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РЕЗЮМЕ

В статье представлены результаты исследований по оценке эффективности различных приемов поверхностной обработки механизированными орудиями на деградированные травостой житняка гребневидного (*Agropyrum pectiniforme*) в условиях степной зоны Павлодарской области.

Из-за ежегодной гибели отдельных растений, их стеблей, побегов, соцветий и семян, а также появление новых весенних побегов и формирование новых корневых систем из года в год плотность травостоя житняка увеличивается в несколько раз, при этом площади питания растений снижаются до минимальных значений, что приводит к снижению урожайности на житняковых кормовых угодьях.

Согласно полученным данным, применение поверхностных механизированных обработок снижало плотность почвы по вариантам на 0,05–0,09 г/см³, улучшая ее водопроницаемость и повышая запасы продуктивной влаги в почве на 11,1–37,1 мм в сравнении с контролем (без обработки), больше всего накоплено влаги было под обработкой посевов дисковой бороной и дискатором – на 37 % и 43 %. За счет разрушения плотной дернины, рыхления почвы и создания оптимальной площади питания для растений увеличивается по годам плотность травостоя – на 20–37 шт./м². Эти приемы оказали положительное влияние не только на почвенные показатели, но и на урожайность зеленой массы житняка: в варианте с игольчатой бороной и дисковым луцильником она составила в среднем за два года 17,55 и 18,53 ц/га соответственно, в варианте с тяжелой дисковой бороной 28,11 ц/га и с дискатором 25,85 ц/га, в сравнении с урожайностью на контроле – 8.2 ц/га.

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APPLICATION OF MINERAL FERTILIZERS IN SUNFLOWER SOWINGS IN SOUTHERN CHERNOZEM IN AGROCLIMATIC CONDITIONS OF NORTHERN KAZAKHSTAN, KOSTANAI REGION

ANNOTATION

The prospect of agricultural development in Kazakhstan is gaining momentum. There is a development of diversification of agriculture, the area under oilseeds is also increasing. To date, one of the promising and popular oilseeds is sunflower, the cultivation area of which is increasing every

year. Sunflower oil is also the most demanded product among the population of the republic. This raises the question of increasing the yield of sunflower, including various cultivation technologies, thereby adapting them to the agrometeorological and soil indicators of the cultivation region. The purpose of this work was to comparatively study and evaluate the effect of mineral fertilizers on the yield and oil content of sunflower in the North of Kazakhstan. The experiment was carried out at the Zarechnoye Agricultural Experimental Station LLP with southern thin chernozem soils. Records and observations of the growth and development of sunflower were carried out using modern methodological recommendations. Agrotechnics of sunflower cultivation in experiments recommended for the study area. We studied different options for the use of mineral fertilizers. The paper concludes on the importance of the combined use of mineral fertilizers according to the scheme N40P40 autumn + N20P20 in spring when sowing + N10P10, top dressing in the conditions of the study area increased the yield and collection of sunflower oil to 1.34 t/ha and 0.65 t/ha. These improvements in the quality and productivity of sunflower as a major oilseed have significant implications for food security and sustainable agriculture in Northern Kazakhstan.

Key words: sunflower, mineral fertilizers, terms and methods of fertilization, oil content, crop structure, productivity

Introduction. After soybeans, peanuts and rapeseed, sunflower oil is the fourth most important vegetable oil in the world trade with an annual sunflower production of about 18 million tons and a cultivated area of more than 47 million hectares. Since sunflower is relatively drought tolerant and makes efficient use of soil nutrients due to its well developed and deeply penetrating root system, it is commonly grown in arid and semi-arid countries. [1].

According to the Ministry of Agriculture of Kazakhstan, in 2022, sunflower sown areas increased to 1 million hectares and farmers harvested about 1.2 million tons, which is almost 2 times more than last year's figures [2].

Worldwide, sunflower is mainly produced for oil. The oil concentration (usually expressed as a percentage of dry weight of seeds) mainly determines commercial yield of grain. Accordingly, both seed yield and oil percentage are essential for growers to maximize gross margin [1].

To increase the yield of sunflower, it is important to improve agricultural technology of this crop through the selection of more adapted hybrids for agro-climatic zone of crop cultivation, it is very important to regulate nutrition through mineral fertilizers, as well as the selection of optimal methods of basic tillage for sunflower crops [3, 4].

Sunflowers have a wide adaptive environment and require full sun areas, but are not affected by photoperiodism in their growth. Inorganic fertilizer components such as NPK are essential nutrients for plant growth and increased sunflower yields [5]. Balanced fertilization plays an important role in providing the nutrients needed to achieve maximum sunflower growth [6]. The level of NPK fertilizer affects not only vegetative mass of plants, but also the yield of sunflower [7]. The amount of nitrogen and potassium had a significant effect on plant height, biological yield, seed yield, and seed oil content [8]. The addition of nitrogen and phosphorus also contributed to growth and yields. When applying N fertilizers at the rate of 60 kg ha⁻¹, the highest yield of seeds and oil was obtained [9]. In studies with 200 kg/ha⁻¹ N fertilizer, an increase in the maximum amount of filled seeds, oil and protein content was noted [10, 11].

In the sunflower cultivation system, it was found that critical phases of nutrient intake are growth period, formation of the first true pair of leaves, phase of inflorescence formation and actual flowering [12, 13]. To obtain 100 kg of sunflower seeds, some authors recommend using 1.8–3.5 kg of nitrogen (N), 0.29–0.27 kg of phosphorus (P₂O₅) and 0.38–1.65 kg of potassium (K₂O) [14], and according to other authors, 4–6 kg of nitrogen (N), 1.5–2.3 kg of phosphorus (P₂O₅) and 7.5–12 kg of potassium (K₂O) [15]. However, scientific research on various schemes for the use of mineral fertilizers in the conditions of North Kazakhstan is still not sufficient, which led to the inclusion of this issue in the research scheme.

Due to the practical lack of research on the use of mineral fertilizers for sunflower crops, the research objectives included the question of a comparative study of different methods of applying mineral fertilizers on sunflower productivity in Kostanay region.

Material and methods. To achieve this goal, field studies were carried out in 2020-2022 at "Zarechnoye" Agricultural Experimental Station LLP (Republic of Kazakhstan, Kostanay region, Kostanay district, Zarechnoye village).

The repetition of the experiment is fourfold, the placement of plots is systematic.

The schemes of experiments corresponded to the requirements according to the current methods [16].

The soil of the experimental plot is southern thin black soil in combination with solonchaks up to 10%. The thickness of humus horizon (A + B) is 41-45 cm. They boil from HCl from 85 cm, the release of carbonates from the same depth. The content of humus is 3.0-3.2%. The soil of the experimental plot in a layer of 0-20 cm contains total nitrogen - 0.15-0.16%, phosphorus - 0.10-0.13%.

In the experiments, phenological observations, biometric measurements and laboratory analyzes for determining the quality of sunflower crop were carried out according to accepted modern methods [16, 17].

The organization of observations for the onset of phenological phases, records of growth and development (height, planting density, crop structure) of sunflower were carried out according to the methodological recommendation [16]. Accounting for phenology made it possible to determine the passage of the main phases of crop development, especially the time of onset of full flowering with different technologies, the duration of flowering, physiological maturation, since the success of harvesting depended on this.

In the studies, the main phases of sunflower growth and development were determined: shoots, 3-4 leaves, basket formation, flowering, ripening.

The study of growth dynamics (height) made it possible to determine the period of the most intensive growth. The height of sunflower plants was determined in 10 places of the plot in 2 non-adjacent repetitions of the experiment.

Calculation of density of plant standing by seedlings and before harvesting made it possible to determine the influence of the studied factor on the state of seedlings and loss of plants during the growing season. The density of seedlings and the number of plants remaining for harvesting were determined by counting the seedlings and sunflower plants before harvesting on 4 permanent plots in 2 non-adjacent replicates of the experiment.

The structure of sunflower crop was determined by disassembling 10 plants from the plot into its component parts.

The biological yield of sunflower was determined by counting the number of surviving plants for harvesting, the number of grains in anther and the weight of 1000 seeds.

The oil content in sunflower seeds was determined by the extraction method by extracting the crude fat from the seeds with the appropriate solvent in a Soxhlet apparatus [17].

Agricultural technology in the experience adopted for Kostanay region. The predecessor is wheat. In autumn, plowing was carried out with PLN 5-35 plow to the depth of 27-30 cm. In spring, in order to level the soil surface and close moisture, harrowing and mechanical pre-sowing tillage were carried out to the depth of seed placement. Before the emergence of sunflower seedlings, the soil glyphosate-containing herbicide Roundup (2 l/ha) was applied in spring.

Sunflower hybrid Pioneer was studied. Sowing was carried out with a SUPN-8 seeder with a row spacing of 70 cm, at the optimum time. The sowing rate of hybrids is 50 thousand viable seeds per 1 ha; depth of laying seeds is 6-8 cm.

From mineral fertilizers, NH_4NO_3 (ammonium nitrate) and $\text{Ca}(\text{H}_2\text{PO}_4)_2$ were used (double superphosphate).

Accounting for sunflower yield was carried out by the method of continuous threshing with Sampo 130 combine.

Yields were adjusted to standard moisture (10%) and purity (100%).

The obtained scientific data were subjected to statistical processing by the method of one-way analysis of variance [18].

Research results. In studies, the prevailing weather conditions of growing season had a significant impact on growth and development of sunflower.

As the data of weather conditions show, of all the studied agricultural years, the conditions of 2022 were the most favorable for the formation of a higher yield with a high oil content of sunflower.

During the germination period (May), the most favorable conditions for humidity and temperature developed in the conditions of 2020. Precipitation in May in the amount of 80.6 mm contributed to the formation of friendly seedlings of sunflower.

The most critical periods in terms of moisture for sunflower is the period of head formation and flowering, i.e. July is the month of the calendar year. Therefore, the uniform precipitation that fell in July 2022 in the amount of 81.2 mm at the optimum temperature of 21.6°C contributed to the formation of a higher sunflower yield. In 2022, the precipitation level for the month of July exceeded the long-term level by 25.2 mm.

In the conditions of 2021, precipitation in the amount of 103.5 mm fell after the sunflower flowering phase (47.5 mm more than the long-term level), so this crop almost did not use the specified amount of atmospheric moisture.

In 2020, during the formation of anthode - flowering of sunflower, i.e. in July, only 17.4 mm of precipitation fell against the background of high temperatures (23.3°C), which significantly reduced the productivity and quality indicators of sunflower.

According to the purpose of research in 2020-2022, in the conditions of Kostanay region, 4 options for mineral fertilizers were studied, applied against the background of main autumn application of $N_{40}P_{40}$, different options for pre-sowing fertilizers.

In the studies, according to the calculation data, the lowest field germination of sunflower (86.69%) and the lowest plant survival for germination-harvest period (76.77%) were determined on the control variant, i.e. when applied as the main mineral fertilizer $N_{40}P_{40}$ in autumn and at a dose of $N_{10}P_{10}$ in spring when sowing.

The highest field germination of sunflower in experiment No. 2 was determined on the variant $N_{40}P_{40}$ background autumn + $N_{30}P_{30}$ in spring when sown - 88.41%. When using $N_{20}P_{20}$ as a pre-sowing fertilizer, the field germination of sunflower was at the level of 87.42% or at the density of 43.71 thousand plants per 1 hectare.

Against the background of the use of mineral fertilizers, along with the formation of productive agrophytocenosis, it is important to preserve the resulting seedlings until harvest. In the studies, the highest safety of sprouted plants (43.43 thousand pieces) for harvesting was determined when applying $N_{40}P_{40}$ background in autumn and $N_{20}P_{20}$ in spring during sowing, as well as foliar top dressing of sunflower during the growing season with mineral fertilizers at the dose of $N_{10}P_{10}$ – 80,51%.

According to the preservation of sunflower plants in agrophytocenoses, options 2 and 3 with doses of presowing application of mineral fertilizers $N_{20}P_{20}$ and $N_{30}P_{30}$ occupied an intermediate position. In these variants, the preservation of sunflower plants for the period of germination-harvesting is at the level of 78.38-79.86%, or by 1.61-3.09% more compared to the control variant; 26-35.30 thousand sunflower plants.

In the studies conducted, different options for the use of mineral fertilizers had a different effect on the height of sunflower crops. If in the control ($N_{40}P_{40}$ background autumn + $N_{10}P_{10}$ in spring when sowing) the height of sunflower plants in the flowering phase was 126.37 cm, then an increase in presowing fertilizer to $N_{20}P_{20}$ contributed to an increase in the growth of sunflower plants to 135.61 cm or by 9.24 cm.

With a further increase in the dose of mineral nutrition to $N_{30}P_{30}$, the height of sunflower crops was 139.15 cm, or 12.78 cm higher compared to the height of crops in the control variant.

For the growth of sunflower plants, the option of using $N_{40}P_{40}$ in autumn + $N_{20}P_{20}$ in spring during sowing, as well as feeding sunflower during the growing season with mineral fertilizers at the dose of $N_{10}P_{10}$, was more optimal. In such combinations, mineral nutrition contributed to an increase in the height of sunflower crops in the flowering phase up to 145.28 cm, and later in the filling-ripening phase up to 148.70 cm or more compared to the control by 18.91 and 19.48 cm.

To obtain a better and more productive crop, it is important to form normal indicators of the sunflower crop structure: sowing density, anthode diameter, number of seeds in anthode and weight of 1000 seeds [19, 20].

As the research data showed, in the studies conducted in the conditions of Kostanay region, different doses of pre-sowing mineral fertilizers had a different effect on the formation of structural elements of productivity. At the same time, the highest indicators of the elements of the crop structure were formed in option 4, where in the autumn period $N_{40}P_{40}$ plus $N_{20}P_{20}$ was applied in the spring

when sowing and combined top dressing during the growing season of sunflower at the dose of $N_{10}P_{10}$. In this variant, sunflower planting density was 35.21 thousand units per 1 hectare, exceeding the control by 1.93 thousand units or by 5.80% (Table 1).

Table 1 - The influence of mineral fertilizers on the indicators of sunflower crop structure elements, average for 2020-2022

Variants of norms of mineral fertilizers	Planting density, thousand units/ha	Anthode diameter, cm	Number of seeds in anthode, pcs	Weight of 1000 seeds, g
$N_{40}P_{40}$ background autumn + $N_{10}P_{10}$ in spring at sowing (Control)	33,28	15,90	909	33,51
$N_{40}P_{40}$ background autumn + $N_{20}P_{20}$ in spring at sowing	34,26	17,43	945	35,62
$N_{40}P_{40}$ background autumn + $N_{30}P_{30}$ in spring at sowing	35,30	19,23	974	36,89
$N_{40}P_{40}$ background autumn + $N_{20}P_{20}$ in spring at sowing + $N_{10}P_{10}$ top dressing	35,21	21,19	1001	37,42
LSD ₀₅	0,05	0,06	4,7	0,02

If the control diameter of sunflower basket on anthode for 3 years (2020-2022) was 15.90 cm, then other options for the use of mineral fertilizers in the spring during sowing contributed to an increase in the diameter of sunflower anthode by 1.50-3.33 cm, and with additional application of mineral fertilizers to top dressing during the growing season of sunflower, the diameter of anthode was 21.19 cm, exceeding the diameter of anthode of sunflower grown on the control variant by 5.29 cm.

In the most optimal variant of the use of mineral nutrition, the number of seeds in anthode increased to 1001 seeds with a weight of 1000 seeds of 37.42 g. On the contrary, these indicators on sunflower plants of the control variant were at the level of 909 seeds with a weight of 1000 seeds of 33.51 g.

Variants of using mineral fertilizers when sowing in doses of $N_{20}P_{20}$ and $N_{30}P_{30}$ when sowing sunflower took an intermediate position in terms of elements of the crop structure.

The results of statistical processing of data on the structure of the sunflower crop indicate significant differences in the options for the use of mineral fertilizers at the level of 95%.

According to the research data of 2020-2022, with the use of mineral fertilizers, the highest sunflower productivity in terms of yield, oil and oil content was determined in the variant of the combined use of mineral fertilizers in autumn as the main fertilizer at the dose of $N_{40}P_{40}$, when sown at the dose of $N_{20}P_{20}$ and during the vegetation of sunflower as top dressing in the dose of $N_{10}P_{10}$. In this variant, the sunflower yield was 1.34 t/ha with an oil content of 48.60%, exceeding the control variant by 0.32 t/ha in terms of yield and by 0.24% in terms of oil content. The collection of sunflower oil on the best option for the use of mineral fertilizers also amounted to 0.65 t/ha, exceeding the control data by 0.16 t/ha or 32.65% (Table 2).

Table 2 – Productivity indicators of sunflower oilseeds quality depending on mineral fertilizers, average for 2020-2022

Options for mineral fertilizers	Productivity, t/ha	Oil content, %	Oil collection, t/ha
1	2	3	4
$N_{40}P_{40}$ background autumn + $N_{10}P_{10}$ in spring at sowing (Control)	1,02	48,36	0,49

1	2	3	4
N ₄₀ P ₄₀ background autumn + N ₂₀ P ₂₀ in spring at sowing	1,17	48,44	0,57
N ₄₀ P ₄₀ background autumn + N ₃₀ P ₃₀ in spring at sowing	1,29	48,47	0,63
N ₄₀ P ₄₀ background autumn + N ₂₀ P ₂₀ in spring at sowing + N ₁₀ P ₁₀ top dressing	1,34	48,60	0,65
HCP ₀₅	0,04	0,07	0,02

Against the background of main application of mineral fertilizers N₄₀P₄₀, the options for using mineral fertilizers when sowing sunflower in rows at the doses of N₂₀P₂₀ and N₃₀P₃₀ ensured sunflower yields at the level of 1.17-1.29 t/ha, oil harvest 0.57-0.63 t/ha at oil content of oilseeds 48.44-48.47%, thereby exceeding the productivity of the control variant by 0.15-0.27 t/ha, respectively; 0.08-0.14 t/ha and 0.08-0.11%.

The results of statistical analysis showed significant differences between the options for the use of mineral fertilizers for sunflower crops in terms of yield, oil yield and seed oil content at the significance level of 95%.

As the data, Pioneer hybrid turned out to be responsive to the application of nitrogen-phosphorus fertilizers in the autumn-spring period. When applying N₄₀P₄₀ in autumn and N₁₀P₁₀ in spring, the yield index had the least effect compared to other options. Thus, when applying N₄₀P₄₀ in autumn and N₂₀P₂₀ in spring, the yield increased by 0.15 t/ha ($p < 0.001$) compared with the scheme N₄₀P₄₀ in autumn and N₁₀P₁₀ in spring. At the same time, the introduction of N₃₀P₃₀ in the spring during tillage showed an increase in yield by 0.12-0.27 t/ha ($p < 0.001$) and 0.12 t/ha ($p \geq 0.05$) of options 1 and 2, respectively. The introduction of additional top dressing in the form of N₁₀P₁₀ and a decrease in the spring dose from N₃₀P₃₀ to N₂₀P₂₀ during the growing season increases the yield by 0.32 t/ha ($p \geq 0.05$) relative to option 1. As for options 2 and 3, the yield is 0, 05 t/ha ($p < 0.001$) and 0.17 t/ha ($p < 0.001$) higher, respectively.

Oil content indicators increased as the doses of applied fertilizers increased. The lowest indicator was shown by the hybrid when applying N₄₀P₄₀ in autumn and N₁₀P₁₀ in spring (option 1), where the indicator was at the level of 48.36%.

With an increase in the spring dose of application to N₂₀P₂₀ in the spring, the oil content index increased by 0.1% ($p \geq 0.05$), with an increase in the spring dose to N₃₀P₃₀, the indicator increased by 0.02% ($p \geq 0.05$), which is almost identical to the indicator of the variant application of N₄₀P₄₀ in autumn and N₂₀P₂₀ in spring.

The use of additional top dressing during the growing season at the dose of N₁₀P₁₀ against the background of autumn application of mineral fertilizers in autumn at the dose of N₄₀P₄₀ and the spring application at the dose of N₂₀P₂₀ made it possible to increase the oil content by 0.1% compared with the option of applying N₄₀P₄₀ in autumn and N₂₀P₂₀ in spring ($p \geq 0.05$) and by 0.2% ($p < 0.01$) compared with N₄₀P₄₀ in autumn and N₁₀P₁₀ in spring, by 0.15% ($p \geq 0.05$) with N₄₀P₄₀ in autumn and N₂₀P₂₀ in spring. A significant increase in the oil content in Pioneer hybrid can be taken as the option of applying N₄₀P₄₀ in autumn and N₂₀P₂₀ in spring and with additional feeding during the growing season.

NPK fertilizer affects plant growth and yield of sunflower oilseeds. In general, the best plant growth and the highest yield were obtained with the combined use of mineral fertilizers according to the scheme N₄₀P₄₀ background autumn + N₂₀P₂₀ in spring when sowing + N₁₀P₁₀ top dressing. With such a scheme for the use of mineral fertilizers, the highest sunflower productivity was obtained. Such a scheme for the use of NPK fertilizers can be recommended for growing sunflower in the conditions of the arid steppe of North Kazakhstan.

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ТҮЙІН

Қазақстанда ауыл шаруашылығын дамыту перспективасы орасан зор қарқын алуда. Ауыл шаруашылығын әртараптандыру дамуда, майлы дақылдар алқаптары да ұлғаюда. Бүгінгі

таңда перспективалы және сұранысқа ие майлы дақылдардың бірі күнбағыс болып табылады, оны өсіру алаңы жыл сайын артып келеді. Сондай-ақ, күнбағыс майы республика халқы арасында ең көп сұранысқа ие өнім болып табылады. Демек, күнбағыс өнімділігін арттыру, соның ішінде әртүрлі өсіру технологиялары, осылайша оларды өсіру аймағының агрометеорологиялық және топырақ көрсеткіштеріне бейімдеу мәселесі туындайды. Бұл жұмыстың мақсаты Қазақстанның солтүстігіндегі күнбағыс өнімділігі мен майлылығына минералды тыңайтқыштардың әсерін салыстырмалы түрде зерттеу және бағалау болып табылады. Эксперимент "Заречное" Ауылшаруашылық тәжірибе станциясы" ЖШС-де оңтүстік қуаты аз қара топырақ жағдайында жүргізілді. Күнбағыстың өсуі мен дамуын есепке алу және бақылау заманауи әдістемелік ұсыныстарды қолдана отырып жүргізілді. Зерттеу аймағына ұсынылған тәжірибелерде күнбағыс өсірудің агротехникасы минералды тыңайтқыштарды қолданудың әртүрлі нұсқалары зерттелді. Жұмыста $N_{40}P_{40}$ күзде, $N_{20}P_{20}$ көктемде қатарларға және $N_{10}P_{10}$ күнбағыстың даму фазасында үстеме коректендіру схемасы бойынша минералды тыңайтқыштарды бірге қолданудың маңыздылығы туралы қорытынды жасалды. Зерттеу аймағы жағдайында минералдық тыңайтқыштарды қолданудың ұсынылатын әдісі күнбағыс майының өнімділігі мен май шығымын тиісінше 1,34 т/га және 0,65 т/га дейін арттырды. Демек, негізгі майлы дақыл ретінде күнбағыстың өнімділігінің артуы мен сапасының жақсаруы Солтүстік Қазақстанда азық-түлік қауіпсіздігін қамтамасыз ету мен ауыл шаруашылығын тұрақты дамытуда айтарлықтай маңызға ие болады.

РЕЗЮМЕ

Перспектива развития сельского хозяйства в Казахстане набирает огромные темпы. Идет развитие деверсификации сельского хозяйства, увеличиваются площади и под масличные культуры. На сегодняшний день одной из перспективных и востребованных масличных культур является подсолнечник, площади возделывания которого увеличиваются с каждым годом. Также подсолнечное масло является самым востребованным продуктом среди населения республики. Отсюда возникает вопрос повышения урожайности подсолнечника, включая различные технологии возделывания, тем самым адаптируя их к агрометеорологическим и почвенным показателям региона возделывания. Цель данной работы заключалась в том, чтобы сравнительно изучить и оценить влияние минеральных удобрений на урожайность и масличность подсолнечника на Севере Казахстана. Эксперимент проводился в ТОО «Сельскохозяйственная опытная станция «Заречное» с южными маломощными черноземными почвами. Учеты и наблюдения за ростом и развитием подсолнечника проводились с использованием современных методических рекомендации. Агротехника возделывания подсолнечника в опытах рекомендованная для зоны исследования. Изучали разные варианты использования минеральных удобрений. В работе сделан вывод о важности совмещенного использования минеральных удобрений по схеме $N_{40}P_{40}$ осень + $N_{20}P_{20}$ весной при посеве + $N_{10}P_{10}$ подкормка в условиях зоны исследований увеличило урожайность и сбор масла подсолнечника до 1,34 т/га и 0,65 т/га. Указанные улучшения качества и увеличения продуктивности подсолнечника как основной масличной культуры имеют значительное значение для продовольственной безопасности и ведения устойчивого сельского хозяйства в Северном Казахстане.

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