

RESEARCH ON THE INFLUENCE OF BASIC SOIL TILLAGES AND CROP CARE WORKS ON BIOMETRIC PARAMETERS AND SUNFLOWER PRODUCTION

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ABSTRACT

This paper presents the experimental results of a research carried out on sunflower crop, within the locality of Bailesti, Dolj County. The factors investigated were the basic tillage of the soil and the crop care of the sunflower crop. The basic tillage of the soil that were researched were: year after year disk tillage, without plowing, normal plowing and deep plowing. The crop care works experienced were: one mechanical hoeing, one mechanical hoeing and one manual hoeing and two mechanical hoeing plus herbicide. The paper presents data on the influence of these two factors on the height of sunflower plants, on the diameter of the calatidium, the oil content of the seeds and on the production of seeds per hectare. The best results were given by the deep plowing and the variant with two mechanical hoeing plus herbicide.

INTRODUCTION

Sunflower is one of the staple field crops in Romania. Sunflower oil is good for the human diet, due to its high content of unsaturated fatty acids and high smoking point (Vrânceanu Al. V., 2000).

The sunflower is a good honey plant (about 20 kg of honey / ha). Sunflower oil has a pleasant taste, a pleasant smell, a high content of vitamins A, D, E and K, is preserved for a long time.

It is drought tolerant, has a lower consumption of chemical fertilizers, is a good precursor for straw cereals and it is competitive in weed control (starting with the second month of vegetation) (Dincu I., Lăcătușu Gh., 2002).

Sunflower oil is also used as an environmentally friendly renewable fuel under the name of biodiesel. Grinding is a protein rich product. The increase in average production per hectare by 61% over two decades is explained by the improvement of cultivation technology, the use of varieties with high oil content

and the location of sunflower in favorable cultivation areas.

Romania has always been in the international statistics, among the big sunflower producing countries (Tianu Al., 1995).

The increase of sunflower cultivated areas was influenced by some economic and social factors. One of these factors is the sale of production immediately after harvest, at advantageous prices and with immediate payment.

On the other hand, farmers can determine the structure of their crops according to the requirements of the agricultural products market, but the sunflower for consumption has had a constantly high market demand in all the last years. it can be said that today the sunflower culture has become one of the most economically efficient crop. from an agronomic point of view, sunflower is drought tolerant, has moderate consumption of chemical fertilizers, and weeds and pests are easily controlled (Dobre M., 2019).

MATERIAL AND METHOD

The research was carried out at a private farm in Bailesti, Dolj County. The experiment was placed according to the

method of subdivided plots (Ciulcă S., 2006; Săulescu N., Săulescu N.N., 1967) and had two factors, namely:

- factor A - basic soil tillages, with three graduations

a1 - disking year by year (not plowed), at 10-12 cm depth:

a2 - normal plowing, at a depth of 18 - 20 cm, every year:

a3 - deep plowing, at a depth of 21-25 cm, every year.

- factor B – crop care works, with three graduations

b1 - one mechanical hoeing, with the cultivator;

b2 - one mechanical hoeing and one manual hoeing, per plant row;

b3 - two mechanical hoeings and a post-emergent herbicide.

The number of replications was three. The sown area was 8 m x 4.2 m = 33.6 m², and the harvested area was 22.4 m² (66.67%). The width of the alleys was 1.5 m. The previous crop was the winter wheat, harvested in early July. About 20 days after harvest, after the growth of the root suckers (*Sorghum halepense*), a non-selective herbicide, Glyphogan, (with total action), based on glyphosate, was applied on the stubble, 3 l/ha, without working the soil for about a month.

For pre-emergent weed control, Acetochlor Super (acetochlor 840 g / l + AD 67 antidote 84 g / l) was used, 2 liters/ha, which controls annual

RESULTS AND DISCUSSIONS

Before harvesting the sunflower, the following biometric measurements were made: the final height of the plants (cm) and the diameter of the heads (cm).

The following results were obtained regarding the interaction of the two experimented factors:

a) The height of the sunflower plants varied between 157.4 cm and 162.7 cm in the variant worked by disk every year, between 163.5 cm and 172.6 cm in the

monocotyledonous weeds and some dicotyledonous ones and in post-emergence Pantera 40 EC herbicide was used (40 g / l), 1.75 liters/ha.

The simple sunflower PR63A90 hybrid was cropped as biological material. It is the most cultivated sunflower hybrid in Europe (about 1 million ha), with high production potential and good production stability. It has tolerance to *Orobanche cumana*, breed E, blight tolerance (*Plasmopara helianthi*), European breed 304, tolerance to white rot attack (*Phomopsis helianthi*), very good resistance to falling and breaking and a high degree of self-fertility.

Harvesting was done manually. The eliminations (rows on the pickets) were first harvested. Production was corrected to STAS humidity. Before harvesting, the height of the plants and the diameter of the head were determined in all replications. After harvesting, the oil content of the seeds were determined, then the yield per hectare.

For the statistical processing, the method of analysis of variance in bifactorial experiments was used.

variant plowed at 18-20 cm depth and between 170, 3 cm and 177.8 cm in the variant plowed at 21-25 cm depth (table 1).

The crop care works contributed to the increase of the plant height by 2.8 - 7.1 cm or by 1.8 - 4.3% depending on the tillage system. All plant height increases are statistically assured (significant in combination a1b2, distinctly significant in combination a1b3 and a3b2 and very significant in combination a2b2, a2b3 and a3b3).

Table 1.

The influence of the interaction of factors A (soil basic tillages) x B (crop care works) on the average height of the plants of sunflower, on the typical chernozem from Bailesti – Dolj

Factors		Plant height			Significance
A	B	cm	%	± / Mt.	
a ₁ - disk tillage every year, no plowing	b ₁ - one mechanical hoeing, with the cultivator	157.4	100	-	-
	b ₂ - one mechanical hoeing and one manual hoeing, per plant row	160.2	101.8	2.8	*
	b ₃ - two mechanical hoeings and a post-emergent herbicide	162.7	103.4	5.3	**
a ₂ - normal plowing	b ₁ - one mechanical hoeing, with the cultivator	163.5	100	-	-
	b ₂ - one mechanical hoeing and one manual hoeing, per plant row	169.1	103.4	5.6	***
	b ₃ - two mechanical hoeings and a post-emergent herbicide	170.6	104.3	7.1	***
a ₃ - deep plowing	b ₁ - one mechanical hoeing, with the cultivator	170.3	100	-	-
	b ₂ - one mechanical hoeing and one manual hoeing, per plant row	174.4	102.4	4.1	**
	b ₃ - two mechanical hoeings and a post-emergent herbicide	176.8	103.8	6.5	***

DL 5 % = 2.78 cm

DL 1 % = 3.83 cm

DL 0,1 % = 5.31 cm

b) The diameter of the head (calatidium) oscillated between 20.2 cm (in the not plowed variant, disk tillage every year and mechanically hoed once) and 21.4 cm (in the variant deeply plowed and mechanically hoed twice plus herbicide), so the amplitude of the variation is small (1.2 cm). The increases are significant in

the a₃b₃ combination, distinctly significant in the a₁b₃ and a₂b₃ combinations, and insignificant in the other combinations (table 2).

The various maintenance works increased the diameter of the sunflower head by 0.2 - 0.5 cm.

Table 2.

The influence of the interaction of factors A (soil basic tillages) x B (crop care works) on the head diameter of the plants of sunflower, on the typical chernozem from Bailesti – Dolj

Factors		Head diameter			Significance
a	b	cm	%	± / mt.	
a ₁ - disk tillage every year, no plowing	b ₁ - one mechanical hoeing, with the cultivator	20.2	100	-	-
	b ₂ - one mechanical hoeing and one manual hoeing, per plant row	20.4	101.0	0.2	-
	b ₃ - two mechanical hoeings and a post-emergent herbicide	20.7	102.5	0.5	**
a ₂ - normal plowing	b ₁ - one mechanical hoeing, with the cultivator	20.8	100	-	-
	b ₂ - one mechanical hoeing and one manual hoeing, per plant row	21.0	101.0	0.2	-
	b ₃ - two mechanical hoeings and a post-emergent herbicide	21.2	101.9	0.4	**
a ₃ - deep plowing	b ₁ - one mechanical hoeing, with the cultivator	21.1	100	-	-
	b ₂ - one mechanical hoeing and one manual hoeing, per plant row	21.3	100.9	0.2	-
	b ₃ - two mechanical hoeings and a post-emergent herbicide	21.4	101.4	0.3	*

DL 5 % = 0.30 cm

DL 1 % = 0.38 cm

DL 0,1 % = 0.51 cm

c) The oil content (%) of the seeds oscillated between 47.0% (in the not plowed variant, disk tillage every year and mechanically hoed once) and 49.1% (in the variant deeply plowed and mechanically hoed twice plus herbicide).

The increases are insignificant in the a₃b₂ combination, significant in the a₂b₂ and a₃b₃ combinations, and distinctly significant in the a₁b₂, a₁b₃, and a₂b₃ combinations (table 3). The various maintenance works increased the oil content by 0.2 - 0.6%.

Table 3.

The influence of the interaction of factors A (soil basic tillages) x B (crop care works) on the oil content of the plants of sunflower, on the typical chernozem from Bailesti - Dolj

Factors		Oil content			Significance
A	B	%	%	± / Mt.	
a ₁ - disk tillage every year, no plowing	b ₁ - one mechanical hoeing, with the cultivator	47.0	100	-	-
	b ₂ - one mechanical hoeing and one manual hoeing, per plant row	47.4	100.9	0.4	**
	b ₃ - two mechanical hoeings and a post-emergent herbicide	47.6	101.3	0.6	**
a ₂ - normal plowing	b ₁ - one mechanical hoeing, with the cultivator	47.8	100	-	-
	b ₂ - one mechanical hoeing and one manual hoeing, per plant row	48.1	100.6	0.3	*
	b ₃ - two mechanical hoeings and a post-emergent herbicide	48.3	101.0	0.5	**
a ₃ - deep plowing	b ₁ - one mechanical hoeing, with the cultivator	48.8	100	-	-
	b ₂ - one mechanical hoeing and one manual hoeing, per plant row	49.0	100.4	0.2	-
	b ₃ - two mechanical hoeings and a post-emergent herbicide	49.1	100.6	0.3	*

DL 5 % = 0.27 %

DL 1 % = 0.40 %

DL 0,1 % = 0.77 %

d) Seed production per hectare

Analyzing the unilateral influence of factor A (soil basic tillage system) it resulted that in the control variant (a₁), disk tillage year by year, the production obtained was only 2,389 kg/ha. In the other variants, worked with the plow, the productions were higher, as follows:

- for the variant in which a normal plowing was performed, of 18 - 20 cm (a₂), the production was of 3,116 kg/ha, with a harvest increase of 727 kg / ha, distinctly significant. The relative

production was 152.3%, so there is a percentage increase of 52.3%;

- for the variant in which a deep plowing was performed, of 21 - 25 cm (a₃), the obtained production was the highest, of 3,408 kg/ha, with a harvest increase of 1,019 kg / ha, very significant. The percentage increase was 73.4%.

Following the analysis of the unilateral influence of factor B (crop care works) it was noticed that in the control variant (b₁), in which a mechanical hoeing was performed, the production obtained was 2,544 kg / ha. In the other

variants, the sunflower productions were higher, as follows:

- for the variant in which a mechanical hoeing and a manual hoeing (b2) were made, a production of 2,951 kg/ha was registered, with a harvest increase of 407 kg / ha, insignificant. The relative production was 126.4%, which results in a percentage increase of 26.4%;

- for the variant in which two mechanical hoeings were carried out plus herbicide (b3), the production obtained was the highest, of 3,418 kg/ha, with a

harvest increase of 874 kg / ha, distinctly significant. The percentage increase was 56.6%. In all three tillage systems (disk, normal plowing and deep plowing) the application of a mechanical hoeing and a manual hoeing brought, compared to the performance of only one mechanical hoeing, insignificant production increases of 401 kg/ha at combination a1b2, of 429 kg/ha combination a2b2 and 390 kg/ha at combination a3b2. The percentage increases were 39.4%, 25.8% and 20.0%, respectively.

Table 4

Unilateral influence of factor A (soil basic tillages) on sunflower production, on typical chernozem from Bailesti - Dolj, in 2019

A factor (soil basic tillage)	Yield			Significance
	Kg / ha	%	± / Mt.	
a ₁ - disk tillage	2,389	100	-	-
a ₂ - normal plow	3,116	152,3	727	**
a ₃ - deep plow	3,408	173,4	1.019	***

DL 5 % = 256.1 kg/ha

DL 1 % = 423.8 kg/ha

DL 0,1 % = 793.2 kg/ha

Table 5

Unilateral influence of factor B (crop care works) on sunflower production, on typical chernozem from Bailesti - Dolj, in 2019

B factor (crop care works)	Yield			Significance
	Kg / ha	%	± / Mt.	
b ₁ - one mechanical hoeing, with the cultivator	2,544	100	-	-
b ₂ - one mechanical hoeing and one manual hoeing, per plant row	2,951	126.4	407	-
b ₃ - two mechanical hoeings and a post-emergent herbicide	3,418	1566	874	**

DL 5 % = 476.8 kg/ha

DL 1 % = 669.3 kg/ha

DL 0,1 % = 945.0 kg/ha

Table 6

The influence of the interaction of factors A (soil basic tillage) x B (crop care works) on sunflower production, on the typical chernozem from Bailesti - Dolj, in 2019

Factors		Yield			Significance
A	B	kg / ha	%	± / Mt.	
a ₁ - disk tillage every year, no plowing	b ₁ - one mechanical hoeing, with the cultivator	2,017	100	-	-
	b ₂ - one mechanical hoeing and one manual hoeing, per plant row	2,418	139.4	401	-
	b ₃ - two mechanical hoeings and a post-emergent herbicide	2,733	170.4	716	*
a ₂ - normal plowing	b ₁ - one mechanical hoeing, with the cultivator	2,663	100	-	-
	b ₂ - one mechanical hoeing and one manual hoeing, per plant row	3,092	125.8	429	-
	b ₃ - two mechanical hoeings and a post-emergent herbicide	3,594	156.0	931	**
a ₃ - deep plowing	b ₁ - one mechanical hoeing, with the cultivator	2,953	100	-	-
	b ₂ - one mechanical hoeing and one manual hoeing, per plant row	3,343	120.0	390	-
	b ₃ - two mechanical hoeings and a post-emergent herbicide	3,927	149.9	974	**

DL 5 % = 544.4 kg/ha

DL 1 % = 764.2 kg/ha

DL 0,1 % = 1,078.9 kg/ha

CONCLUSIONS

Sunflower is a staple crop in our country and, due to its economic importance, cropping technology has evolved over the years, leading to an increase in average production by over 60% in the last 20 years. Romania was the first country in the world to introduce sunflower hybrids in culture.

The present research has considered the influence of basic soil tillage and sunflower crop care works.

Thus, as basic tillage of the soil were disk tillage year after year, without plowing, normal plowing and deep plowing. The crop care works experienced were: one mechanical hoeing, one mechanical hoeing and one manual hoeing and two mechanical hoeing plus herbicide.

The best results were given by the deep plowing and the variant with two mechanical hoeing plus herbicide.

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