered larger losses, the wheat even 80%.

Figure 2 gives a comparative review of the quantities of N assimilated by sunflower plants at different stages of development (I-VI) and the quantities of $NH_4 + NO_3$ — N in fallow soil to the depth of 50 cm (1-7). It is obvious that the soil potential for available N offered sufficient quantities of N to the sunflower crop at all times.

The available literature data from different countries show a large variability in the reaction of sunflowers to both, the application of N fertilizers in general and the method of application. Zubrinski and Zimmerman (1974) reported that N fertilization increased sunflower seed yields by 648-850 kg/ha in all 12 localities in eastern North Dakota. At the time of planting, the contents of NO_3—N to the depth of 61 cm were lower than 60 kg/ha in these localities, which explains the reaction of sunflowers to N fertilization. Girase et al. (1975) obtained increases in seed yields with the dosage of 25 kg/ha of N whereas higher dosages reduced the yields. Vitkov et al. (1974) found that N fertilization brought yield increases only in irrigation. Massey (1971) obtained yield increases with 56 kg/ha of N while higher dosages reduced the yields. Rao et al. (1976) stated that highest yields were obtained when 50% of N were applied before planting and the remainder was applied in two equal portions 21 and 45 days after the planting. Petrova and Koleva (1976) reported that N

fertilization in one turn during the soil cultivation in spring was more efficient than N fertilization in several turns. All these data show that N fertilization for sunflowers is definitely regional in character; it should be planned on the basis of the sunflower requirements for N and soil-climatic conditions of the region of growing.

ABSTRACT

Field trials on chernozem soil were conducted in the period 1977-1979 to examine the effect of different methods of N fertilization on seed yield, oil content, and yield of sunflower hybrid NS-H-26-RM. There were neither visible reactions to the application of N fertilizers nor differences in reaction to different methods of fertilization. The index of available N in soil indicated that the sunflower was supplied with sufficient quantities of N throughout the growing season.

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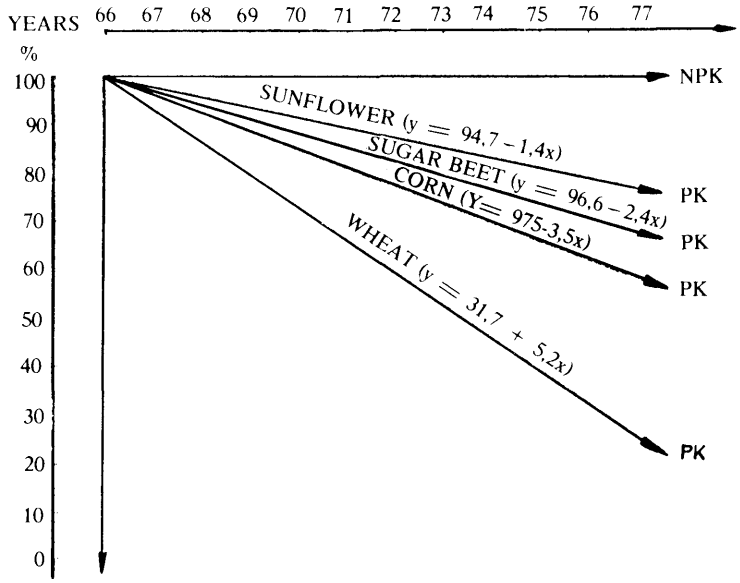

Figura 1.— Decrease of yields in absence of N-fertilizers
(Rajkovic Z. and Bogdanovic D., 1978)

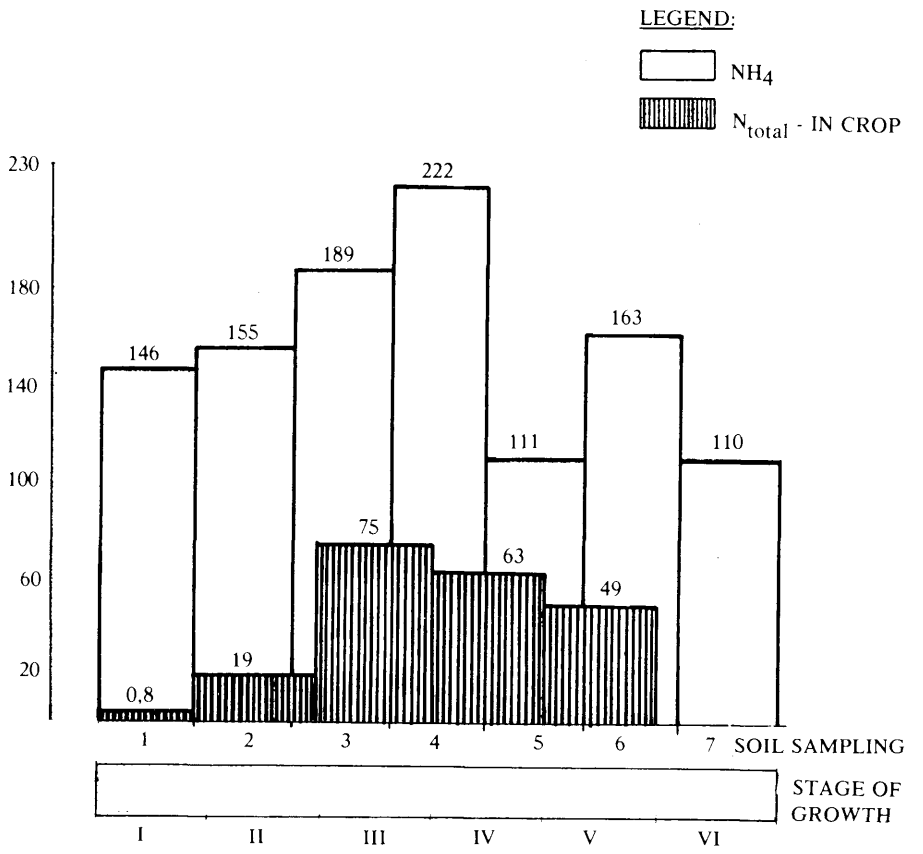

Figura 2.— The relationship between NH_4 + NO_3 - N in fallow soil (0-50 cm de and N uptake by the crop at different stages of growth