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## CULTIVATION OF SUNFLOWER DEPENDING ON FERTILIZER SYSTEM

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**Problem statement.** Ukraine is considered to be one of the world leaders in the production of sunflower oil and its subsequent export [1]. It is important to maintain the efficiency of producing sunflower products at the relevant level, since the improvement of the latest technologies for its cultivation is an important component, because it is about the rational use of fertilizers [2, 3].

The main factors that influence the cultivation of sunflower are as follows: climate, soil, mineral nutrition, varieties and hybrids that are adapted to a particular soil and climatic zone [4]. Throughout the growing season, sunflower needs mineral nutrition as there is an increase in vegetative mass matter. To get a high yield of sunflower and a good profit, it is necessary to implement agrotechnical measures and rationally use the fertilizer system [5].

Application of fertilizers significantly increases the content of mineral nutrients available to plants in the soil. Throughout the growing season, sunflower needs micronutrients such as zinc, manganese, boron, as well as obligatory fertilizers such as nitrogen, phosphorus, and potassium [4]. Under such conditions, fertilizers significantly change the chemical composition of the soil, its physical and other properties.

It is the improvement of mineral nutrition of plants that has a positive effect on the processes of photosynthesis, promotes normal growth and development of

plants, creates conditions for yield formation and improves the quality of sunflower seeds [2].

**Statement of basic materials.** The study was conducted during 2018-2020 in Vertokyivka LLC, village Vertokyivka, Zhytomyr raion, Zhytomyr oblast.

The study was carried out on typical black soil, which is characterized by the following agrochemical parameters: arable layer 0-20 cm contains humus -3.22-4.35%, the reaction of the soil solution is slightly acidic (pH 6.2-6.5), the content of active forms of nitrogen and phosphorus is medium, the content of potassium is high.

The sequence of crops in crop rotation is the following:

1) corn 2) soybean 3) sunflower 4) winter wheat 5) bean.

Fertilizers included the use of organic fertilizers in the form of semi-rotten manure (40 t/ha), mineral fertilizers (nitrogenous – 90 kg/ha (carbamide), phosphorous – 60 kg/ha (simple granular superphosphate), potassium – 120 kg/ha (potassium salt). Mineral fertilizers were applied in a scattering manner.

Variants of sunflower fertilizers:

1. Control (without fertilizers)
2.  $N_{90}P_{60}K_{120}$
3. Manure 40 t/ha +  $N_{90}P_{60}K_{120}$

In the course of the experiment, generally accepted methods and agricultural techniques of sunflower cultivation common for the Forest-Steppe zone were applied. The main type of tillage was plowing to a depth of 22-24 cm.

Variety No. 1 Aidar was used in the course of the experiment.

The variety was created in Ukraine. It is an early-maturing variety (102-107 days). It is unpretentious to different types of soils. It is a good precursor for winter crops. The indicators of yield and oil content are good. It is characterized by relative resistance to common diseases of sunflower. It is mainly used as an oil crop. Its quality is high oil. It is relatively resistant to drought. The sowing rate is 70,000 seeds per hectare. The oil content is 50-51%. The height of sunflower reaches 150-160 cm. The flower head is 19-21 cm in diameter. The weight of 1000 seeds is 55-65 grams. The yield is up to 50 centner/ha. It has high resistance to diseases such as powdery

mildew, Phoma rot, gray rot, white rot and sunflower broomrape. Plant density before harvest is 60-65 thousand plants/ha [2].

Variety No. 2. SI Edison. It is a mid-season hybrid with genetic resistance to new races of broomrape. The hybrid is flexible to the condition of cultivation; it demonstrates a stable high yield in all areas of its cultivation. It has a high level of drought resistance and resistance to false powdery mildew. Owing to the leaves, the hybrid is ruffled, which significantly increases the effective area of photosynthesis and ensures maximum yield and full filling in various arid conditions. It is characterized by high oil content, up to 54%. In 2018, the yield of the hybrid in the Central and Northern Steppe zones ranged within 26.5-38.4 centner/ha, in the Forest-Steppe zone of Ukraine it reached 45.2-52.1 centner/ha [2].

Fertilizers have a significant influence on the growth and development of sunflower plants. This is confirmed by the results of studies on the height of sunflower plants, which are presented in (Table 1).

Table 1

Growth indicators of sunflower plants depending on fertilizers

Variant of fertilizer	Sunflower variety	Years of study	Height of plants, m	Stem diameter, cm	Number of leaves, pcs/plant	Area of leaf surface, thousand m <sup>2</sup> /ha
Control (without fertilizers)	Aidar	2018	1.39	1.90	17.9	43.0
		2019	1.43	1.64	17.4	43.2
		2020	1.60	2.25	13.0	36.0
		Average	1.47	1.93	16.1	40.7
	SI Edison	2018	1.57	2.50	19.2	52.0
		2019	1.55	2.77	18.5	55.8
		2020	1.60	2.89	14.8	38.4
		Average	1.57	2.72	17.5	48.7
N <sub>90</sub> P <sub>60</sub> K <sub>120</sub>	A	2018	1.61	2.30	20.0	51.5
		2019	1.58	2.25	17.2	48.6
		2020	1.66	2.59	13.9	39.9
		Average	1.61	2.38	17.0	46.6
	SI Edison	2018	1.65	2.50	20.0	53.5
		2019	1.66	2.45	19.9	52.7
		2020	1.70	2.54	14.0	40.5
		Average	1.67	2.49	17.9	48.9
Manure 40 t/ha + N <sub>90</sub> P <sub>60</sub> K <sub>120</sub>	A	2018	1.59	2.64	19.5	52.1
		2019	1.70	2.75	16.5	50.5
		2020	1.77	2.80	14.4	41.3
		Average	1.68	2.73	16.8	47.9
	SI	2018	1.68	2.83	20.6	53.8
		2019	1.70	2.90	17.5	49.9

	Edison	2020	1.86	3.10	14.0	40.9
	Average		1.74	2.94	17.3	48.2
HIP <sub>05</sub>	A (varieties)		0.23	0.17	0.26	1.21
	Б (fertilizers)		0.17	0.09	0.19	0.96

Fertilizers significantly affect the growth and development of sunflower plants.

In the control variant, in the flowering phase of the plants, the height in the Aidar variety was 1.47 m, and in the SI Edison variety it was 1.57 m. When mineral fertilizers were applied, the height of plants increased and reached 1.61 m for Aidar and 1.67 m for SI Edison.

Additional application of organic fertilizers at the rate of 40 t/ha helped to increase the height of sunflower plants for the variety Aidar to 1.68 m and for the variety SI Edison 1.74 m.

The same data was obtained regarding the diameter of the stem. In the control variant, the height of the plants reached 1.93-2.72 cm. When mineral fertilizers were applied, the diameter increased to 2.38-2.49 cm, and when organic fertilizers were added, to 2.73-2.94 cm.

The number of leaves of the plant did not depend on the amount of fertilizer, but depended on the variety and was 16.1-17.0 pieces per plant for the Aidar variety and 17.3-17.9 pieces per plant for the SI Edison variety.

It should be noted that fertilizers significantly affected the area of leaf surface. In the control variant, the area was 40.7-48.7 thousand m<sup>2</sup>/ha depending on the variety. When mineral fertilizers were applied, the area increased to 46.6-48.9 thousand m<sup>2</sup>/ha, and when organic fertilizers were added, the area of leaf surface increased to 47.9-48.2 thousand m<sup>2</sup>/ha, which is significant at 95% of the level of significance.

The yield of sunflower, which is given in (Table 2), depended on the applied fertilizers.

In the control variant (without fertilizers), the yield was 15.2 centner/ha for the Aidar variety. When mineral fertilizers were applied, the yield increased to 29.8

centner/ha, and when manure was added, to 31.6 centner/ha, or the increase was 14.6-16.4 centner/ha, respectively.

In the control variant, the yield ranged within 16.0 centner/ha for the SI Edison variety. When mineral fertilizers were applied, the yield increased to 33.2 centner/ha, or the increase was 17.2 centner/ha.

When organomineral fertilizers were applied, the increase in yield compared to the control variant increased by 18.8 centner/ha, or the yield was 34.8 centner/ha and was the highest in the experiment. That is the SI Edison variety was more yielding compared to the Aidar variety.

Table 2.

The yield of sunflower depending on the fertilizer, average during 2018-2020

Variant of fertilizer	Yield, centner/ha	Yield increase		Oil content %	Increase of oil content %
		centner/ha	%		
Aidar variety					
Control (without fertilizers)	15.2	-	-	44.6	-
N <sub>90</sub> P <sub>60</sub> K <sub>120</sub>	29.8	14. 6	196	46.7	2. 1
Manure 40 t/ha + N <sub>90</sub> P <sub>60</sub> K <sub>120</sub>	31.6	16. 4	207	46.9	2. 3
SI Edison variety					
Control (without fertilizers)	16.0	-	-	44.9	-
N <sub>90</sub> P <sub>60</sub> K <sub>120</sub>	33.2	17. 2	208	46.8	1. 9
Manure 40 t/ha + N <sub>90</sub> P <sub>60</sub> K <sub>120</sub>	34.8	18. 8	217	47.7	2. 8
HIP <sub>05</sub> A		2.8			
(variaties)		1.7			
B (fertilizers)					

The application of fertilizers contributed to an increase of the oil content in sunflower. In the control variant, the oil content was 44.6% for the Aidar variety. When mineral fertilizers were applied, it increased to 46.7%, and when organomineral fertilizers were applied, it increased to 46.9%. This was by 2.3% more than in the control variant.

For the SI Edison variety, the oil content in the control variant was 44.9%. When mineral fertilizers were applied, it was 46.8%. Additional application of manure increased the oil content to 47.7%, or was higher than the control by 2.8%.

### CONCLUSIONS

For cultivation of sunflower in Vertokiyivka Agricultural LLC in Zhytomyr raion of Zhytomyr oblast, it is recommended to grow sunflower of SI Edison and to apply organomineral fertilizer system, namely, manure 40 t/ha +  $N_{90}P_{60}K_{120}$ , which provides a yield of 34.8 centner/ha and seed oil content within 47.7%.

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## Схожість

Джерела з Інтернету

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1 [http://www.imk.zp.ua/bulletin/pdf/2016/23/zmist\\_en\\_23.pdf](http://www.imk.zp.ua/bulletin/pdf/2016/23/zmist_en_23.pdf)

3 джерела 0.58%

2 <https://www.pahrtners.be/fr/offres-emploi>

2 джерела 0.48%

3 <http://www.forestcarbonpartnership.org/sites/forestcarbonpartnership.org/files/Documents/PDF/Jan2011/Viet%20N>

2 джерела 0.48%