

Article

Protein and Oil Content in Grain of Soybean Varieties

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Abstract: This article describes research conducted on the influence of sowing dates and seeding rates on the protein and oil content in the grain of various soybean varieties.

Keywords: Soybean, variety, protein, oil, timing, norm.

1. Introduction

The strategic importance of soybeans as a vital industrial raw material is directly linked to the protein and oil content found in its grain.

Protein is a high-molecular-weight compound primarily composed of amino acids, nitrogen, carbon, oxygen, hydrogen, and sulfur. It is a fundamental component necessary for the normal growth and development of the human body. Global protein supply is mainly derived from livestock and agricultural products.

The protein content in soybean grains can range from 27% to 68%. According to scientific findings, soybean protein stands out among global agricultural crops for being both the most cost-effective and the most widely utilized.

In terms of global vegetable oil production, soybean oil ranks second. Its production volume significantly surpasses that of other crops; for context, oils from cotton, sunflower, peanut, and rapeseed are produced in quantities ten times smaller in certain market segments. Oil extracted from soybeans serves as a vital energy source for the human body. It contains fat-soluble vitamins essential for metabolism and cellular functions, and it acts as a protective barrier for human skin against external stressors.

On average, soybean grains contain up to 20% oil, which, through processing, yields high-quality oil for both human consumption and industrial purposes.

The Rice Research Institute conducted studies to determine the protein and oil content of newly developed soybean varieties. The research results are as follows:

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Table 1

Impact of sowing dates and seeding rates on the grain quality of soybean varieties.

No	Soybean Varieties	Sowing dates	Seeding Rate (kg/ha)	Oil content in the seed, %	Protein content in seeds, %	Hardness in the seed, %
1	Madad	25.04-30.04	45 (280)	19,1	38,1	75,4
2			60 (375)	19,8	38,9	75,1
3			75 (465)	19,3	38,4	74,7
4		05.05-10.05	45 (280)	18,7	37,6	75,0
5			60 (375)	19,5	38,1	74,8
6			75 (465)	19,1	37,8	74,2
7		15.05-20.05	45 (280)	18,5	37,2	74,5
8			60 (375)	19,2	37,7	74,1
9			75 (465)	18,8	37,3	74,0
10	Sevinch	25.04-30.04	45 (300)	18,3	36,7	74,8
11			60 (400)	18,7	37,3	74,5
12			75 (500)	18,4	36,8	74,1
13		05.05-10.05	45 (300)	18,0	36,4	74,3
14			60 (400)	18,5	37,0	74,1
15			75 (500)	18,2	36,4	73,7
16		15.05-20.05	45 (300)	17,6	35,8	74,0
17			60 (400)	18,1	36,6	73,8
18			75 (500)	18,0	36,1	73,5

Results

According to the obtained data, it was determined that different sowing dates and seeding rates of soybeans had an impact on the protein and oil content in their composition.

In the initial year of the study, it was observed that when both soybean varieties were sown at an early date (25.04–30.04) at a rate of 60 kg per hectare, the protein and oil content in their composition was high. In the "Madad" variety, the protein content was 38.9% and the oil content was 19.8%, while in the "Sevinch" variety, these indicators were found to be 37.3% and 18.7%, respectively.

When these varieties were sown early at a rate of 45 kg per hectare, the protein content was 38.1% and 36.7%, and the oil content was 19.1% and 18.3%, respectively. When sown at 75 kg per hectare, these figures were 38.4% and 36.8% for protein, and 19.3% and 18.4% for oil.

When soybean varieties were sown at a mid-term date (05.05–10.05), the protein and oil content in the grain was slightly lower compared to the early sowing date. According to the data, when varieties were sown at 45 kg per hectare, the protein and oil contents were 37.6%; 36.4% and 18.7%; 18.0% by variety; at 60 kg per hectare, they were 38.1%; 37.0% and 19.5%; 18.5%; and at 75 kg per hectare, they were 37.8%; 36.4% and 19.1%; 18.2%, respectively.

When varieties were sown at a late date (15.05–20.05), the protein and oil content in the grain showed even lower indicators compared to the early and mid-term sowing dates. In this case, at a rate of 45 kg per hectare, these indicators were 37.2%; 35.8% and 18.5%; 17.6% by variety; at 60 kg per hectare, they were 37.7%; 36.6% and 19.2%; 18.1%; and at 75 kg per hectare, it was observed that they were 37.3%; 36.1% and 18.8%; 18.0%.

When analyzing the data on the effect of sowing dates on protein and oil content in soybean varieties, it can be concluded that when soybean varieties are sown 10 days later than the early date (25.04–30.04), the protein content is lower by 0.5% to 0.8% and the oil content by 0.2% to 0.4% in the "Madad" variety. When sown 20 days later, the protein content is lower by 0.9% to 1.2% and the oil content by 0.5% to 0.6%. In the "Sevinch" variety, these indicators were lower by 0.3% to 0.4% for protein and 0.2% to 0.3% for oil when delayed by 10 days, and by 0.7% to 0.9% for protein and 0.4% to 0.7% for oil when delayed by 20 days compared to the early sowing date.

When analyzing the data obtained on seeding rates of the varieties, it was found that in both varieties and across all sowing dates, seeding rates that were low (45 kg) or very high (75 kg) resulted in lower protein and oil content compared to the variants sown at 60 kg per hectare. In the first variant of the experiment where the "Madad" variety was sown early at 45 kg per hectare, the protein content was 38.1% and the oil content was 19.1%, while in the third variant sown at 75 kg per hectare, these indicators were 38.4% and 19.3%, respectively. In the second variant sown at 60 kg per hectare, these indicators were higher than the previous ones, with protein at 38.9% and oil at 19.8%, meaning the protein content was higher by 0.8% and 0.5%, and the oil content by 0.7% and 0.5% compared to variants 1 and 3. The same pattern was observed in the variants sown at mid-term and late dates.

These patterns were also observed in the variants where the "Sevinch" variety was sown, and this variety also showed higher protein and oil content when sown at a rate of 60 kg per hectare compared to the variants sown at 45 kg and 75 kg per hectare. According to the data, in variant 10 where this variety was sown early at 45 kg per hectare, the protein content was 36.7% and the oil content was 18.3%, while in variant 12 sown at 75 kg per hectare, these indicators were 36.8% and 18.4%, respectively. In variant 11 sown at 60 kg per hectare, these indicators were higher, with protein at 37.3% and oil at 18.7%, meaning the protein content was higher by 0.6% and 0.5%, and the oil content by 0.4% and 0.3% compared to variants 10 and 12.

Therefore, it can be concluded from the obtained data that to achieve a high amount of protein and oil in soybean grain, it is advisable to sow both varieties at an early date at a rate of 60 kg per hectare. Sowing 15 kg less (45 kg) than this optimal rate leads to a reduction in protein content by 0.5–0.8% and oil content by 0.3–0.7%, while sowing 15 kg more (75 kg) leads to a reduction of 0.5–0.6% and 0.3–0.5%, respectively.

It should be noted that another quality indicator in soybeans is grain hardness. Grain hardness is important mainly in the crushing and processing of the grain.

According to the data obtained on this quality of the grain, the studies found that the earlier the soybean varieties are sown and at lower rates, the higher the grain hardness. In all variants of the experiment sown at an early date and low rate, grain hardness was higher than in the variants sown at mid-term and late dates at rates of 60 kg and 75 kg per hectare. For example, when the "Madad" variety was sown early at 45 kg per hectare, grain hardness was 75.4%, while at 60 kg per hectare it was 75.1%, and at 75 kg per hectare it was 74.7%. Similar patterns were observed in the variants sown at mid-term and late dates, where these indicators were found to be 75.0%; 74.8%; 74.2% and 74.5%; 74.1%; 74.0% respectively, based on seeding rates.

Delaying the sowing dates also affected grain hardness, leading to lower grain hardness. While grain hardness in the early sowing date was 75.4%; 75.1% and 74.7% according to the rates, it was 75.0%; 74.8% and 74.2% in the mid-term sowing, and 74.5%; 74.1% and 74.0% in the late sowing.

Conclusion

To achieve a high amount of protein and oil in the grain of soybean varieties (38.9% protein and 19.8% oil in "Madad", 37.3% protein and 18.7% oil in "Sevinch"), it is advisable to sow both varieties at an early date at a rate of 60 kg per hectare. Sowing 15 kg/ha less (45 kg/ha) than this optimal rate (60 kg/ha) leads to a reduction in protein content by 0.5–0.8% and oil content by 0.3–0.7%, while sowing 15 kg/ha more (75 kg/ha) leads to a reduction of 0.5–0.6% and 0.3–0.5%, respectively.

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