https://doi.org/10.26898/0370-8799-2022-2-2
УДК: 631.53:631.816.1
Тип статьи: оригинальная
Type of article: original

# ВЛИЯНИЕ УДОБРЕНИЙ И СРОКОВ ПОСЕВА НА КАЧЕСТВО СЕМЯН ЯРОВОГО ЯЧМЕНЯ В КРАСНОЯРСКОЙ ЛЕСОСТЕПИ

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По представленным результатам исследования отзывчивость сортов на внесение разных доз минерального питания оказалась более значительной по сравнению со сроками посевов. Дозы удобрений $N_{60}P_{30}K_{60}$ и $N_{90}P_{30}K_{60}$ повышали урожайность сортов ячменя Такмак, Абалак, Буян и перспективного образца Д-5-7022 на 1,2–1,8 т/га, массу 1000 зерен – на 2–6 г, всхожесть – на 1–4% по сравнению с контролем (без удобрений). Сорт Буян превысил урожайность всех изучаемых сортов на 0,2 т/га на удобренных фонах и в данной группе проявил себя как интенсивный (прибавка урожая к контролю – 1,8 т/га, *bi* (коэффициент линейной регрессии урожайности) = 1,34). Урожайность нового образца Д-5-7025 была выше районированных сортов в контроле без удобрений на 0,3–0,4 т/га. С внесением удобрений урожайность сортов Абалак, Такмак выравнивалась в среднем до 5,68 т/га при $N_{60}P_{30}K_{60}$ и до 5,85 т/га при $N_{90}P_{30}K_{60}$. Они менее требовательны к условиям возделывания и более пластичны. Элементы структуры урожайности, продуктивный стеблестой, озерненность колоса и масса 1000 зерен в целом влияли на ее повышение во втором сроке посева на интенсивных агрофонах. Величина развитости проростков семян, как и урожайность, в меньшей степени зависела от сроков посева, а больше – от внесения удобрений. При дозе $N_{90}P_{30}K_{60}$ все показатели развитости проростков увеличились на 1,2–2,5 см по сравнению с контролем. Использование оптимального срока посева (27 мая) при сумме активных температур 182,8° и рекомендованная доза удобрений $N_{90}P_{30}K_{60}$ позволили увеличить выход семян сортов ячменя Такмак, Абалак, Буян и нового образца Д-5-7022 в среднем на 20–30%.

**Ключевые слова:** яровой ячмень, посевные качества, минеральное питание, сроки посева, дозы удобрений, развитость проростков

# INFLUENCE OF FERTILIZERS AND SOWING DATES ON THE QUALITY OF SPRING BARLEY SEEDS IN THE KRASNOYARSK FOREST-STEPPE

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According to the presented results of the study, the responsiveness of varieties to the application of different doses of mineral nutrition was more significant compared to the sowing dates. Doses of fertilizers $N_{60}P_{30}K_{60}$ and $N_{90}P_{30}K_{60}$ increased the barley yield of varieties Takmak, Abalak, Buyan and a promising sample D-5-7022 by 1,2-1,8 t/ha, weight of 1000 grains by 2-6 g, germination - by 1-4% as compared to the control (without fertilizers). The Buyan variety exceeded the yield of all

the varieties studied by 0.2 t / ha on a fertilized background and in this group proved to be intensive (increase in yield to control - 1.8 t / ha, bi (linear regression coefficient of yield) = 1.34). The yield of the new sample D-5-7025 was 0.3-0.4 t/ha higher than the released varieties in the control without fertilizers. With fertilization the yield of Abalak, Takmak varieties leveled off to an average of 5.68 t/ha at $N_{60}P_{30}K_{60}$ and to 5.85 t/ha at $N_{90}P_{30}K_{60}$. They are less demanding to the conditions of cultivation and more plastic. Elements of yield structure, productive stem, ear grain content and 1000 grains weight generally influenced its increase in the second sowing term on intensive agricultural backgrounds. The size of the development of seedlings, as well as the yield was less dependent on the sowing dates, but more on the application of fertilizers. At a dose of $N_{90}P_{30}K_{60}$ all indicators of seedling development increased by 1.2-2.5 cm compared with the control. The use of optimal sowing date (May 27) with the sum of active temperatures of 182,8° and the recommended dose of fertilizers $N_{90}P_{30}K_{60}$ made it possible to increase the yield of barley seeds of Takmak, Abalak, Buyan and the new sample D-5-7022 on average by 20-30%.

**Keywords:** spring barley, sowing qualities, mineral nutrition, sowing time, fertilizer doses, seedlings development

**Для цитирования:** *Сурин Н.А., Бутковская Л.К., Сурина Е.А.* Влияние удобрений и сроков посева на качество семян ярового ячменя в красноярской лесостепи // Сибирский вестник сельскохозяйственной науки. 2022. Т. 52. № 2. С. 12–21. https://doi.org/10.26898/0370-8799-2022-2-2. EDN ANZIDI.

**For citation:** Surin N.A., Butkovskaya L.K., Surina E.A. Influence of fertilizers and sowing dates on the quality of spring barley seeds in the Krasnoyarsk forest-steppe. *Sibirskii vestnik sel'skokhozyaistvennoi nauki = Siberian Herald of Agricultural Science,* 2022, vol. 52, no. 2, pp. 12–21. https://doi.org/10.26898/0370-8799-2022-2-2. EDN ANZIDI.

**Конфликт интересов**
Авторы заявляют об отсутствии конфликта интересов.
**Conflict of interest**
The authors declare no conflict of interest.

## INTRODUCTION

Crop seed quality is the primary basis for effective use of modern varieties in production. Creation of favorable agrotechnical conditions (sowing dates, seeding rates, fertilizer systems) for the growth and development of crop varieties allows to some extent reduce the dependence of plants on the effects of adverse environmental factors and to form quality seeds [1].

It is possible to create optimal moisture supply and favorable nutritional conditions for grain crops in the forest-steppe zone of the Krasnoyarsk region through the rational use of summer precipitation by changing the timing of sowing, as well as through the selection of optimal doses of fertilizers and forecrops [2, 3].

Among the many technological processes that affect the formation of yield and seed quality, the most significant and controllable techniques are the use of mineral fertilizers, the use of different rates and timing of sowing [4].

The timing of sowing influences the yield, sowing qualities, and yield properties of seeds to the extent that they coincide with favorable environmental conditions. The study of crop varieties shows that for some varieties a late sowing date is impossible, while for others it is acceptable. The timing of sowing is decided taking into account the onset of biological and physical ripeness of the soil, the distribution of heat and moisture during the growing season, etc. Therefore, the effect of the timing of sowing on the yield is often more effective than other agronomic techniques [5].

In the conditions of the Krasnoyarsk region a high yield of seeds with good sowing qualities can be obtained only with a balanced ratio of nutrients. The germination energy of spring barley seeds grown on a fertilized background often increases by 14% and germination - by 10% in comparison with those grown on an unfertilized one. High results in obtaining high-quality seeds provide phosphate fertilizers, increasing field germination, contributing to accelerated and uniform maturation of plants, increasing resistance to lodging. Seeds on such a background are formed with high sowing and yield qualities [6]. In wet years, there is a tendency to increase germination in improved conditions of mineral nutrition, and in unfavorable years, the completeness of germination in the presence of fertilizers

decreases. The increase in field germination in fertilized backgrounds can be explained by the greater availability of phosphorus, which is involved in metabolic processes immediately at seed germination [7].

Improvement of mineral nutrition conditions by applying the basic fertilizer has a positive effect on the yield structure. Close connections of yield with such parameters as the number of productive shoots and grain weight per ear were revealed [8].

The main characteristics of seed quality, reflecting their suitability for sowing are germination energy, laboratory and field germination, weight of 1000 grains, etc. For a more in-depth comprehensive assessment of the yield properties of variety seeds, morphophysiological evaluation of seedling organs of cereal crops is additionally used. Such indicators as seedling height, average coleoptile length, length of germinal roots and their number are evaluated [9]. When breeding new varieties, it is necessary to create such conditions that would contribute to the formation of large grains (large mass of 1000 grains), increasing the number of grains in the ear and productive stem per square meter, affecting the amount of the yield [10].

The purpose of the research is to develop a seed-growing technology of cultivation of new barley varieties for seeds depending on the timing of sowing and different doses of fertilizers, providing an increase in the yield of quality barley seeds by 20-30%.

## MATERIAL AND METHODS

Weather conditions of the growing season 2020 were characterized by sufficient moisture in all months. Sprouting phase of cereal crops took place with good moisture, in the first decade of May there were abundant rains, which contributed to the appearance of friendly sprouts. The largest amount of precipitation fell in June and July, higher by 53.3 and 83.6 mm compared with the average annual data.

Spring was warm according to temperature distribution. Monthly average temperature in May was 14.2°C, which exceeded the long-term average by 3.2°C. In June and July air temperatures were close to the long-term average annual indicators.

Weather conditions of the growing season 2021 were characterized by a lack of moisture. May and July were particularly dry, with precipitation 13.7 and 28.5 mm below the long-term average. Precipitation in June was 58.8 mm greater than the long-term average. Spring was cool, and mean monthly temperatures in May were 0.5°C below average. Summer months were warm, with average monthly temperatures in June, July and August 1.0-1.7°C above the long-term average.

An important indicator determining the degree and speed of crop ripening is the sum of active temperatures above 10 °C. This indicator averaged 1897.4° in 2020, 2021. This amount of active temperatures allowed to ensure the ripening of the studied varieties of crops. Along with good heat supply during vegetation period 2020, 2021 on average 261.8 mm of precipitation fell. The HTC was 1.38. The average perennial amount of precipitation for the year in the region is 370 mm. The multiyear HTC was 1.25.

Agrotechnical experiments were carried out in the experimental fields of Krasnoyarsk Research Institute of Agriculture (KrasNIISKh) in the village of Minino. The seeds of released barley varieties Takmak, Abalak, Buyan and promising sample of KrasNIISKh selection - D-5-7022 - were used as research objects.

**Buyan.** Originator - KrasNIISKh Rosselkhozacademy.

Pedigree: Cedar × Jo 1345 (Finland). Nutans variety. Weight of 1000 grains is 43-54 g. Average yield in the region - 24,0 c/ha. In the area recommended for cultivation of the Krasnoyarsk Territory the increase to the standard Acha was 4.3 cwt/ha with an average yield of 47.2 cwt/ha. The maximum yield of 68.9 cwt/ha was obtained in the Krasnoyarsk Territory in 2011. Late maturing, with a vegetation period of 77-99 days, ripening 8-11 days later than the Acha standard. Grain forage. Protein content 8.1-15.2%.

**Abalak.** Originators and patent holders are KrasNIISKh Rosselkhozakademy, Research Institute of Agriculture of the Northern Trans-Urals.

Pedigree: U-53-8515 × Sa46925. Included in the State Register of breeding achievements for the East Siberian (11) region. Weight of 1000 grains is 42-55 g. The average yield in the tolerance region was 26.8 c/ha, exceeding the average standard by 2.2 c/ha. The maximum yield of 62.6 cwt/ha was obtained in the Krasnoyarsk Territory in 2011. Medium early, growing season 72-89 days, ripening 2-3 days earlier than sort Acha and 2-3 days later than sort Biom. Valuable by quality. Protein content 9.1-14.5%.

**Takmak.** Pedigree: Priazovsky 9 × [(Wiener × Omsk 13709) × (Wiener × Donetsk 650)]. The variety is included in the State Register of breeding achievements allowed for use in the East Siberian (11) region. Variety Nutans. Weight of 1000 grains is 40-50 g. The maximum yield of 60.8 t/ha was obtained in 2018 in the Krasnoyarsk Territory. Medium-maturing, vegetation period 73-92 days, ripening 3-6 days later than standards Acha and Biom. Valuable by quality. Protein content 11.6-15.9%. Moderately resistant to head smut.

**D-5-7022**. A promising breeding line of KrasNIISKh breeding. Obtained from crossing the varieties Omsk 95 and Olenek. Variety Nutans. Represents the group of medium-maturing varieties. The mass of 1000 grains of 37-42 g. The yield in the competitive strain testing 4,5-4,9 t / ha. Protein content 14.4%, husk content 9.5%, oil content 2.3%.

Studies on the effect of different doses of fertilizers and timing of sowing on obtaining quality and high-yield barley seeds of varieties Takmak, Abalak, Buyan and the promising sample D-5-7022 were carried out according to the following scheme:

a) control (without mineral fertilizers);

b) fertilizer application ($N_{60}P_{30}K_{60}$), azophoska;

c) fertilizer application ($N_{90}P_{30}K_{60}$), azophoska + ammonium nitrate;

Sowing dates are May 20 (1st - early) and May 27 (2nd - late).

The soil of the experimental plot is represented by alpine heavy loamy leached chernozem, characterized by the following agrochemical parameters: humus content 3.8%, neutral reaction ($pH_{sal}$ = 6.4), hydrolytic acidity 1.3 mg-eq / 100 g, nitrate nitrogen content - very low (3.3 mg / kg), labile phosphorus (by Chirikov) - very high (200-250 mg / kg), potassium - high (145 mg / kg).

Experiments were sown by SSFK-7 seeder, harvesting by Hege harvester. Grain was dried, cleaned from impurities, and weighed. Germination energy and germination rate were determined according to GOST 12036-66. Field experiments and observations were performed according to the methods[1] and recommendations[2].

Determination of the sprout length, coleoptile, germinal roots (central) and their number in the seedlings was carried out after 10 days in order to establish the different qualities of seeds by degree and rate of development as much as possible [9].

## RESULTS AND DISCUSSION

In the experiments, different doses of fertilizers were applied at early (May 20) and late (May 27) sowing dates (see Fig. 1).

Generalization of science and practice shows that the choice of the optimal sowing period has a positive impact on the yield increase, seed uniformity, protein content in the grain, sowing qualities and contributes to reducing the total duration of the growing season by 5-7 days [11]. The conditions of mineral nutrition affect the whole complex of plant growth and development at all stages of organogenesis [12].

A later date increased the yield by 0.1-0.2 t/ha in all variants, the weight of 1000 grains increased by 1.1-1.3 g and germination by 1-2%.

The response of varieties to the application of mineral fertilizers was more significant in comparison with the timing of sowing. Doses of fertilizers $N_{60}P_{30}K_{60}$ and $N_{90}P_{30}K_{60}$ increased

[1]Dospekhov B.A. Methodology of field experience. Moscow: Agropromizdat, 1985. 240 p.

[2]Methodical recommendations for the production of elite seeds of grain, legume and cereal crops. M.: VASKHNIL, 1990. 39 p.

the yield of varieties Takmak, Abalak, Buyan and the sample D-5-7022 by 1.2-1.8 t/ha (see Table 1).

Moreover, the weight of 1000 grains increased on average by 2-6 g, and the germination rate increased by 1-4% (see Table 2).

To identify the response to changes in the growing conditions (fertilizer) the coefficient of linear regression of varieties yield (*bi*) according to the method of S.A. Eberhart and V.A. Russell [13] was calculated. The higher the value of the coefficient (*bi*> 1), the more responsiveness the variety has. In case of bi < 1, the variety responds weaker to changes in environmental conditions than the average of the whole set of varieties under study.

Buyan variety exceeded the yield of the studied varieties by 0.2 t/ha when using fertilizers and in this group showed itself as the most intensive (yield increase to the control of 1.8 t/ha, *bi* = 1.34). Varieties Abalak, Takmak, D-5-7022 were less demanding to the conditions of cultivation, the gain to the control without fertilizers respectively amounted to 1,41; 1,47; 1,13 t / ha, linear regression coefficients *bi* equal to 1.12; 1,2; 1,14.

In the control variant (without fertilizers) a promising sample D-5-7022 stood out among the varieties, the yield of which is higher than the released varieties by 0.3-0.4 t / ha.

According to some authors[3], the value of yield depends mainly on the density of the productive stem, the number of grains in the ear and 1000 grains weight. In our experiments with increasing the dose of mineral fertilizer to $N_{90}P_{30}K_{60}$ the productive stemming increased compared with the control on average over time by 45-101 pcs/m$^2$. The number of grains in the ear increased by 2-4 pcs, productive bushiness - by 0.1-0.5 (see Table 3).

It should be noted that basically all elements of the yield structure, with the exception of productive bushiness, influenced its increase at the late sowing date.

Additional characteristic of the yield properties of the seed lots are the parameters of seedling organs development of the studied varieties (see Table 4).

***Рис. 1.*** Опытные делянки сортов ячменя с различными дозами удобрений
***Fig. 1.*** Experimental plots of barley varieties with different doses of fertilizers

[3]Butkovskaya L.K., Kozulina N.S. Sowing time and seeding rate in the new wheat varieties cultivation for seeds // IOP Conf. Ser.: Earth Environ. Sci. 839. 2021. № 4. P. 1–5.

**Табл. 1.** Влияние различных доз удобрений на урожайность семян сортов ячменя, 2020, 2021 гг.
**Table 1.** Effect of different fertilizer doses on barley seed yields, 2020, 2021

| Variety | Sowing date | Fertilizer dosage | | | Addition to the control | | *bi* |
|---|---|---|---|---|---|---|---|
| | | control | $N_{60}P_{30}K_{60}$ | $N_{90}P_{30}K_{60}$ | $N_{60}P_{30}K_{60}$ | $N_{90}P_{30}K_{60}$ | |
| Takmak | 1st | 4,32 | 5,52 | 5,82 | 1,20 | 1,50 | 1,20 |
| | 2nd | 4,40 | 5,72 | 5,84 | 1,32 | 1,44 | |
| | Average | 4,36 | 5,62 | 5,83 | 1,26 | 1,47 | |
| D-5-7022 | 1st | 4,56 | 5,63 | 5,82 | 1,07 | 1,26 | 1,14 |
| | 2nd | 4,86 | 5,73 | 5,88 | 0,87 | 1,02 | |
| | Average | 4,72 | 5,68 | 5,85 | 0,96 | 1,13 | |
| Buyan | 1st | 4,44 | 5,74 | 5,91 | 1,30 | 1,47 | 1,34 |
| | 2nd | 4,49 | 5,80 | 6,41 | 1,31 | 1,92 | |
| | Average | 4,46 | 5,77 | 6,26 | 1,31 | 1,8 | |
| Abalak | 1st | 4,38 | 5,48 | 5,74 | 1,10 | 1,36 | 1,12 |
| | 2nd | 4,42 | 5,69 | 5,88 | 1,27 | 1,46 | |
| | Average | 4,40 | 5,59 | 5,81 | 1,19 | 1,41 | |

Note. $LSD_{0,5}$ fertilizers – 1,2; $LSD_{0,5}$ variety – 0,3; $LSD_{0,5}$ sowing date – 0,2.

**Табл. 2.** Влияние различных доз удобрений на посевные качества семян сортов ячменя, 2020, 2021 гг.
**Table 2.** Influence of different fertilizer doses on the sown quality of barley varieties seeds, 2020, 2021

| Variety | Fertilizer dosage | Germination rate, % | | Average | Thousand-kernel weight, g | | Average |
|---|---|---|---|---|---|---|---|
| | | 1st term | 2nd term | | 1st term | 2nd term | |
| Takmak | Control | 84 | 85 | 84 | 46,2 | 46,4 | 46,3 |
| | $N_{60}P_{30}K_{60}$ | 88 | 88 | 88 | 47,1 | 48,0 | 47,6 |
| | $N_{90}P_{30}K_{60}$ | 87 | 89 | 88 | 48,0 | 49,2 | 48,6 |
| D-5-7022 | Control | 84 | 86 | 85 | 41,5 | 45,2 | 43,4 |
| | $N_{60}P_{30}K_{60}$ | 85 | 87 | 86 | 46,4 | 49,1 | 47,7 |
| | $N_{90}P_{30}K_{60}$ | 89 | 89 | 89 | 49,2 | 49,1 | 49,2 |
| Buyan | Control | 84 | 86 | 85 | 48,1 | 50,1 | 49,1 |
| | $N_{60}P_{30}K_{60}$ | 85 | 87 | 86 | 49,6 | 52,0 | 50,8 |
| | $N_{90}P_{30}K_{60}$ | 86 | 90 | 88 | 53,0 | 53,6 | 53,3 |
| Abalak | Control | 89 | 91 | 90 | 45,8 | 46,0 | 45,9 |
| | $N_{60}P_{30}K_{60}$ | 90 | 93 | 91 | 47,3 | 48,3 | 47,8 |
| | $N_{90}P_{30}K_{60}$ | 90 | 93 | 91 | 48,9 | 49,7 | 49,3 |

Note. $LSD_{0,5}$ of the thousand-kernel weight: sowing date – 0,2; fertilizers – 0,3; variety – 0,2.

In the 1st period of sowing, the height of seedlings at the dose of $N_{90}P_{30}K_{60}$ was higher compared to the control by 0,9-1,5 cm, the length of the main root - by 1,4-2,7 cm, coleoptile length - by 0,2-0,3 cm. In the 2nd period, the height of seedlings was greater by 0.6-2.4 cm compared to the control, the length of the main root - by 0.3-2.0 cm, the length of coleoptile - by 0.5-0.6 cm. It should be noted that seedling development, as well as the yield, was registered higher in the 2nd term and on the fertilized crops.

Analysis of the average experimental data by dates and varieties showed that at higher doses of fertilizers at all stages of sowing, the indicators of seedling development exceeded the control by 1.2-2.5 cm (see Fig. 2).

**Табл. 3.** Влияние удобрений и сроков посева на структуру урожайности сортов ячменя, 2020, 2021 гг.

**Table 3.** Influence of fertilizers and sowing dates on the structure of barley varieties yield, 2020, 2021

| Variety | Fertilizer dosage | Productive plant stand, pcs. /m² | | Average | Number of grains in an ear, pcs. | | Productive bushiness | |
|---|---|---|---|---|---|---|---|---|
| | | Term | | | Term | | | |
| | | 1st | 2nd | | 1st | 2nd | 1st | 2nd |
| Takmak | Control | 392 | 394 | 393 | 21 | 21 | 2,18 | 1,79 |
| | $N_{60}P_{30}K_{60}$ | 424 | 448 | 435 | 22 | 23 | 2,56 | 2,07 |
| | $N_{90}P_{30}K_{60}$ | 436 | 548 | 492 | 24 | 25 | 2,72 | 2,28 |
| D-5-7022 | Control | 466 | 488 | 477 | 22 | 23 | 1,69 | 1,66 |
| | $N_{60}P_{30}K_{60}$ | 502 | 504 | 503 | 24 | 24 | 1,61 | 1,55 |
| | $N_{90}P_{30}K_{60}$ | 540 | 556 | 548 | 26 | 27 | 1,95 | 1,79 |
| Buyan | Control | 378 | 389 | 384 | 24 | 25 | 2,21 | 2,01 |
| | $N_{60}P_{30}K_{60}$ | 404 | 424 | 414 | 26 | 27 | 2,61 | 2,21 |
| | $N_{90}P_{30}K_{60}$ | 421 | 438 | 429 | 26 | 28 | 2,71 | 2,51 |
| Abalak | Control | 369 | 371 | 370 | 21 | 23 | 2,19 | 1,85 |
| | $N_{60}P_{30}K_{60}$ | 402 | 414 | 408 | 22 | 24 | 2,44 | 2,12 |
| | $N_{90}P_{30}K_{60}$ | 420 | 428 | 424 | 24 | 24 | 2,51 | 2,28 |

Note. $LSD_{0,5}$ of the productive plant stand: sowing date – 25; fertilizers – 30; variety – 35.

**Табл. 4.** Влияние удобрений и сроков посева на развитость проростков сортов ячменя, 2020, 2021 гг.

**Table 4.** Effect of fertilizers and sowing dates on the development of barley seedlings, 2020, 2021

| Variety | Fertilizer dosage | Sprout height, cm | | Main spine length, cm | | Coleoptyl length, cm | |
|---|---|---|---|---|---|---|---|
| | | Term | | | | | |
| | | 1st | 2nd | 1st | 2nd | 1st | 2nd |
| Takmak | Control | 17,2 | 17,4 | 6,2 | 9,3 | 4,1 | 4,1 |
| | $N_{60}P_{30}K_{60}$ | 18,6 | 18,5 | 7,1 | 9,5 | 4,7 | 4,7 |
| | $N_{90}P_{30}K_{60}$ | 18,6 | 19,8 | 8,9 | 9,6 | 4,8 | 4,7 |
| D-5-7022 | Control | 17,0 | 19,2 | 5,8 | 4,8 | 4,8 | 4,5 |
| | $N_{60}P_{30}K_{60}$ | 17,6 | 18,6 | 7,2 | 6,9 | 4,9 | 4,5 |
| | $N_{90}P_{30}K_{60}$ | 17,9 | 19,8 | 8,2 | 6,8 | 5,0 | 5,0 |
| Buyan | Control | 18,1 | 18,8 | 6,8 | 8,8 | 4,0 | 4,2 |
| | $N_{60}P_{30}K_{60}$ | 19,2 | 20,1 | 7,4 | 8,9 | 4,5 | 4,7 |
| | $N_{90}P_{30}K_{60}$ | 19,6 | 20,4 | 7,4 | 9,0 | 4,8 | 4,8 |
| Abalak | Control | 17,3 | 18,0 | 7,2 | 8,0 | 5,0 | 5,4 |
| | $N_{60}P_{30}K_{60}$ | 18,4 | 19,6 | 8,8 | 9,0 | 5,2 | 5,4 |
| | $N_{90}P_{30}K_{60}$ | 18,6 | 19,6 | 8,9 | 9,4 | 5,0 | 5,2 |

## CONCLUSIONS

1. The barley varieties under study responded more significantly to the application of mineral nutrition compared to the timing of sowing. Doses of fertilizers $N_{60}P_{30}K_{60}$ and $N_{90}P_{30}K_{60}$ increased the barley yield of the barley varieties Takmak, Abalak, Buyan and the promising sample D-5-7022 by 1.2-1.8 t/ha, the weight of 1000 grains by 2-6 g, germination by 1-4% compared to the control.

2. Buyan variety exceeded the yield of the studied varieties by 0.2 t/ha when using fertilizers and in this group showed itself as the

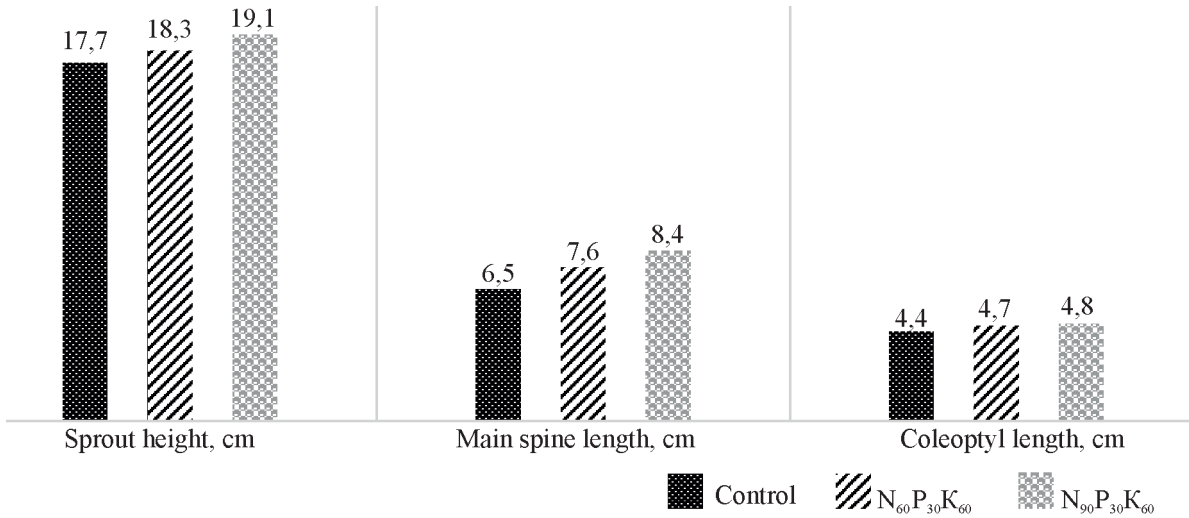


***Рис. 2***. Влияние различных доз удобрений на развитость проростков образцов ячменя, 2020, 2021 гг.
***Fig. 1.*** Effect of different fertilizer doses on the development of barley sample seedlings, 2020, 2021

most intensive (yield increase to control - 1.8 t/ha, *bi* = 1.34). Varieties Abalak, Takmak, D-5-7022 were less demanding to the conditions of cultivation, the gain to the control without fertilizers were 1,41; 1,47; 1,13 t / ha, linear regression coefficients bi equal to 1.12; 1,2; 1,14 respectively. The yield of the new sample D-5-7022 is higher than the released varieties in the control without fertilizers by 0.3-0.4 t/ha.

3. Elements of the yield structure: productive stem, ear grain content and the weight of 1000 grains generally influenced its increase in the 2nd sowing date and on intensive agrofonts. The value of seedling development, as well as the yield, depended less on the timing of the sowing, and more on the application of fertilizers. At a dose of $N_{90}P_{30}K_{60}$ all indicators of the seedling development increased by 0,2-2,5 cm compared with the control.

4. The use of optimal sowing date (May 27) at the sum of active temperatures of 182,8o and the recommended dose of fertilizers $N_{90}P_{30}K_{60}$ increased the yield of barley seeds of Takmak, Abalak, Buyan and the new sample D-5-7022 varieties on average by 20-30%.

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*Дата поступления статьи / Received by the editors 20.11.2021*
*Дата принятия к публикации / Accepted for publication 16.03.2022*
*Дата публикации / Published 25.05.2022*