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Analysis Of The Total Protein Content In Soybean Grain

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Annotation: This article examines the total protein content in the grains of certain soybean varieties, with laboratory experiments on protein content conducted at the laboratory of the Institute of Bioorganic Chemistry of the Academy of Sciences of the Republic of Uzbekistan. Local and foreign soybean varieties, selected as the research object, were grown in an experimental field located in the Asaka district of Andijan region. Agrotechnical measures specified in the description of each variety were implemented during cultivation. The protein content indicators of the varieties were compared and discussed based on data provided in scientific literature.

Keywords: soybean, variety, nitrogen, total protein, grain.

Today, ensuring the population is provided with protein and environmentally friendly food, as well as increasing soil fertility in the export of soybeans and soybean-derived products, holds significant importance [1.1-7 p]. Soybean is a vital global food resource due to its unique chemical composition, nutritional value, many industrial applications, and high potential for use in the food industry, manufacturing, and pharmaceutical sectors [7.1313-c]. The protein content in the grains of plants is considered close to the protein content found in meat products. These products typically include proteins from soybeans, peas, or wheat [8.1-10 p]. Until 1990, according to protein efficiency evaluation standards, soybean protein had a lower coefficient compared to animal protein. Currently, the protein digestibility-corrected amino acid score (PDCAAS) is accepted as a quality criterion, which compares the amino acid composition of proteins to that of animal proteins. Moreover, the absorption coefficient of soybean amino acids is equivalent to that of animal proteins, opening many opportunities for producing foods with high protein content [11.85-c].

Research Object and Methodology. For the research, local soybean varieties such as Genetik-1, Ustoz MM-60, Orzu, Gavhar, Oyjamol, Zamin, Baraka, Sochilmas, and To‘maris, as well as foreign varieties like Selekta-302, Slaviya, and Vilana, were selected. These observations were conducted in 2023 at the crop fields of the “Qora tepa zar tuprog‘i” farm in the Asaka district of Andijan province. In our research, one of the methods used to determine the total protein content in soybean grains was the Keldal method. The essence of this method involves calculating the total protein content by determining the amount of nitrogen [3].

Research Results and Discussion. According to S. Hageraats, L. Graamans, I. Righini, and others, the soybean (Glycine max. L.) is considered to have a very high protein content [5.1-8 p]. O.V. Shovkova’s experiments have shown that foliar fertilization with micronutrients positively affects protein accumulation [12.65-c].

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S. Ciabotti and A. Silva's studies indicate that while the protein content in soybean grains is genetically determined, environmental factors can lead to quantitative changes [13.625-p].
According to research by V.N. Bosak, V.V. Skorina, and T.V. Koloskova, the protein content in the "Pripyat" variety increased from 26.3% to 28.6–31.1% when mineral fertilizers were applied. In the "Yaselda" variety, the protein content rose from 27.1% to 30.4–32.0% [6.18-c]. O.V. Litvinenko, E.S. Stasenko, and others noted in their studies on soybean grain protein content that the Nevesta variety showed 40.70%, while the Krujevnisa variety achieved 41.58%, both above average [9.54-c]. D.E. Zima [10.64-c] observed in their studies that the protein content in seeds during summer planting was significantly higher, by an average of 3.1%, compared to spring planting. The maximum protein content in summer planting was 44.0% in the SK Farta variety, while the lowest was 42.1% in the SK Agra variety.
Several studies have indicated that the protein content in soybean grains ranges from approximately 28.95% to 45.5%, depending on the genetic characteristics of the variety, ecological conditions, and breeding practices [14.74-79 p], [15.148-155 p], [16.2115-2124 p], [4.2-14 p].
In studies by B. Szostak, A. Glovaska, and others on the biochemical indicators of soybean grains, the highest protein content was obtained from the Amandine variety with the fourth level of nitrogen fertilization (i.e., 30 kg before planting and an additional 30 kg at BBCH 73–75 stages). This fertilization level resulted in a protein yield 239 kg/ha higher than that of soybeans grown without nitrogen. The protein content in the Merlin variety also varied depending on the amount of nitrogen fertilizer. The difference in protein content between the highest (fourth level) and non-fertilized (first level) Merlin variety was 132.9 kg/ha [2.45-57 p].
A subsequent study conducted in collaboration with professors from Andijan State University and Andijan State Pedagogical Institute focused on determining the protein content in soybean grains, using selected local and foreign varieties as research objects. According to the results, high protein content was observed in the Genetik-1 variety (36.5%), Zamin variety (35%), Orzu variety (32.37%), and the foreign Selekta-302 variety (35%) (diagram). Lower results were recorded for the local To'maris variety (26.25%), Oyjamol and Baraka varieties (28.4%), and the foreign Vilana variety (30.6%) (diagram).

Diagram

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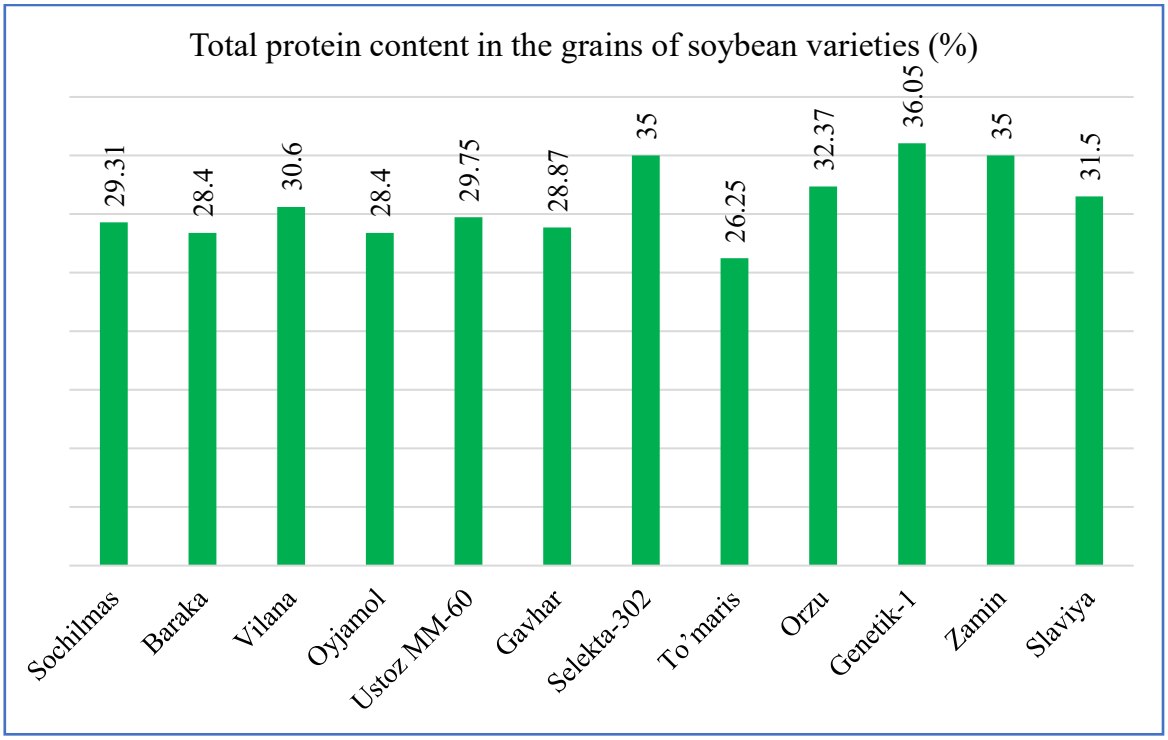

Based on the results of our research on the protein content in soybean grains, among the studied local and foreign varieties, Genetik-1 and Selekta-302 exhibited high protein content. The primary reasons for this include the individual biological characteristics of the plant, the soil-climate conditions of the cultivation environment, and the applied agro-technological measures.

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