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INFLUENCE OF SOYBEAN SEEDING STANDARDS ON ITS QUALITATIVE CHARACTERISTICS

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Abstract

Experimental studies were carried out in the conditions of the Partnership with limited responsibility "Olzha - Agro" of the Fedorovsky district of Kostanay region. The research climate is sharply continental, with an annual rainfall of 330... 340 mm. The soil cover is represented by ordinary chernozems. Field germination of soybean plants ranged from 76.5% to 85.8%, with 80.0% control. Plant safety ranged from 65.6-80.8%, with control - 70.2%. The height of the plants ranged from 75.4-80.5 cm, with a control of 79.3 cm. The height of attachment of the bean ranged from 16.0-17.1 cm, with a control of 16.9. Elements of the crop structure: the number of beans per plant ranged from 17.6-19.6 pieces, with 18.0 pieces under control; the number of seeds per plant ranged from 26.8-33.3 pieces, under control - 29.2; the number of seeds in the bean ranged from 1.52-1.71 pieces, under control - 1.62; The weight of 1000 seeds ranged from 129.2-138.1 g, under control of 137 g. The largest harvest was harvested with a sowing rate of 600 thousand pieces per 1 hectare - 12.2 centners per 1 hectare. With a norm of 500 thousand pieces per 1 hectare, the yield was almost the same - 11.8 centners per 1 hectare. With an increase in the norm to 800 thousand pieces per 1 hectare, it decreased by 2.6 centners per 1 hectare. Under control and the lowest sowing rate (400 thousand pieces per 1 hectare), the yield was lower by 1.0 centners per 1 hectare.

Key words: soybeans; sharply - continental climate; seeding rates; yield, quality.

Introduction

Among the most significant sources of protein for diet and livestock feed are legume crops. The protein content of these crops' seeds and by-products ranges from 20 to 50 percent, which is three times more than that of cereal crops' grains. An increase in land set aside for leguminous crops can balance the diet of animals by increasing both their total amount of digestible protein and their lysine content [1].

There was a need to boost the crops of certain crops, particularly in Northern Kazakhstan, due to the diversification of crop production and taking into account the rising requirement of agricultural producers to cultivate soybeans [2]. Most of the soybean crops are concentrated in the southeastern regions of the country, in particular, in Turkestan and Almaty, as well as Zhambyl regions. In the northern regions of the Republic of Kazakhstan, soybeans are grown in relatively small areas, which is largely determined by the lack of highly productive soybeans with the ability to mature in a sharply continental climate. For the regions of the north and east of Kazakhstan, first of all, new ultra-mature varieties are important for growing grain with a growing season of 80... 95 days. A necessary condition is the relatively high attachment of lower fruits with resistance to cracking [3].

In connection with the above, the purpose of

the studies is to select the standards for sowing soybeans of Marina in the conditions of the first zone of the Kostanay and to identify their impact on the yield and quality of grain.

Materials and Methods

The production experience was carried out in the field of Olzha Agro LLP, which studied the reaction of the Marina variety to increase the seeding rate according to the following scheme: 400, 500, 600, 700, and 800 thousand pieces of germinated seeds per 1 hectare.

During the growing season, soybeans carried out several observations and accounts:

1. The standing density was determined twice - during seedlings and before cleaning. Plant preservation was defined as the difference between the number of seedlings and the number of plants before harvesting.

2. To measure biometric indicators and crop structure, 126 p of plant samples were selected.

4. Crop accounting was carried out by direct combine.

5. Crop quality indicators were determined in the laboratory of agrochemical analyzes of the Republican Agrochemical Service. Protein content in soybean seeds was determined by the Kjedal method, oil content - by the defatted residue method using the Sokolet apparatus.

6. Studies were conducted according to generally accepted methods of conducting studies [4].

Agrotechnics in experience.

In the experience, soybean agricultural equipment recommended by the Kostanay NIIX was used. The predecessor was spring wheat in pairs.

In spring, moisture was closed by rotating harrows of CHD -12. A week before sowing, herbicidal treatment was performed to kill all weed species. For spraying, "Roundup-extra with a consumption rate of 1.5 l/ha was used. After treatment, sowing was carried out on a clean field without pre-sowing tillage by the John Deer sowing unit 1830 with a row spacing of 25 cm and a norm of 700 thousand pcs/ha of seeds on May 26 by 4... 5 cm. The Marina variety of the first reproduction was sown. After sowing, the field rolled. Cultures were treated with Pivot herbicide at a dose of 0.6 L/ha. Harvesting was carried out by John Deere harvesters by a direct combine. The area of the experimental site was 2,000 hectares. Test plot area 50 m 2.

Research conditions

Climate, meteorological, and soil characteristics of the research site.

The research climate is sharply continental. The experimental site is located at the place where the forest steppe passes into the steppe natural zone, with an annual rainfall of 330... 340 mm. The average annual air temperature is 13 ° C. Droughts are typical for the area, as well as strong seasonal and even daily temperature fluctuations and low water availability of fields due to low rainfall.

The climatic characteristic of the territory is given based on observations of the weather station Fedorovka. Rain is of paramount importance in the area, which serves as the main indicator of plants' water supply. There is extremely uneven precipitation during the calendar year. The amount of precipitation that fell in the warm season (176... 185 mm), 2... 2.5 times higher than their amount in the cold period (48... 76 mm). Moreover, during this period they are often completely absent. The most precipitation falls in July, in the so-called "July" maximum.

The soil cover is represented mainly by ordinary chernozems. The humus horizon A + V1 with a thickness of 48... 63 cm. In the V1 horizon, there are new formations of Ca carbonates, however, soils have high potential fertility. The nutrient content is humus content: A 0-26 - 4.82 %, V1 55 - 87 - 3.72 %, B2 55-87 -2.84 %, BC 87-105 - 1.17%, nitrate nitrogen (N-NO3): A 0-26 - 14.4 mg/kg, V1 55-87 - 5.5 mg/kg, V2- 3.2 mg/kg, BC 87- 105 - 2.1 mg/kg. Soils have a pH of 7.2.

Results

Field germination and plant safety.

For the formation of high yields, various agricultural practices are important, aimed at obtaining the required number of plants per unit area, which during growth and development ensures optimal accumulation of biomass [5].

The density of plant standing depends on many factors, the main of which are soil fertility, the provision of plants with moisture and light, varietal features, norms and terms of sowing, the quality of seed material, field germination, plant survival, etc.

Any crop in the current soil-climatic conditions has its optimal density of plant standing for harvesting. In thickened crops, the yield will increase until the reduction in the mass of one plant due to compaction is compensated by an increase in their number per unit area [6].

The height and mass of plants, the structure of the harvest, the dates of onset of phenological phases, and many other biometric indicators largely depend on the density of crops. With the thickening of crops, a delayed formation of generative organs is observed, and their share in the harvest significantly decreases. Field germination is of exceptional importance for obtaining timely and friendly seedlings of soybeans, as well as their safety. With reduced field germination, there is a significant loss of seed material, as well as crop shortage due to sparse crops [7].

In our experience, the highest field germination rate was observed at the lowest seeding rate (400 thousand pcs. /ha). An increase in seeding rates led to a consistent decrease in field germination. Thus, with a seeding rate of 400 thousand pcs. /ha, it amounted to 85.8%, and with the highest rate (800 thousand pieces /ha) only 76.5% or 9.3% less. When sowing 500 and 600 thousand seeds/ha, it was almost equal and was at the level of 84.6... 84.4%. Field germination at the control was 80%.

The main conditions ensuring the appearance of good seedlings are moisture and soil temperature. The reserves of productive moisture by the time of sowing (May 26) significantly decreased due to hot weather, while the soil at different depths of the sowing layer warmed up well, which affected the number of seedlings. In addition, in the soil, there were a large number of seedlings of weeds that were not destroyed by pre-sowing, which had a negative effect on germinating soybeah seeds. The number of rising plants at different sowing rates was 343... 612 plants (Table 1). In this regard, to ensure the production of high yields with high beans quality, it is necessary to determine the optimal soybean sowing rate for a particular region. Optimal density regulates the feeding area of plants, which plays an important role in providing them with moisture, nutrients, and light.

Table 1- Field germination and preservation of plants for harvesting, pcs/m², %.

Seeding rate, thousand pieces/ ha	Number of sprouted plants, pcs/m2	field germination, %	Number of plants to be harvested, pcs/m2	Preservation of plants, %
400	343	85.8	277	80.8
500	423	84.6	327	77.4
600	506	84.4	383	75.6
700, control	560	80.0	393	70.2
800	612	76.5	401	65.6
			$LSD_{0,5}$	0.37

The preservation of plants for harvesting is a significant indicator that characterizes the field germination of plants and their survival during the growing season.

During the growing season, soybeans were influenced by various factors, which, as a result, led to the deterioration of the stem due to the fall of weak plants. By harvesting, the number of preserved plants differed significantly and depended on seeding standards and weather conditions.

In the course of the experience, it was found that as the seeding rates decreased, the survival rate of plants increased. In particular, a decrease in seeding rates increased plant safety by 5.4... 10.6% compared to control.

Biometric indicators. Among the morphological features of soybean, the height of plants is of particular importance in the formation of fodder mass [8].

In our experience, the impact of seeding rates on this indicator was significant. With an increase in the seeding rate, the height of plants increases. In particular, with a seeding rate of 400 thousand pieces//ha, it was 75.4 cm. An increase in the seeding rate led to a smooth increase in height and with a seeding rate of 800 thousand pieces/ ha, it was the highest - 80.5 cm. The height of the plants under control was 79.3 cm. That is, with an increase in seeding rates, the height of the plants increased due to their mutual shading.

The attachment height of the lower beans is the most important economic feature of soybeans since it determines the possibility of using effective mechanized harvesting. The largest losses of grain are because the lower beans are attached close to the ground (10 cm from it), which is why part of the crop remains unharvested. In this regard, all agrotechnical techniques should ensure a high attachment height of the lower beans (Table 2).

Table 2 - Biometric indicators of plants

Seeding rate, thousand pieces/ha	Plant height, cm	The lower of the bean attachment bean, cm
400	75.4	16.0
500	76.2	16.4
600	78.0	16.7
700, control	79.3	16.9
800	80.5	17.1
$LSD_{0.5}$	4.62	3.67

During the experiment, it was determined that the change in this indicator according to the seeding standards was small, and it was depending on the height of the plants and changed with it from 16.0 to 17.1 cm. Since at all seeding standards, the attachment height was higher than 10 cm, it could not worsen the cleaning conditions.

Crop structure.

Bean productivity is one of the main elements of soybean productivity [9].

The elements forming the structure of the bean are varietal features. Seeding rates did not have a significant impact on the formation of bean productivity. The number of beans per plant ranged from 17.6 to 19.4 pieces. With an increase in the seeding rate, it decreased and was the lowest on control and the highest seeding rate (800 thousand pieces/ha) - 18.0 and 17.6 pcs, respectively (Table 3)

Table 3 - Elements of crop structure, pcs/m^2, g.

Seeding rate, thousand pieces/ha	Number of beans per plant	Number of seeds per plant	Number of seeds in a bean	Weight of 1000 seeds
400	19.4	33.1	1.71	137.2
500	19.6	33.3	1.70	137.5
600	19.5	32.8	1.68	138.1
700, control	18.0	29.2	1.62	137.0
800	17.6	26.8	1.52	129.2
$LSD_{0.5}$	0.35	0.47	1.28	0.52

The number of seeds per plant ranged from 26.8 to 33.3 pieces. This indicator shows the same trend as with the number of beans on one plant - with the largest number at lower seeding rates and the minimum on control and an increased rate. The reason for this is the illumination of plants. When thickening crops, illumination decreases, and reduced illumination reduces the number of beans and seeds on the same plant.

The same pattern is observed when determining the number of seeds in a bean and the weight of 1000 seeds.

Thus, the decrease in the seeding rate contributes to an increase in the basic indicators of the soybean crop structure. The best indicators of the structure elements were noted at a seeding rate of 400,500 and 600 thousand pieces/ha. At the same time, some elements are subject to stronger changes than others.

Yield. The yield of all field crops, including soybeans, is determined by counting the plants per unit area and the mass of one plant or seeds derived from that plant. In our experience, the yield of Marina soybeans was largely determined by weather conditions during the growing season and seeding rates (Table 4).

Table 4 - Yield, c/ha.

Seeding rate, thousand pieces/ha	Yield, c/ha
400	11.2
500	11.8
600	12.2

Continuation of Table 4

700, control	11.2
800	9.6
$LSD_{0.5}$	2.34

The largest harvest was harvested at 600 thousand pieces/ha - 12.2 c/ha. With an increase or decrease in seeding rates, it decreased. With a norm of 500 thousand pieces/ha, the yield was almost the same - 11.8 c/ha. With an increase in the norm to 800 thousand, it decreased by 2.6 c/ha. Under control and the lowest seeding rate (400 thousand), the yield was lower by 1.0 c/ha. Consequently, yields are largely determined by seeding rates.

Grain quality.

The quantity and quality of crop production are affected by growing conditions, agricultural machinery, resistance against pests and diseases, varietal features of the variety, as well as prevailing conditions during harvesting and storage [10,11].

In modern conditions, the efforts of the agro-industrial complex are aimed at improving the quality of grain. In addition, the collection of high-quality grain and seeds is one of the priority conditions for the formation of effective crop production [12].

The amount of protein in the soybean grain varied from seeding rates. The increase in reduced seeding rates is mainly due to the increased consumption of soil nitrogen. The amount of protein according to the test variants ranged from 31.0 to 33.1%. Most of the protein was contained at low seeding rates. For example, with a rate of 400 thousand, it was equal to 33.1%, and under control 31.7% (Table 5).

Table 5 - Grain Quality Indicators

Seeding rate, thousand pieces/ha	Protein content, %	Oil content, %
400	33.1	19.5
500	33.0	19.5
600	32.7	19.4
700, control	31.7	19.0
800	31.0	18.8
$LSD_{0.5}$	0.42	0.23

An increase in the seeding rate reduced the protein content, for example, at a rate of 800 thousand pieces/ha, it decreased by 1.6... 2.1% compared to lower seeding rates.

Analysis of the Marin soybean grain determined that seeding rates had a greater effect on protein content than oils. The content of oil in soybean grains is influenced by the same factors as the content of total protein (varieties, growing season conditions, agricultural machinery).

The oil content at all seeding rates were almost equal and amounted to 18.8... 19.5%, then the network influence of seeding rates was minimal.

Thus, the seeding rates did not significantly affect the formation of soybean grains with an increased amount of protein and oil.

Discussion

The purpose of the studies was to select the optimal seeding rate (seeding rates were considered: 400, 500, 600, 700, control, 800 thousand units/ha) of the Marina soybean variety in the conditions of the Kostanay region and to identify the impact on the yield and quality of soybean grain. As a result of the studies, the optimal seeding rate for the Marina soybean variety was 600 thousand units/ha, while the maximum yield was obtained - 12.2 c/ha. With an increase in the norm to 800 thousand, it decreased by 2.6 c/ha. Under control and the lowest seeding rate (400 thousand), the yield was lower by 1.0 c/ha.

Marina soybeans depended on the quality indicators on the seeding rate, so at a rate of 400, 500, thousand units/ha were 33.3%, oils 19.5%. With an increase in the norm (600,700,800) sowing, the protein content decreased to 31.0%, the oil content - 18.8%.

Conclusions

1. An increase in seeding rates led to a consistent decrease in field germination;

2. With a decrease in seeding rates, plant survival increased. A decrease in seeding rates increased plant safety by 5.4... 10.6% compared to control;

3. With an increase in the seeding rate, the height of plants increases. With an increase in the seeding rate, there is a smooth growth in height, and at 800 thousand pieces/ha it was the largest - 80.5 cm;

4. The change in the attachment height of beans according to the seeding standards was small, and it was depending on the height of the plants and changed with it from 16.0 to 17.1 cm. For all seeding standards, it was higher than 10 cm, that is, it did not worsen the harvesting conditions;

5. The largest harvest was harvested at 600 thousand pieces/ha - 12.2 c/ha. With an increase or decrease in seeding rates, it decreased;

7. The amount of protein varied from 31.0 to 33.1% depending on the test variants. Most of the protein was contained at low inoculation rates;

8. Seeding rates had a greater effect on protein content than oils. The oil content at all seeding rates were almost equal and amounted to 18.8... 19.5%, then the influence of seeding rates was minimal.

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ВЛИЯНИЕ НОРМ ВЫСЕВА СОИ НА ЕЕ КАЧЕСТВЕННЫЕ ХАРАКТЕРИСТИКИ

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Аннотация

Экспериментальные исследования проводились в условиях Товарищества с ограниченной отвественностью «Олжа - Агро» Федоровского района Костанайской области. Климат исследуемой территории резко-континентальный, с годовым количеством осадков – 330…340 мм. Почвенный покров представлен черноземами обыкновенными. Полевая всхожесть растений сои составляла от 76,5 % - 85,8%, при контроле 80,0%. Сохранность растений составляла от 65,6 - 80,8%, при контроле - 70,2%. Высота растений составляла от 75,4 -80,5 см, при контроле 79,3 см. Высота прикрепления боба составляла от 16,0 – 17,1 см, при контроле – 16,9. Элементы структуры урожая: количество бобов на одном растении составляли от 17,6-19,6 штук, при контроле 18,0 штук; количество семян на одном растении составляли от 26,8- 33,3 штук, при контроле – 29,2; число семян в бобе составляло от 1,52-1,71 штук, при контроле – 1,62; масса 1000 семян составляла от 129,2 – 138,1 г, при контроле 137 г. Наибольший урожай был собран при норме высева 600 тысяч штук на 1 гектар – 12,2 центнера на 1 гектар. При норме 500 тысяч штук на 1 гектар урожайность была практически такой же - 11,8 центнера на 1 гектар. При повышении нормы до 800 тысяч штук на 1 гектар она понижалась на 2,6 центнера на 1 гектар. На контроле и наименьшей норме высева (400 тысяч штук на 1 гектар) урожайность была ниже на 1,0 центнера на 1 гектар.

Ключевые слова: соя; резко-континентальный климат; нормы высева; урожайность; качество.

МАЙБҰРШАҚТЫҢ СЕБУ МӨЛШЕРЛЕРІНІҢ ОНЫҢ САПАЛЫҚ СИПАТТАМАЛАРЫНА ӘСЕРІ

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Түйін

Тәжірибелік зерттеулер Қостанай облысы, Федоров ауданы «Олжа - Агро» жауапкершілігі шектеулі серіктестігі жағдайында жүргізілді. Зерттелетін аймақтың климаты, жылдық жауын-шашын мөлшері 330…340 мм. Топырақ жамылғысы кәдімгі қара топырақ. Майбұршақ

өсімдіктерінің далалық өнгіштігі 76,5%-дан 85,8%-ды, бақылау кезінде 80,0% -ды құрады. Өсімдіктердің сақталуы 65,6-80,8%, бақылау кезінде 70,2% құрады. Өсімдіктердің биіктігі 75,4-80,5 см, бақылау кезінде 79,3 см, бұршақтың бекіну биіктігі 16,0-17,1 см, бақылауда 16,9 см құрады. Өнімділік құрылымының элементтері: бір өсімдіктегі бұршаққап саны 17,6-19,6 дана, бақылау кезінде 18,0 дана; бір өсімдіктегі тұқым саны 26,8- 33,3 дананы құрады, бақылау кезінде - 29,2; бұршаққаптағы тұқымдардың саны 1,52-1,71 дананы құрады, бақылау кезінде - 1,62; 1000 тұқымның массасы 129,2-138,1 г, бақылауда 137 г. Ең көп өнім 1 гектарға 12,2 центнер - 1 гектарға 600 мың дана себу мөлшері кезінде жиналды. Себу мөлшері 1 гектарға шаққанда 500 мың дана болса, өнімділік 1 гектарға шаққанда 11,8 центнер болды. Себу мөлшерін 1 гектарға 800 мың данаға дейін көтергенде, өнімділік 2,6 центнерге төмендеді. Бақылауда және ең аз себу нормасында (1 гектарға 400 мың дана) өнімділік 1 гектарға 1,0 центнерге төмен болды.

Кілт сөздер: майбұршақ; күрт континентальды климат; себу мөлшері; өнімділік; сапа.