Research in: Agricultural & Veterinary Sciences
Vol.6, No.3, 2022, pp.147-151

THE EFFECT OF MINERAL FERTILIZERS ON THE DYNAMICS OF TOTAL PHOSPHORUS IN THE ABOVEGROUND MASS OF SUNFLOWER

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Abstract. The paper deals with the effect of mineral fertilizers on the dynamics of total phosphorus in the aboveground mass of sunflower in gray-brown soils. It is determined that the use of mineral fertilizers in sunflower crop has a significant effect on the accumulation of total phosphorus in the aboveground mass on the phases of growth. Total phosphorus increases by 0.02-0.11% in stem, 0.02-0.13% in receptacle and 0.03-0.12% in seed compared to the control (no fertilizer) option at the end of vegetation under the influence of mineral fertilizers. The highest amount of total phosphorus is observed in the $N_{120}P_{120}K_{120}$ option at each growth phase. As a result of the use of mineral fertilizers in sunflower crops, it is found that there is a high correlation between the amount of total nitrogen, phosphorus and potassium (%) in the stem, receptacle, seeds and the yield (c/ha) in the ripening phase on options.

Keywords: *sunflower, gray-brown, soil, mineral fertilizers, aboveground mass, stem, leaf, receptacle, seed, phases of growth, total phosphorus.*

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Received: *20 October 2022;* ***Accepted****: 17 November 2022;* ***Published:*** *12 December 2022.*

1. Introduction

Sunflowers were planted in area of 11,017 ha in Azerbaijan, 4966 ha in Ganja-Dashkasan economic region and 1944 ha in Samukh region in 2020. Sunflower yielding for grain was accordingly 23946, 12167 and 4684 tons, and the average crop yield was 22.4; 24.3 and 23.4 c/ha (www.stat.gov.az).

According to many sources, sunflower is one of the main oil plants, and is in the third place after soybean and groundnut. The seeds of sunflower hybrids contain 48-52% oil and 23-26% protein. It is used for getting oil and fodder in the national economy. Sunflower oil has high nutritional quality. Oilseed residues and oilcake, which are the strong fodder used in cattle breeding, are made from the processing products. Furfural, feed yeast and ethyl alcohol are made from the seed shell. At the same time, silage is got from sunflower and it is a honey-producing plant (Smirnov, 2019).

According to many authors, the study of mineral nutrition conditions is considered the main factor among sunflower cultivation technologies (Lukashev, 1992; Tishkov & Yenkina, 2003).

The effect of poultry manure as organic fertilizer and mineral fertilizers on the change of total nitrogen, phosphorus and potassium in the aboveground part of sunflower was studied by plowing with a 10-12 cm disc harrow and at a depth of 25-27 cm on two backgrounds in the Rostov region in the research, which was carried out by D.A. Manashov. Total nitrogen of the plant was almost the same – 2.71-2.73% in the control in both backgrounds, 1.85-1.92% in flowering, 3.18-3.98% in seeds at the rate of 25 t/ha of organic fertilizer, and 1.02-1.49% in the aboveground mass. Phosphorus in plant

increased by 0.08% in discing and 0.04% in plowing and potassium by 0.30-0.32% under the influence of organic and mineral fertilizers in both backgrounds (Manashov, 2015).

The effect of various cultivation factors on sunflower productivity was studied in researches conducted in the Rostov region of Russia. It was determined that the yield of sunflower was 1.88 t/ha, and nitrogen was 2.62%, phosphorus 1.05%, potassium 1.29% in seeds by cultivation with extensive technology, and the yield of sunflower was 2.41 t/ha in the option of 300 kg/ha of ammophos fertilizer, total NPK was 2.88; 2.12; 1.34% (3.4) by cultivation with intensive technology ($N_{32}P_{156}$).

The use of fertilizers in sunflower crops was studied in the research conducted in washout black soils in Russia. It was determined that the use of mineral fertilizers increases the amount of total nitrogen, phosphorus and potassium in seeds and vegetative mass. On average, nitrogen was 3.14-3.24%, phosphorus 0.91-0.93%, potassium 0.14-0.17% in seeds, and they ranged between 0.71-0.73%; 0.4- 0.25; 3.26-3.41% in vegetative organs (Tishkov & Pikhtyarev, 2019).

Nitrogen was 4.17%, phosphorus 0.65% in the control option, nitrogen was 4.56-5.06%, phosphorus 0.76-1.29% in the fertilized option in the phase of receptacle formation of sunflower plant under the influence of mineral fertilizers. Nitrogen and phosphorus decreased in the plant towards the end of vegetation (Kravtsov *et al*., 2018)).

Nutrients are reduced in the plant near the end of vegetation. D.N. Belevsev notes that nitrogen is 3.8-5.0%, phosphorus 0.8-1.1% and potassium 5.8-8.0% in sunflower in the initial phase of growth, and nitrogen decreased to 0.8- 1.0%, phosphorus to 0.16-0.50% and potassium to 3.6-3.8% in vegetative mass at the end of the vegetation (Belevtsev, 1977).

The nutritional conditions of sunflower have not been almost studied in our republic. It is possible to increase the productivity and quality of sunflower by using new cultivation technologies, and most importantly, mineral fertilizers. Mineral fertilizers influence on the physiological and biological processes in the plant, the formation of valuable economic indicators and productivity directly. Therefore, taking into account its importance as a valuable food plant, optimization of nutritional conditions influencing on the improvement of the productivity and quality of sunflower in the region is one of the urgent problems.

The influence of mineral fertilizer rates on the dynamics of total phosphorus on the phases of growth in the aboveground mass (stem, leaf, bud, receptacle, seed) of sunflower in irrigated gray-brown (chestnut-colored) soils is studied in our study.

2. Research object and methodology

The main purpose of the research is to study the effective nutrition conditions of mineral fertilizers affecting the growth, development stages, productivity, and quality, biological and economic indicators of sunflower in the irrigated gray-brown (chestnut-colored) soils of Ganja-Gazakh region on a balance basis.

Field experiments were carried out with the fast-growing large-grain Lakomka variety of sunflower, which was purchased from the All-Union Scientific-Research Institute of Oil Plants located in Krasnodar, Russian Federation. These experiments were realized in the irrigated gray-brown soils (chestnut-colored) of the Ganja Regional Agrarian Science and Innovation Center of the Ministry of Agriculture in 2018-2021 and were presented in the following scheme: 1. Control (no fertilizer); 2. $(NPK)_{60}$; 3. $(NPK)_{90}$; 4. $(NPK)_{120}$; 5. $(NPK)_{150}$.

Field experiments were carried out 3 times with a total area of 100 m^2 (40x2.5 m) by sowing in rows (50x35 cm, 15 kg of seeds per hectare). Nitrogen-ammonium nitrate with 34.7%, phosphorus-single superphosphate with 18.7% and potassium-potassium sulfate with 46% were used as mineral fertilizers in the experimental field. Phosphorus, 80% of potassium were used in fall plowing, the remaining 20% in feeding and nitrogen was used in feeding 2 times. Phenological observations were repeated 2 times on 25 plants, and agrotechnical measures were carried out as a rule adopted for the region.

In the collected soil samples the total humus was determined by the method of I.V. Tyurin; absorbed ammonia by D.P. Konev in the pH potentiometer; dissolved ammonia in a calorimeter with the help of Nesler's reagent; nitrate nitrogen by Grandval-Lyaju; total nitrogen, total phosphorus by K.E. Ginzburg and G.M. Sheglova; active phosphorus by B.P. Machig's method; dissolved phosphorus by Denij; total potassium by Smith; dissolved potassium by Alexandrov; exchangeable potassium in a flame photometer by P.B. Protasov's method; granulometric content by N.A. Kachynski; absorbed bases by K.K. Hedroys method. In plant samples: absolute dry matter, total nitrogen, phosphorus and potassium were determined at 1050ºC thermostat by K.E. Ginzburg, G.M. Sheglov and E.V. Vulfus.

3. Discussion and analysis of research results

The table shows the dynamics of total phosphorus. As in total nitrogen, high amount of total phosphorus was observed at the beginning of vegetation – budding phase and decreased towards the end of vegetation. As can be seen from the Table 1, total phosphorus was 1.08-1.13% in the stem, 2.17-2.23% in the leaf, and 1.35-1.41% in the bud in the budding phase, and 0.85-0.92% in the stem, 1.88-1.95% in the leaf, 1.28-1.33% in the receptacle in the flowering phase, and 0.24-0.26% in the stem, 0.31-0.33% in the receptacle, 0.83-0.88% in the seed in the ripening phase in the control (no fertilizer) option according to air dry matter.

As a result of the use of different rates of mineral fertilizers, the amount of total phosphorus increased significantly compared to the control (no fertilizer) option. So, these indicators increased and became 1.11-1.15% in the stem, 2.20-2.26% in the leaf, and 1.38-1.43% in the bud in the budding phase, 0.88-0.94% in the stem, 1.93-1.98% in the leaf, 1.31-1.35% in the receptacle in the flowering phase, and 0.26-0.28% in the stem, 0.33-0.38% in the receptacle, 0.85-0.91% in the seed in the ripening phase in the $(NPK)_{60}$ option, and 1.14-1.18% in the stem, 2.22-2.28% in the leaf, 1.41-1.46% in the bud in the budding phase, 0.91-0.96% in the stem, 2.01-2.05% in the leaf, 1.35-1.38% in the receptacle in the flowering phase, 0.29-0.31% in the stem, 0.35-0.41% in the receptacle, 0.88-0.93% in the seed in the ripening phase in $(NPK)_{90}$ option. The highest amount of total phosphorus was observed in $(NPK)_{120}$ option and was 1.18-1.23% in the stem, 2.29-2.33% in the leaf, 1.47-1.53% in the bud in the budding phase, 0.95-1.01% in the stem, 2.06-2.13% in the leaf, 1.41-1.43% in the receptacle in the flowering phase, 0.33-0.36% in the stem, 0.43-0.46% in the receptacle, 0.95-0.98% in the seed in the ripening phase.

As the mineral fertilizer rates increase, the amount of total phosphorus, as the amount of total nitrogen, decreased in the $(NPK)_{150}$ option compared to the $(NPK)_{120}$ option and was 1.15-1.21% in the stem, 2.27-2.31% in the leaf, 1.43-1.50% in the bud in the budding phase, 0.93-0.98% in the stem, 2.03-2.09% in the leaf, 1.38-1.41% in the receptacle in the flowering phase, 0.31-0.33% in the stem, 0.40-0.43% in the receptacle, 0.93-0.96% in the seed in the ripening phase.

Table 1. The effect of mineral fertilizers on the dynamics of total phosphorus in the aboveground mass of sunflower (in air dry matter, %)

o/n	Options of practice	Budding			Flowering			Ripening		
		Stem	Leaf	Bud	Stem	Leaf	Receptacle	Stem	Receptacle	Seed
2018										
1	Control (no fertilizer)	1,11	2,20	1,38	0,92	1,95	1,31	0,26	0,33	0,85
2	$N_{60}P_{60}K_{60}$	1,13	2,23	1,40	0,94	1,98	1,35	0,28	0,35	0,88
3	$N_{90}P_{90}K_{90}$	1,16	2,25	1,43	0,96	2,03	1,38	0,31	0,38	0,91
4	$N_{120}P_{120}K_{120}$	1,21	2,31	1,50	1,01	2,09	1,43	0,36	0,46	0,98
5	$N_{150}P_{150}K_{150}$	1,18	2,29	1,45	0,98	2,06	1,40	0,33	0,43	0,96
2019										
1	Control (no fertilizer)	1,08	2,17	1,35	0,89	1,92	1,28	0,24	0,31	0,83
2	$N_{60}P_{60}K_{60}$	1,11	2,20	1,38	0,92	1,95	1,31	0,26	0,33	0,85
3	$N_{90}P_{90}K_{90}$	1,14	2,22	1,41	0,93	2,01	1,35	0,29	0,35	0,88
4	$N_{120}P_{120}K_{120}$	1,18	2,29	1,47	0,98	2,06	1,41	0,33	0,43	0,95
5	$N_{150}P_{150}K_{150}$	1,15	2,27	1,43	0,95	2,03	1,38	0,31	0,40	0,93
2020										
1	Control (no fertilizer)	1,13	2,23	1,41	0,85	1,88	1,33	0,25	0,33	0,88
2	$N_{60}P_{60}K_{60}$	1,15	2,26	1,43	0,88	1,93	1,35	0,27	0,38	0,91
3	$N_{90}P_{90}K_{90}$	1,18	2,28	1,46	0,91	2,05	1,38	0,30	0,41	0,93
4	$N_{120}P_{120}K_{120}$	1,23	2,33	1,53	0,95	2,13	1,43	0,35	0,45	0,98
5	$N_{150}P_{150}K_{150}$	1,21	2,31	1,50	0,93	2,09	1,41	0,33	0,43	0,96

4. Conclusion

As a result of the investigations it is shown that the use of mineral fertilizers in sunflower crop has a substantial effect on the accumulation of total phosphorus in the aboveground mass on growth phases. Total phosphorus increases by 0.02-0.11% in the stem, 0.02-0.13% in the receptacle and 0.03-0.12% in the seed compared to the control (no fertilizer) option at the end of vegetation under the effect of mineral fertilizers. The highest amount of total phosphorus was observed in each of the growth phases in the $N_{120}P_{120}K_{120}$ option. As a result of the use of mineral fertilizers in sunflower crop, it was found that there is a correlation between the amount of total nitrogen, phosphorus and potassium in the stem, receptacle and seeds and the yield (c/ha) in the ripening phase on the options. This relationship varied r=+0.953±0.041 and r=+0.969±0.030 between the yield (c/ha) and the total NPK in the stem (%), r=+0.981±0.017 and r=+0.976±0.021 between the yield (c/ha) and the total NPK in the receptacle (%) and r=+0.988±0.011 and r=+0.994±0.005 between the yield (c/ha) and the total NPK in the seeds (%) by years.

References

Bayrambekov, Sh.B. Korneva, O.G., Valeyeva, Z.B. (2013). Biological efficiency of herbicides on sunflower crops under irrigated conditions of the Volga Delta. *Scientific and practical aspects of technologies for the cultivation and processing of oil crops: Collection of scientific works*, Ryazan: RSATU, 31-36.

Belevtsev, D.N. (1977). The use of fertilizers in sunflower crop in the zone of relative humidity. Basic tillage and fertilizers for oil crops, Krasnodar, 81–91.

Dontsov, V.G. (2012). Influence of cultivation technologies on sunflower productivity on ordinary chernozems of the Rostov region. Don Agrarian Scientific and Practical Conference Innovative ways of development of the agro-industrial complex: tasks and prospects, Zernograd, 164-166.

Dontsov, V.G. (2013). Crop yield and quality of sunflower seeds depending on cultivation technologies in the southern zone of the Rostov region. Moscow, Grain economy of Russia. 2(26), 34-38.

Kravtsov, A.M., Zagorulko, A.V., Kravtsova, N.N., Novoseletsky, S.I. (2018). Efficiency of fertilizer in sunflower cultivation on leached chernozem with different levels of fertility. *Scientific journal of KubSAU, 138*(04), http://ej.kubagro.ru/2018/04/pdf/25.pdf 1

Lukashev A.I. (1992). Fertilization of sunflowers. Biology, breeding and cultivation of sunflower. Moscow, Agropromizdat, 172–180.

Manashov, D.A. (2015). The use of turkey manure in the cultivation of sunflower on ordinary chernozem of the Rostov region. Ph.D thesis, Saratov, 23 p.

Smirnov, V.P. (2019). Study of the influence of growth regulators and potassium dehydrophosphate on the yield and quality of sunflower. *Bulletin of the Michurinsk State Agrarian University*, 3. 76-81.

Tishkov, N.M., Pikhtyarev, R.V. (2019). Influence of methods of using fertilizers on sunflower productivity and consumption of nutrients on leached chernozem. Krasnodar, Oil crops, *2*(178), 61–68.

Tishkov, N.M., Yenkina, O.V. (2003). Research on agrochemistry of oil crops. Collection of scientific works. ARI oil crops: materials of the international conference dedicated to the 90th anniversary of ARIOC, Krasnodar, pp.81-102.