
INFLUENCE OF SOWING RATE AND FERTILIZERS ON GRAIN QUALITY INDICATORS OF CHICKPEA VARIETIES

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Abstract

This study presents information on the effects of seed sowing rates and nitrogen fertilization on the grain quality indicators of chickpea varieties. The research focuses on the locally developed chickpea varieties "Obod" and "Polvon". The findings contribute to understanding how agronomic practices influence grain quality in these cultivars.

Keywords: Chickpea, variety, sowing rate, fertilizer, mineral fertilizer, protein, carbohydrate, productivity, grain, fat.

Аннотация

В данном исследовании представлена информация о влиянии норм высева семян и азотного удобрения на показатели качества зерна различных сортов нута. Исследование сосредоточено на местных сортах нута «Обод» и «Полвон». Полученные результаты способствуют пониманию того, как агротехнические приемы влияют на качество зерна этих культур.

Ключевые слова: нут, сорт, норма высева, удобрение, минеральное удобрение, белок, углевод, урожайность, зерно, жир.

Introduction

Chickpea seeds contain up to 20.0–32.5% crude protein, 8% fat, and 47–60% starch. The carbohydrate content in chickpeas is considered to be several times higher than that in soybean meal. In terms of the essential amino acids methionine and tryptophan, chickpeas surpass other leguminous plants. Chickpea grains contain a large amount of mineral salts and rank first among all leguminous crops in selenium content. Advantages of chickpeas over other leguminous crops include less damage from pests, higher positioning of the lower pods above the ground, resistance to lodging, and pods that do not split or shatter when ripe. They are adapted for harvesting with conventional grain harvesting machines [1].

One of the important indicators determining the quality of chickpeas is the amount of protein in the grain. The protein content, whether high or low, is influenced by the biological characteristics of the variety, cultivation methods, and climatic conditions. The main indicators of grain quality include the grain's shape, its size, and the quality

and quantity of protein. Often, an increase in yield leads to a decrease in the protein content of the grain [2].

According to the classification of protein content in chickpea grains, they are characterized as follows: 14–18% is considered very low, 20.1–24% is average, 24% to 28% is high, and over 28% is very high [3].

Research Materials and Methods. Field experiments were conducted at the experimental field of the Southern Agriculture Research Institute. The experiment consisted of 24 variants, arranged in a single tier with three replications. Chickpea varieties "Obod" and "Polvon," which are registered in the State Register, were sown. The chickpea varieties were planted at three different planting densities—333,333 plants/ha, 166,666 plants/ha, and 111,111 plants/ha—using three spacing systems (60×5-1 cm, 60×10-1 cm, 60×15-1 cm). During the growing period, mineral fertilizers were applied at rates of N₀P₉₀K₆₀, N₃₀P₉₀K₆₀, N₄₅P₉₀K₆₀, and N₆₀P₉₀K₆₀kg/ha. Phenological observations, biometric measurements, and calculations during the growth period of the chickpea varieties were carried out according to the commonly accepted methods: "Dala tazhribalarini utkazish uslublari" (2017), "Metodika Gosudarstvennogo sortoispytaniya sel'skokhozyajstvennykh kul'tur" (1989), B.A. Dospekhov's "Metodika polevogo opyta" (1985)[3], and "Metody agrokhimicheskikh, agrofizicheskikh i mikrobiologicheskikh issledovaniy v polivnykh khlopkovykh rajonakh" (Soviet Research Institute of Cotton, 1963) [4]. The net productivity of photosynthesis was determined using the methods of A.A. Nichiporovich ("O putyah povysheniya produktivnosti fotosinteza rastenij v posevakh. In the book Fotosintez i voprosa produktivnosti rastenij (1963)).

Research Results. In the variants where the "Obod" variety was sown at a density of 333,333 seeds per hectare (using a 60×5×1 cm planting scheme), the protein content in the grain was 19.1% in the variant with a fertilizer ratio of N₀P₉₀K₆₀, 22.1% with N₃₀P₉₀K₆₀, 22.8% with N₄₅P₉₀K₆₀, and 21.6% with N₆₀P₉₀K₆₀. It was determined that, compared to the control variant, the protein content was higher by 3.0% in the N₃₀P₉₀K₆₀ variant, 3.7% in the N₄₅P₉₀K₆₀ variant, and 2.5% in the N₆₀P₉₀K₆₀ variant. The fat content in the grain was 3.9% in the variant sown with the fertilizer ratio N₀P₉₀K₆₀, 4.5% with N₃₀P₉₀K₆₀, 4.6% with N₄₅P₉₀K₆₀, and 4.4% with N₆₀P₉₀K₆₀. It was determined that, compared to the control variant, the fat content increased by 0.6% in the N₃₀P₉₀K₆₀ variant, 0.7% in the N₄₅P₉₀K₆₀ variant, and 0.5% in the N₆₀P₉₀K₆₀ variant.

The carbohydrate content was 31.1% in the variant sown with N₀P₉₀K₆₀, 35.9% with N₃₀P₉₀K₆₀, 37.1% with N₄₅P₉₀K₆₀, and 35.1% with N₆₀P₉₀K₆₀. Compared to the control variant, the carbohydrate content increased by 4.8% in the N₃₀P₉₀K₆₀ variant, 6.0% in the N₄₅P₉₀K₆₀ variant, and 4.0% in the N₆₀P₉₀K₆₀ variant, as demonstrated in the experiments.

It was observed that the fiber content in the grain reached 9.8% in the variant sown with N₀P₉₀K₆₀ kg/ha. In the variant sown with N₃₀P₉₀K₆₀ kg/ha, the fiber content was 11.3%, which is 1.5% higher than the control variant. The variant sown with N₄₅P₉₀K₆₀

kg/ha also showed a fiber content of 11.3%, representing a 1.9% increase compared to the control. In the variant sown with N₆₀P₉₀K₆₀ kg/ha, the fiber content reached 11.1%, which is 1.3% higher than the control variant.

In the variants where the chickpea variety was sown at a density of 111,111 seeds per hectare (using a 60×15×1 cm planting scheme), the protein content in the grain was 25.9% with a fertilizer ratio of N₀P₉₀K₆₀, 27.5% with N₃₀P₉₀K₆₀ kg/ha, 29.8% with N₄₅P₉₀K₆₀ kg/ha, and 28.1% with N₆₀P₉₀K₆₀ kg/ha. Compared to the control variant, the protein content increased by 1.6% in the N₃₀P₉₀K₆₀ variant, 3.9% in the N₄₅P₉₀K₆₀ variant, and 2.2% in the N₆₀P₉₀K₆₀ variant.

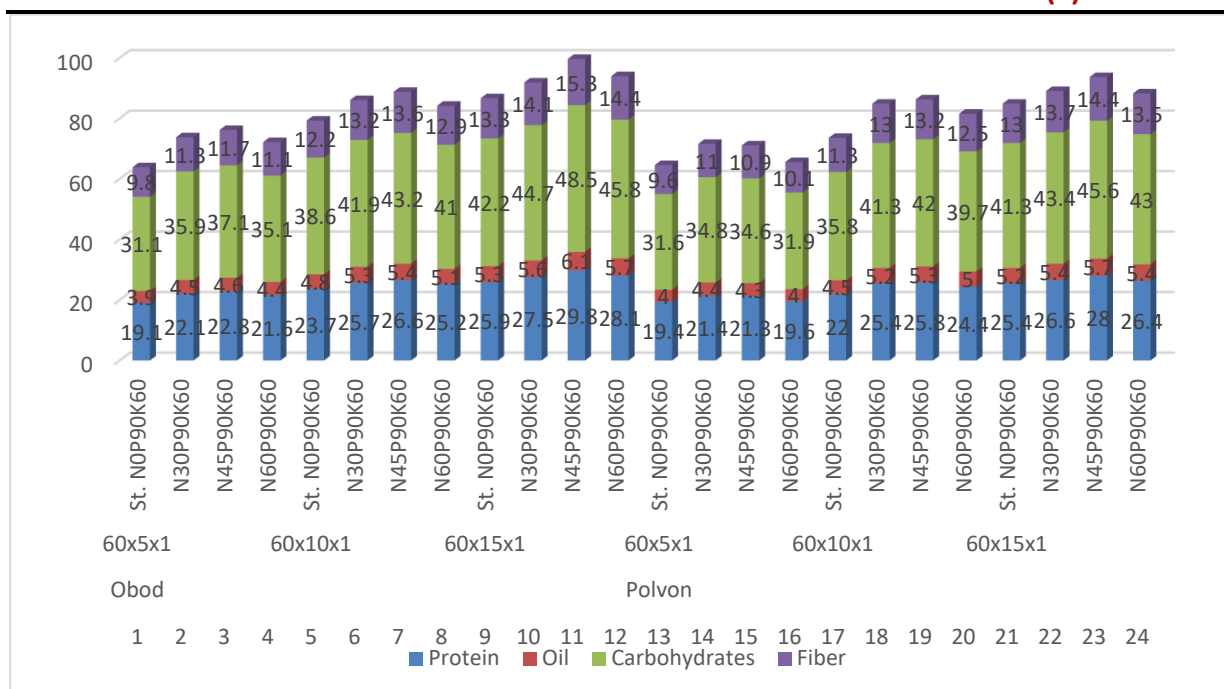
Regarding the fat content in the grain, the measurements were 5.3% with N₀P₉₀K₆₀ kg/ha, 5.6% with N₃₀P₉₀K₆₀ kg/ha, 6.1% with N₄₅P₉₀K₆₀ kg/ha, and 5.7% with N₆₀P₉₀K₆₀ kg/ha. Compared to the control variant, the fat content was higher by 0.3% in the N₃₀P₉₀K₆₀ variant, 0.8% in the N₄₅P₉₀K₆₀ variant, and 0.4% in the N₆₀P₉₀K₆₀ variant.

The carbohydrate content was observed to be 42.2% in the variant sown with N₀P₉₀K₆₀ kg/ha, 44.7% in the variant sown with N₃₀P₉₀K₆₀ kg/ha, 48.5% in the variant sown with N₄₅P₉₀K₆₀ kg/ha, and 45.8% in the variant sown with N₆₀P₉₀K₆₀ kg/ha. Compared to the control variant, the carbohydrate content was higher by 2.5% in the N₃₀P₉₀K₆₀ kg/ha variant, 6.3% in the N₄₅P₉₀K₆₀ kg/ha variant, and 3.6% in the N₆₀P₉₀K₆₀ kg/ha variant.

In the experiments, it was observed that the fiber content in the grain was 13.3% in the variant sown with N₀P₉₀K₆₀ kg/ha. In the N₃₀P₉₀K₆₀ kg/ha variant, the fiber content reached 14.1%, which is 0.8% higher than the control variant. The N₄₅P₉₀K₆₀ kg/ha variant showed a fiber content of 15.3%, representing a 2.0% increase compared to the control, while the N₆₀P₉₀K₆₀ kg/ha variant had a fiber content of 14.4%, which is 1.1% higher than the control variant.

Experimental findings demonstrated that the protein content in the grains of the "Obod" variety is more strongly influenced by changes in sowing rates than by the levels of nitrogen fertilization. Specifically, an increase in nitrogen fertilizer application led to an increase in protein content by 1.6–3.9%, whereas a reduction in sowing rates resulted in a more substantial increase in protein content by 3.6–7.0%.

Thus, it was determined that the protein content in the grain is not solely dependent on nitrogen fertilizers; phosphorus and potassium fertilizers also contribute to its formation.



Picture-1 Effect of seeding rates and fertilization rates on grain quality indicators of chickpea varieties

Similarly, in the variants where the "Polvon" variety was sown at a density of 333,333 seeds per hectare (using a 60×5×1 cm planting scheme), the protein content in the grain was 19.1% with a fertilizer ratio of NoP90K60 kg/ha, 21.4% with N30P90K60 kg/ha, 21.3% with N45P90K60 kg/ha, and 19.6% with N60P90K60 kg/ha. Compared to the control variant, the protein content was higher by 2.3% in the N30P90K60 kg/ha variant, 2.2% in the N45P90K60 kg/ha variant, and 0.5% in the N60P90K60 kg/ha variant.

It was determined that the fat content in the grain was 4.0% in the variant sown with NoP90K60, 4.4% in the variant sown with N30P90K60, 4.3% in the variant sown with N45P90K60, and 4.0% in the variant sown with N60P90K60. Compared to the control variant, the fat content was higher by 0.4% in the N30P90K60 variant and by 0.3% in the N45P90K60 variant.

The carbohydrate content was observed to be 31.6% in the variant sown with NoP90K60, 34.8% in the variant sown with N30P90K60, 34.6% in the variant sown with N45P90K60, and 31.9% in the variant sown with N60P90K60. The experiments demonstrated that, compared to the control variant, the carbohydrate content increased by 3.2% in the N30P90K60 variant, by 3.0% in the N45P90K60 variant, and by 0.3% in the N60P90K60 variant.

It was observed that the fiber content in the grain reached 9.6% in the variant sown with NoP90K60 kg/ha. In the variant sown with N30P90K60 kg/ha, the fiber content was 11.0%, which is 1.4% higher than the control variant. The variant sown with N45P90K60 kg/ha showed a fiber content of 10.9%, representing a 1.3% increase compared to the

control, while the variant sown with N₆₀P₉₀K₆₀ kg/ha had a fiber content of 10.1%, which is 0.5% higher than the control variant.

In the variants where the variety was sown at a density of 166,666 seeds per hectare (using a 60×10×1 cm planting scheme), the protein content in the grain was 22.0% with a fertilizer ratio of N₀P₉₀K₆₀, 25.4% with N₃₀P₉₀K₆₀ kg/ha, 25.8% with N₄₅P₉₀K₆₀ kg/ha, and 24.4% with N₆₀P₉₀K₆₀ kg/ha. Compared to the control variant, the protein content was higher by 3.4% in the N₃₀P₉₀K₆₀ kg/ha variant, 3.8% in the N₄₅P₉₀K₆₀ kg/ha variant, and 2.4% in the N₆₀P₉₀K₆₀ kg/ha variant.

Regarding the fat content in the grain, it was 4.5% in the variant sown with N₀P₉₀K₆₀ kg/ha, 5.2% with N₃₀P₉₀K₆₀ kg/ha, 5.3% with N₄₅P₉₀K₆₀ kg/ha, and 5.0% with N₆₀P₉₀K₆₀ kg/ha. Compared to the control variant, the fat content was higher by 0.7% in the N₃₀P₉₀K₆₀ kg/ha variant, 0.8% in the N₄₅P₉₀K₆₀ kg/ha variant, and 0.5% in the N₆₀P₉₀K₆₀ kg/ha variant.

The carbohydrate content was observed to be 35.8% in the variant sown with N₀P₉₀K₆₀ kg/ha, 41.3% in the variant sown with N₃₀P₉₀K₆₀ kg/ha, 42.0% in the variant sown with N₄₅P₉₀K₆₀ kg/ha, and 39.7% in the variant sown with N₆₀P₉₀K₆₀ kg/ha. Compared to the control variant, the carbohydrate content increased by 5.5% in the N₃₀P₉₀K₆₀ kg/ha variant, 6.2% in the N₄₅P₉₀K₆₀ kg/ha variant, and 3.9% in the N₆₀P₉₀K₆₀ kg/ha variant.

Regarding the fiber content in the grain, it was 11.3% in the variant sown with N₀P₉₀K₆₀ kg/ha, 13.2% in the variant sown with N₃₀P₉₀K₆₀ kg/ha (which is 1.7% higher than the control variant), 13.2% in the variant sown with N₄₅P₉₀K₆₀ kg/ha (1.9% higher than the control variant), and 12.5% in the variant sown with N₆₀P₉₀K₆₀ kg/ha (1.2% higher than the control variant).

Conclusion. The "Obod" variety demonstrated slightly higher levels of protein, fat, and carbohydrate content in the grain compared to the "Polvon" variety across the various treatment variants. This difference is attributed to the "Obod" variety being developed under the specific soil and climatic conditions of the study area. In the "Polvon" variety, an increase in the amount of nitrogen fertilization resulted in an increase in protein content by 0.2–3.8%, while a reduction in sowing rates led to an increase in protein content by 2.6–6.8%, as observed in the experiments.

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