# The effect of seed fractions and nutrition on the physiological changes and productivity of spring barley grown in the south of Uzbekistan

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**Abstract.** The influence of physiological changes on the grain yield of spring barley sown in optimal fractions and fed with mineral fertilizers in optimal norms in irrigated light gray-meadow soils with unfavorable conditions (subject to wind erosion) of the steppe zones of the Kashkadarya region was studied.

## 1 Introduction

Spring barley is one of the important food, fodder and technical cereals. Barley groats, pearl barley, flour are made from its grain due to the presence of an average 12% protein, 5.5% gluten, 64.6% non-nitrogen extractables, 2.1% fat, 13% water, 2.8% ash. Spring barley is a good concentrate feed for pigs and horses, 1 kg of its grain contains 1.2 kg of nutritional units. In addition, barley grain is the main raw material of beer and alcohol industry. Two-rowed, full, large-grained, low-hulled (8-10%), high germination energy (95%) varieties are used for brewing beer. Barley grain is the best raw material for brewing beer when grown on the 4th day [1].

Spring barley yield and grain quality indicators depend on the applied agrotechnological processes, since 2015, scientific and research work on seed fractions and fertilization rates of spring barley has been conducted. According to the results of the experiment, when large-fraction seed barley was fed with the norms of mineral fertilizers N210P105K70, compared to the control option where mineral fertilizers were not applied, the field fertility was 2.0%, tillering was up to 0.3-0.5 grains, and the accumulation of organic matter in the tuber phase of 10 plants was up to 0.8-4.9 grams, the increase in the amount of sugar to 1.5-3.3% created a sufficient foundation for a significant increase in the grain yield of barley [2].

Review of literature on the subject.

Kh. N. Atabaeva, J. B. Khudaykulov, T. G. Golova, L. I. Gladkikh's studies have shown that the ability of barley to ripen quickly and to withstand drought increases the chances of planting it in early spring under the conditions of different climatic regions, increasing the chances of growing an abundant and high-quality grain crop. V. V. Koshelyaev, K. R. Kuleshov, V. T. Rymar have noted that abundant and high-quality grain crops are formed

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when large-fraction grains of barley varieties are sown in spring and the feeding regime is optimized.

It is possible to emphasize that the scientific and research works dedicated to the further improvement of agro-technologies for growing abundant and high-quality barley crops are developing widely and rapidly. For example, A. V. Kupryanov in Volgograd, S. V. Ubushaeva in Astrakhan, in Arab countries, in Italy and in other countries.

Grains with a large fraction are an important indicator in making quality beer [2] and a significant level of scientific researches have been carried out in growing high yield [4] .

A. E. Osin [2] studies show that the thickness of seedlings and the need for mineral fertilizers of barley varieties are different, and grain yield increases proportionally to these factors.

In the studies of G. V. Chuvarleeva, V. M. Korotkov, G. M. Lesovaya [5], A. A. Ageeva [6], it was noted that when autumn and spring barley varieties are planted in optimal terms and fed in moderation, the productivity and quality of the harvest is higher than when it is planted early and late.

## 2 Materials and methods

When spring barley seeds were sown in different fractions and fed at different rates for research purposes, parameters such as field fertility, grass clumping, and accumulation of organic matter in barley grasses were determined.

Field experiments were conducted in 2015-2017 at the farm named by "Saipov Shakhboz" in Kasan district of Kashkadarya region. The total area of the experimental field is 6480 $m^2$, the field experiments were conducted in four iterations, the size of the surface of the experimental fields was 180 $m^2$, the calculation fields were 100 $m^2$, the width of the fields was 7.2 meters, and the length was 25 meters.

Observations were carried out in odd repetitions of experimental options, number of sprouted plants, duration of phases of growth and development, germination, productivity and other observations were made. For observations, the amount of organic matter accumulated in the upper part of the ground and in the joint of 10 plants in odd returns of the experiment was determined. The amount of sugar in the joint of the stem is determined by H.N. Pochinok [7] was determined by the methodology based on the reduction of sugar with copper oxide.

## 3 Results and Discussion

The dependence of seed germination on weight is based on the results of several research studies [2]. However, although there are enough scientific-research works dedicated to increasing the weight and quality of barley seeds with the help of mineral fertilizers[6] fractions, this problem has not been studied. It is difficult to find scientific and research work devoted to increasing the weight of large fraction grains. In addition, the effect of mineral fertilizers applied at the same time as planting barley on the field fertility of barley seeds has not been fully determined. Because there are very few scientific-research works in this direction. In our opinion, it is natural that with the sowing of barley seeds in early spring, the main part of mineral fertilizers is applied, and as a result of watering the land, mineral fertilizers dissolve and enter the soil in very short periods of time. In this case, the soil solution may have an indirect physical effect on the young shoots of barley, if the nutrients in the soil are not assimilated by the young plants during the germination process. For this reason, in our research, the field fertility of barley fractions was studied, and the data on the results were presented in the table (Table 1).

**Table 1.** Field fertility of barley by fractions of seeds of the Kyzylkurgan variety (2015-2017 average).

| Experiment options, mm | Laboratory fertility % | The number of sown seeds is $1m^2$/pc | Field germination rate of seeds, $1m^2$/pc | | | Field fertility after 7 days, % |
|---|---|---|---|---|---|---|
| | | | After 5 days | After 6 days | After 7 days | |
| NPK is not applied (St) | | | | | | |
| 2.5 | 98 | 400 | 243 | 267 | 304 | 76.00 |
| 2.0 | | | 249 | 273 | 310 | 77.50 |
| 1.7 | | | 252 | 288 | 314 | 78.50 |
| NPK was applied at the recommended rate and ratio ($N_{180}P_{90}K_{60}$) | | | | | | |
| 2.5 | 98 | 400 | 231 | 268 | 307 | 76.75 |
| 2.0 | | | 238 | 279 | 313 | 78.25 |
| 1.7 | | | 241 | 291 | 316 | 79.00 |
| NPK was applied in excess of the recommended rate and ratio ($N_{210}P_{105}K_{70}$) | | | | | | |
| 2.5 | 98 | 400 | 233 | 283 | 312 | 78.00 |
| 2.0 | | | 240 | 287 | 317 | 79.25 |
| 1.7 | | | 245 | 296 | 320 | 80.00 |

For example, the field germination of barley seed after 5 days with fractions of 1.7 mm showed that 252 grains of 400 grains germinated in 1 $m^2$, 288 grains after 6 days and 314 grains after 7 days, or 78.5% were sprouted.

It was determined, when the standards and proportions of mineral fertilizers are used in the recommended standards and proportions ($N_{180}P_{90}K_{60}$), the field fertility of 1.7 mm fraction seeds of the Kyzilkurgan variety of barley is 79.0%, while the field fertility when sowing high fraction barley seeds (2.5 mm) is 76.75%. It was observed that the field fertility of low-fraction barley seeds was 79.0-80.0%, while the field fertility of high-fraction seeds was 78.0% when the rates and proportions of mineral fertilizers were increased. This condition is caused by the high indirect effect of mineral fertilizers along with other factors in the field fertility of barley seeds with low fraction.

So, in the conditions of the irrigated light gray soils of the southern regions of Uzbekistan, the Kyzilkurgan variety of barley depends on the field fertility fractions, and due to the improvement of the soil solution concentration and physicochemical conditions of the mineral fertilizers used with planting, it indirectly affects the field fertility of the seeds and increases the field fertility up to 79.25-80.0%, provides an increase in productivity up to 40.8-44 tons/ha.

When barley is planted in the cotton complex in early spring, the growth process changes depending on the quality of the sown seeds, the method of feeding and other factors [10]. For this reason, in the cultivation of barley, it is necessary to develop agrotechnology for its cultivation in the conditions of each region [8]. Therefore, the fractions related to the cultivation of the Kyzilkurgan variety of barley in the conditions of the region of light gray soils of Kashkadarya region and the duration of germination with feeding, the depth of the joints of the tillers and the levels of the tillers were studied (Table 2).

Depending on the planting depth of barley and the depth of planting, as with grain crops, in the experiment, barley seeds were planted with the SD-3.6 A seeder, and the seeds were planted in narrow rows of 13-15 cm in a depth of 4-5 cm. It was observed that the period from seed germination to tillering phase varied from 19 to 25 days depending on the fractions of sown seeds and feeding.

The time from germination to tillering was up to 2 days longer when barley seeds were sown with high fractions than those with low fractions, and up to 4 days longer when mineral fertilizer application was optimized.

When large-fraction barley seeds were sown, grasses showed that the tiller joints penetrated 0.5-1.4 cm deeper than the soil surface. Also, observing the positive effect on the grain size of barley when sowing large fraction seeds, it was found that the grain size

increases to 0.3 pieces when large fraction seeds are planted, and the grain size increases to 1.5 pieces when using increased mineral fertilizer rates.

**Table 2.** Effect of barley on accumulation of seed fractions and feeding of Kyzylkurgan variety (in 2015-2017, average).

| No. | Experiment options, mm | Germination | Tillering | |
|---|---|---|---|---|
| | | days | days | piece, M±m |
| NPK is not applied (st) | | | | |
| 1 | 2.5 | 8 | 21 | 2.7±0.15 |
| 2 | 2.0 | 7 | 20 | 2.5±0.09 |
| 3 | 1.7 | 6 | 19 | 2.3±0.11 |
| NPK was applied at the recommended rate and ratio ($N_{180}P_{90}K_{60}$) | | | | |
| 4 | 2.5 | 9 | 23 | 3.0±0.10 |
| 5 | 2.0 | 8 | 21 | 2.8±0.14 |
| 6 | 1.7 | 7 | 19 | 2.5±0.11 |
| NPK was applied in excess of the recommended rate and ratio ($N_{210}P_{105}K_{70}$) | | | | |
| 7 | 2.5 | 10 | 23 | 3.2±0.08 |
| 8 | 2.0 | 9 | 21 | 3.1±0.12 |
| 9 | 1.7 | 8 | 19 | 3.0±0.37 |

So, if spring barley seeds of the Kyzilkurgan variety are planted with large fraction seeds, the yield increases by 0.3 pieces, and when the norms and proportions of mineral fertilizers are optimized, this indicator is even higher, up to 1.5 pieces.

Accumulation of organic matter and sugar in barley meadows varies depending on fractions of sown seeds and feeding [10-15].

According to the data presented in table 3, it was shown that the level of accumulation of organic matter and sugar in the tiller joints increases when large-fraction barley seeds are sown and the feeding procedure is optimized.

At the beginning of the tuber phase, the accumulation of organic matter (2.5 mm) of 10 plants increased to 1.0 g when seeds of the Kyzilkurgan variety of barley with a large fraction were planted, compared to when seeds with a low fraction (1.7 mm) were planted, and the recommended rates and proportions of mineral fertilizers ($N_{180}P_{90}K_{60}$) accumulation of organic matter by 10 plants was 6.1-5.2 g.

**Table 3.** Effects of barley Kyzilkurgan seed fractions and feeding on lawn organic matter accumulation (2015-2017, average).

| No. | Experiment options, mm | Accumulation of organic matter at the beginning of the tuber phase | | Productivity | |
|---|---|---|---|---|---|
| | | Dry mass of 10 plants, g M±m | Accumulation of sugar in the joint, in % of dry matter, M±m | Tons/ha | Difference compared to control, +- |
| NPK is not applied (st) | | | | | |
| 1 | 2.5 | 5.3±0.14 | 13.8±0.14 | 24.4 | 0 |
| 2 | 2.0 | 4.9±0.13 | 12.1±0.12 | 22.5 | 0 |
| 3 | 1.7 | 4.3±0.11 | 10.3±0.12 | 20.7 | 0 |
| NPK was applied at the recommended rate and ratio ($N_{180}P_{90}K_{60}$) | | | | | |
| 4 | 2.5 | 6.1±0.11 | 15.3±0.13 | 40.4 | 16 |
| 5 | 2.0 | 5.7±0.12 | 14.8±0.12 | 37.1 | 14.6 |
| 6 | 1.7 | 5.2±0.11 | 14.3±0.12 | 34.3 | 13.6 |
| NPK was applied in excess of the recommended rate and ratio ($N_{210}P_{105}K_{70}$) | | | | | |
| 7 | 2.5 | 7.2±0.10 | 17.1±0.11 | 44.0 | 19.6 |
| 8 | 2.0 | 6.3±0.13 | 16.3±0.12 | 40.8 | 18.3 |
| 9 | 1.7 | 5.9±0.13 | 15.4±0.14 | 38.5 | 17.8 |

Mineral fertilizers showed a 0.8-0.9 g higher than the control option. It showed that organic matter accumulated in 10 plants was 7.2-5.9 g higher at the beginning of the tuber phase when mineral fertilizer application rates and ratios were further increased ($N_{210}P_{105}K_{70}$).

Therefore, in the unfavorable weather conditions for farming in the Kashkadarya region, when the Kyzilkurgan variety of barley is grown, the seeds of large fractions are sown and cultivated.

When large-fraction seeds of barley are sown in the spring, and the feeding standards and proportions are optimized, the level of accumulation of organic matter is observed to increase further. When 2.5 mm fraction seeds of barley are planted and mineral fertilizers are applied in the recommended rates and proportions, the accumulation of organic matter in the tuber phase of 10 plants is 6.1 g, when 2.0 mm fraction seeds are planted - 0.4 g, when 1.7 mm fraction seeds are planted and it was observed to increase up to 0.9 g. This indicator was shown to be higher, up to 1.9 g, when grown without the use of mineral fertilizers, compared to when seeds with a large fraction were planted.

The higher level of resistance of barley to any unfavorable soil and climatic conditions is determined by the higher level of sugar accumulation in the joint. [15]

For this reason, when large-fraction seeds of the Kyzilkurgan variety of spring barley were planted and the procedure of feeding with mineral fertilizers was optimized, the level of resistance to the negative effects of unfavorable weather was observed due to the activation of sugar accumulation in the joint. For example, the amount of sugar in the tillering joint of barley grown in control variants without mineral fertilizers increased to 13.8% at the beginning of the tuber phase compared to when seeds with a large fraction of 2.5 mm were planted, and 1 of the amount of sugar when seeds with a small fraction of 2.0 mm and 1.7 mm were planted. showed a decrease to 7-3.5%. Therefore, the degree of resistance to the effects of adverse weather increases due to the increase in the level of accumulation of sugar in the joint of the stalk when large fraction seeds of the Kyzilkurgan variety of barley are planted in adverse weather conditions.

Because, when large-fraction barley seeds are sown, and the application of mineral fertilizer norms and proportions is optimized, the level of sugar accumulation at the joint of the stem increases to 15.3-17.1%.

However, even when small-fraction seeds of the Kyzilkurgan variety of barley are planted and the procedure of feeding with mineral fertilizers is optimized, the level of sugar accumulation in the joints of the stem increases. For example, it was observed when low-fraction 1.7 mm seeds of the Kyzilkurgon variety of barley were planted and the procedure of feeding with mineral fertilizers was optimized, the amount of sugar in the tiller joint increased to 4.2-5.1% compared to the control option where mineral fertilizers were not applied.

Therefore, in the conditions of the light gray soil region of Uzbekistan, which is unfavorable for agriculture, even when small fraction seeds of barley are planted, as a result of optimizing the procedure of feeding with mineral fertilizers, the level of resistance to the adverse effects of adverse weather is observed due to the greater accumulation of sugar in the joints of the stem.

## 4 Conclusion

In the conditions of the irrigated light gray soils of the southern regions of Uzbekistan, seeds of spring barley of the Kyzilkurgon variety with a large fraction (2.5 mm) should be sown and fed with the recommended norms and proportions of mineral fertilizers ($N_{180}P_{90}K_{60}$) in increased $N_{210}P_{105}K_{70}$) norms. Due to the improvement of the soil solution concentration and physico-chemical conditions of the mineral fertilizers applied along with the planting of large-fraction tulik and bulik seeds, it has a positive effect on the field germination and germination of seeds, as well as on the accumulation of organic matter in lawns, in particular, on the moderate accumulation of sugars at the time of germination. For example, the field fertility increased to 79.25-80.0%, tillering increased to 3.0-3.2 grains,

that the amount of sugar in the joints has increased to 15.4-17.1%, which directly increased the productivity to 40.8-44 t/ha.

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