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INFLUENCE OF BIOTIC AND ABIOTIC FACTORS ON FIELD GERMINATION AND PRESERVATION OF WINTER WHEAT PLANT VARIETIES DEPENDING ON PREDECESSORS AND TERMS OF SOWING UNDE CONDITIONS OF RIGHT-BFNK FOREST-STEPPE UKRAINE

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Abstract

The article presents the results of studies on the effectiveness of predecessors on the yield properties of wheat varieties of winter domestic and foreign selection. It has been established that field germination of seeds depends both on the varietal characteristics of the precursor and on the time of sowing.

The availability and survival of plants were determined depending on the factors studied and the features of the growth and development of plant varieties were established. The decisive factor is the influence of the weather conditions of the research years.

It was proved that the bushiness of plants was individual for the studied varieties, however, it was higher in the varieties of foreign selection of Bohemia and Mulan. The bushiness varied depending on the time of sowing, so during the early terms of sowing the autumn tillering of plants grew and the spring tapering, and vice versa during the late terms of sowing the spring tillering was more intense in autumn. That is, for the late terms of sowing, the number of stems to grow due to spring tillering and the varieties of foreign selection had the best.

The cultivation of domestic and foreign winter wheat varieties after soybeans and beans in the first decade of October leads to an increase in overwintering of plants. The overall survival of winter wheat plants in all studied varieties was slightly higher after the precursor of soybean and at sowing on September 25 and October 11.

Keywords: winter wheat, field similarity, hibernation, tillering factor, timing of sowing, predecessor.

Formulation of the problem. In recent years, winter wheat producers have experienced significant climate change. Experts predict a further reduction in the continentality of the climate in Ukraine, which is the reason for reducing the maturation of winter wheat grain to earlier. That is, the main part of the growing season occurs at lower temperatures. Long-term observations of the growing season of winter wheat have shown that the optimal timing of sowing of winter wheat in the Forest-Steppe of Ukraine has shifted from 1-10 September to 10-20 September. Thus, along with the reduction of grain ripening time, the growing season of winter wheat was reduced by 20-25 days [1].

In the context of global climate change, the constant updating of the register with different morphoagrobiological properties of varieties and the improvement of agricultural technology, the process of studying the optimal sowing dates should be ongoing. Sowing dates should be clarified and adjusted for each variety in each soil-climatic region, region and economy depending on weather conditions, moisture supply, agrophones, predecessors, resource provision, intensification of agricultural technologies, variety [2].

When determining the calendar dates for sowing winter wheat, it is advisable to take into account the autumn growing season, when it has the opportunity to grow well and harden. Therefore, the choice of sowing date significantly affects the time of emergence and completeness of seedlings, growth and development of plants and the amount of yield. Only when sowing in the optimal time plants can fully use all the necessary factors for their growth and development and reach before wintering the tillering phase with the formation of 4-5 shoots and formed a well-developed root system, as well as acquire high resistance to adverse wintering conditions. This is possible only with sufficient soil moisture and the sum of average daily temperatures of 400-550 ° C for this requires about 45-55 days of autumn vegetation. The timing of sowing winter wheat should be optimal so that the seeds do not fall under the influence of stressors during germination and subsequent plant growth and crop formation. In the right-bank Forest-Steppe of Ukraine, the optimal sowing dates of winter wheat occur in the case of transition of the average daily air temperature below 15 ° C [3].

Therefore, the study of sowing dates and predecessor is relevant and necessary in the event of a sharp change in climatic conditions.

Analysis of recent research and publications. Among the measures aimed at creating high-yielding crops and obtaining a high yield of winter wheat, an extremely important role belongs to the timing of sowing. Sowing dates for high yields of winter wheat are no less important than tillage and fertilization. Depending on them, plants fall into different conditions, grow differently, develop and accumulate spare substances in the leaves and bushes. They acquire different resistance to low and high temperatures, diseases and pests, as well as form different yields and different grain quality [4].

An important condition for obtaining high yields of wheat grain is sowing in optimal agronomic terms, which are determined by varietal characteristics, soil and climatic conditions and reserves of available moisture to plants in the seed layer of the soil [5]. Therefore, the sowing period is the most effective element of technology, which does not require additional material costs, but significantly affects the realization of the productivity potential of wheat [6].

Many years of research D.M. Alimov (2000) found that friendly and full wheat seedlings can be obtained in the presence of 10 mm of available moisture in the seed layer of the soil. Therefore, the sowing period must be agreed, first of all, with the soil moisture reserves and the date of termination of autumn vegetation [7].

Many years of research V.G. Влоха, M.Я. Bombi, W.W. Likhochvora (1998) proved that the optimal calendar period for sowing wheat in the Forest-Steppe is September 10-25. And scientists of the Lviv State Agrarian University consider the best conditions for obtaining friendly seedlings and better growth and development of winter wheat plants are created when sowing on September 30 [5].

The timing of sowing determines the time of emergence and friendliness of seedlings, further growth and development of plants, and, consequently, yields. When sowing at the optimal time, plants can make full use of natural factors to reveal the genetic potential [5].

The most important indicator of the structure of the winter wheat crop is the density of productive stems. It was found that the density of productive stems increases with sowing in the first decade of October, compared with sowing in the second decade of September, regardless of the predecessor and varietal affiliation [8].

With the creation and introduction into production of varieties there is a question of optimization of sowing dates for each new variety, which will allow to make full use of its potential and stabilize the grain market in Ukraine without additional investment [9].

Sowing dates vary depending on the biological characteristics of the variety. For plastic varieties, the interval of optimal sowing dates is longer. The calendar sowing dates of intensive varieties have significantly shifted, compared to previously grown varieties, to the second half of the optimal time. The peculiarity of the variety should be taken into account, as some of them require early sowing dates, the second - later, and the third have advantages in terms of yield only in the case of late sowing. It is necessary to begin sowing with plastic grades which in the autumn slowly develop and well brake growth and development at the reduced duration of day. Sowing at the end of the optimal, in the admissible and late terms, it is necessary to use grades which weakly react to reduction of length of day, in the autumn intensively develop, have good compensatory properties, form a large number of productive stalks, precocious.

In addition, for sowing wheat in acceptable and late terms, it is necessary to use varieties adapted to late sowing and increase the sowing rate by 15-20% and reduce the depth of seed wrapping to 3-4 cm [9].

The purpose of the research is to investigate the influence of predecessors and sowing dates on field germination and overwintering of intensive domestic and foreign varieties of winter wheat.

Methods and conditions of research. Field experiments were conducted during 2017-2018 in the research field of VNAU. The soil of the experimental plots is typical - gray forest, medium loam with pHNol. - 5.6 and the content in the arable layer (according to Tyurin) of humus - 2.3%, easily hydrolyzed nitrogen (according to Cornfield) 71 g / kg, mobile phosphorus (P2O5) and exchangeable potassium (K20) (according to Chirikov), respectively 155 and 42 g / kg of soil. Hydrolytic acidity - 3.6-3.8 mg-eq./100 g of soil, the sum of absorbed bases is 18.6 mg-eq./100 g of soil at a degree of saturation of bases with 86%.

Weather conditions were different in terms of hydrothermal parameters. During the autumn period (September - October) in 2017 - the amount of precipitation was 122 mm, in 2018 these figures were respectively 69 mm [10].

After the resumption of spring vegetation to the phase of full ripeness of wheat grain (March - the second decade of July) in 2017 fell 152 mm. in 2018 the amount of precipitation was 322 mm. Weather conditions in general during the autumn and spring-summer vegetations of winter wheat were favorable for the formation of optimal grain yields.

After harvesting the predecessors, the field was cleaned of crop residues and tillage was carried out with a BDT-7 disc harrow in two tracks and an AG-2.4 unit to a depth of 12-14 cm. which was carried out in the fall, made nitroammophoska (N16P16K16). Nitrogen fertilization was carried out in the spring on permafrost soil at the rate of 45 kg of active substance per hectare of sowing. Before sowing, the seeds were treated with the combined drug Celeste Top 312.5 FS (1.5 l/t).

According to the research plan, two experiments were set up.

Experiment № 1: Winter wheat of domestic varieties was sown: Forest Song and Housewife according to two predecessors: winter rape and soybean. Sowing was carried out in two terms, taking into account the presence of moisture: 1st - third decade of September (25.09); 2nd - the first decade of October (5.10). Seeds of originators of varieties were used for sowing: in 2017 elite, in 2018 - the first reproduction. The scheme of the experiment is shown in table 1.

Table 1

Scheme of the experiment № 1 term of 2017-2018 in the conditions of the Institute of Forage and Agriculture of Podillya NAAS

Factor A (predecessors)	Factor B (sowing dates)	Factor C (varieties)
A1 - Winter rape	B1 - the third decade of September, B2 - the first decade of October	Forest Song, Housekeeper
A2 - Soybeans	B3 - the third decade of September, B4 - the first decade of October	Forest Song, Housekeeper

Experiment № 2: Winter wheat of foreign varieties: Bohemia and Mulan was sown according to two predecessors: beans and soybeans. Sowing was carried out in two terms, taking into account the presence of moisture: 1st - the first decade of October (1.10); 2nd - the second decade of October (11.10). Seeds of originators of varieties were used for sowing: 2017 - elite. The scheme of the experiment is shown in table 2.

Table 2

The scheme of the experiment № 2 terms of 2017-2018 in the experimental field of VNAU

Factor A (predecessors)	Factor B (sowing dates)	Factor C (varieties)
A1 - Beans	B1 - the first decade of October, B2 - the second decade of October	Bohemia, Mulan
A2 - Soybeans	B3 - the first decade of October, B4 - the second decade of October	Bohemia, Mulan

Sowing of winter wheat of medium-early varieties Lisova Pisnya, Ekonomka, Bohemia and Mulan was carried out with a sowing rate of 5 million pieces / ha of similar seeds. Sowing was carried out with a selection seeder CH-16 in the unit with a tractor T-25. After sowing, the field was rolled with 3KKSH-6 rollers. Method of sowing - solid row with a row spacing of 15 cm, seed wrapping depth of 5-6 cm.

Repetition in the experiment - four times, which meets the requirements of experiments with cereals, placement of options on the site - systematic in one tier. The total area of the plot is 50 m^2, accounting - 25 m^2.

Presenting main material. Growth and development of winter wheat includes the definition of the following main indicators: field germination, survival during the growing season, overwintering of plants, passing the phases of growth and development. The structure of the elements of the grain harvest of winter wheat involves determining the density of productive stalks, the length of the ear, the number of ears in the ear, the number of grains in the ear, the weight of 1000 grains.

The first element of growth and development of winter wheat, we determined the field germination of grain depending on the predecessors and sowing dates. Long-term observations have shown that in years when full-fledged seedlings are obtained in time, autumn crops develop well and have a strong root system and, as a rule, provide high grain yields even in adverse weather conditions in the summer months. But poorly developed and liquefied since autumn crops are almost always low-yielding. The appearance of seedlings is influenced by air and soil temperature, as well as its humidity. The most favorable temperature for the germination of winter wheat seeds is 12-18 ° C, the minimum - 1-2 ° C, the optimum 24-28 ° C, and the maximum 36-38 ° C.

Field germination of seeds varied greatly depending on sowing dates and weather conditions of the autumn growing season over the years of research. Analyzing the data in table 3, we can see that the highest indicators of field germination of grain on average for 2017-2018 were obtained when sowing in the third decade of September for both winter rape and soybeans, which were for the variety Forest Song (78.0 % -79.3%), and by the variety Ekonomka (82.3-77.4%) (Table 3). The shift of sowing dates to later ones led to a decrease in field germination of seeds by an average of 1-2.2%.

We observed a similar trend in table 4 in the autumn growing season on average for 2017-2018, when the highest field germination of winter wheat seeds was found for sowing in the first decade of October. Thus, sown seeds of Bohemia variety on field beans had field germination - 79.3%, and soybeans - 82.4%, which is 0.5 and 2.6% higher compared to sowing in the second decade of October. A significant difference was observed in the variety Mulan, so under the conditions of sowing on October 1, the field germination of grain for common beans was - 82.1%, and for soybeans - 83.5%, which is 2.5-2.1% more than with sowing on October 11.

Therefore, we can conclude that the highest indicators of field germination of grain in 2017-2018 for domestic varieties of winter wheat we obtained after winter rape, which is 1.6% higher compared to sowing. A significant difference was observed in foreign varieties, so when placing them on the soybean predecessor, the field germination rate of plants was 1.8% higher compared to sowing on common beans. The decrease in field germination of winter wheat grain in late sowing can be explained by a sharp decrease in the average daily air and soil temperature.

Table 3

Field germination of seeds and general survival of winter wheat plants of domestic varieties depending on predecessors and sowing date (average for 2017-2018)

Predecessor	Terms of sowing	Sort	Field germination,%	Included in winter, pcs.	It came out of winter, pcs.	Overwintering,%	Preserved plants, before harvest, pcs / m^2	Total survival,%
Winter rape	Dec. III September	Forest Song	78,0	427	377	88,29	235	62,33
	And Dec. October		77,0	421	375	89,07	230	61,33
	Dec. III September	Housekeeper	82,3	434	385	88,71	250	64,93
	And Dec. October		80,2	429	382	89,04	243	63,61
Soy	Dec. III September	Forest Song	79,3	411	374	91,00	253	67,65
	And Dec. October		79,0	404	375	92,82	250	66,66
	Dec. III September	Housekeeper	77,4	415	384	92,53	262	68,23
	And Dec. October		75,2	413	383	92,74	258	67,36

Overwintering of winter wheat plants is one of the main factors influencing the formation of productivity in the spring-summer growing season due to the survival of plants during the period of cessation of autumn and resumption of spring vegetation. Overwintering of winter wheat crops largely depends on the accumulation of carbohydrates in the bushes, as they are the main energy substances that play an important role in protecting plants from the effects of low temperatures and other adverse factors in winter.

Weather conditions for the winter period of 2017-2018 were different. On average, the cessation of autumn vegetation over the years of research occurred on November 15, and the resumption of spring vegetation on April 2, ie the period of "rest" of plants with subzero temperatures was 138 days. The weather and winter conditions of 2017-2018 were favorable for overwintering and satisfactory for hardening of winter wheat plants of all studied varieties.

Table 4

Field germination of seeds and general survival of winter wheat plants of foreign varieties depending on predecessors and sowing date (average for 2017-2018)

Predecessor	Terms of sowing	Sort	Field germination,%	Included in winter, pcs.	It came out of winter, pcs.	Overwintering,%	Preserved plants, before harvest, pcs / m^2	Total survival,%
Bean ordinary	Dec. III September	Bohemia	79,3	435	386	88,94	288	74,61
	And Dec. October		78,8	434	380	87,36	292	76,84
	Dec. III September	Mulan	82,1	453	447	98,68	294	65,77
	And Dec. October		79,6	423	381	90,07	280	73,49
Soy	Dec. III September	Bohemia	82,4	430	378	87,91	285	75,39
	And Dec. October		79,8	436	380	87,16	294	77,36
	Dec. III September	Mulan	83,5	486	450	92,59	298	66,22
	And Dec. October		81,4	425	380	89,41	295	77,63

Winter wheat varieties Forest Song, Housewife, Bohemia and Mulan are characterized by increased winter hardiness. Overwintering of winter wheat plants was different depending on sowing dates and predecessors.

From the data of table 3 it is possible to see that the highest indicator of overwintering of plants was received by us in winter wheat of the Forest Song variety for its sowing in the first decade of October, on soybean it made 92,8%, on winter rape - 89% that on 1,8 -1%, respectively, more than for sowing in the third decade of September.

During sowing in the first decade of October, the value of this indicator in the variety Ekonomka in areas of winter rape was 89%, and soybean - 92.7%, which is 0.3-0.2% higher than compared to sowing in the third decade of September.

However, in terms of survival, on average for 2017-2018, for all varieties and for all predecessors, the best sowing date is the third decade of September. So, for sowing on September 25 of the Forest song variety on winter rape we received 62,3% of plants, and on soybean 67,6%. Whereas the best result of survival of winter wheat plants in the variety Ekonomka was obtained for soybeans and was 68.2%, and for winter rape 64.9%.

The results of our research for 2017-2018 spring-summer vegetation showed that during sowing in the third decade of September, the overall survival of winter wheat plants in all predecessors was higher by 1% compared to sowing in the first decade of October.

Analyzing the data from table 4, we can see that the highest rate of overwintering plants of foreign varieties on average in 2017-2018 was obtained in winter wheat Mulan for sowing in the first decade of October, for beans it was 98.6%, and for soybeans - 92.5%, which is 8.6% and 3.1% respectively more than for sowing in the second decade of October. During sowing in the first decade of October, the value of this indicator in the variety Bohemia in the areas of common beans was 88.9%, and after soybeans - 87.9%, which is 1.5% and 0.7%, respectively, higher than sowing in the second decade of October.

Therefore, we can conclude that the highest rate of overwintering in 2017-2018 for domestic varieties of winter wheat we obtained after soybeans, which is 3.5% higher than sowing for winter rape. A significant difference was observed in foreign varieties in 2018, so when placing them on the predecessor of beans, the rate of overwintering of plants was 1.9% higher compared to sowing. Whereas the highest survival of plants of all varieties of winter wheat was obtained when placing them on the predecessor of soybeans by 4.4% compared to sowing on winter rape and 1.5% compared to common beans. The decrease in the rate of overwintering of plants both during sowing in the third decade of September and in the second decade of October is explained by the fact that the plants had an insufficient amount of accumulated carbohydrates in the bushes and less developed root system.

Tillering is the appearance of lateral shoots and nodular roots in plants. This phase occurs after the formation of 3-4 leaves, about 23-27 days after emergence, due to active photosynthesis and influx of mineral nutrients. The most favorable temperature for winter wheat tillering is 13-18 ° C, and at 2-4 ° C the tillering process is almost suspended. The tillering node is the main organ, it is several close underground nodes, when it dies the plant dies. In the soil it is placed at a depth of 1.5-3.0 cm and can withstand frosts down to minus 17-20 ° C. The depth of the tillering node plays an important role in the life of winter wheat, the deeper it lies, the greater the frost resistance, and also increases its resistance to lodging [11, 12].

In addition, there are a number of agronomic measures that also have an extremely large impact on the tillering process and can even compensate for the shortcomings that have arisen due to changes in optimal factors. The process of tillering plants is influenced by the sowing rate, timing and methods of sowing, the depth of seed wrapping. According to Fursova GK (2004) the coefficient of tillering of winter wheat decreases with increasing sowing rate, seed wrapping depth and late sowing dates, and vice versa: decreasing rate, normal depth (4-6 cm) and early sowing increase bushiness. The level of development of the root system in the tillering phase significantly affects the formation of elements of the crop structure, especially the number of productive stems and the number of spikelets in the ear [13].

The period of autumn and spring tillering depends on the sowing date. In autumn, tillering continues to reduce the average daily temperature to 2-3 ° C. The duration of autumn tillering under normal conditions is 25-30 days, spring 25-35 days. In the spring tillering is restored with the onset of spring vegetation and lasts until the beginning of the tube, when the average daily temperature rises to 10-12 ° C. In late sowing and reduction of the period of autumn tillering, the density of stems is formed due to spring tillering [14]. The number of stems per plant is determined by the coefficient of tillering. The number of stems on one plant determines the total bushiness, and the number of stems with a grain ear - productive bushiness. The coefficient of tillering is a varietal affiliation of winter wheat [11].

In our studies, the process of intensive tillering was influenced by sowing dates, precursors and biological features of the studied varieties. It was found that the plants of the first and second sowing dates were well pruned in autumn, the coefficient of tillering of winter wheat of the studied varieties before the end of autumn vegetation in 2017-2018 varied from 1.4 to 2.2 pieces shoots. The highest rates were obtained in winter wheat plants for sowing in the third decade of September and they ranged from 2.0 to 2.2 pieces, respectively. shoots, which is 0.6-0.8 pcs. more than sowing in the first decade of October. (Table 5).

Table 5

Coefficients of tillering of winter wheat plants of domestic varieties dependingь from the predecessor and the sowing date (on average for the growing season 2017-2018)

Predecessor	Terms of sowing	Sort	Tillering ratio			
			autumn	in the spring	general	productive
Winter rape	Dec. III September	Forest Song	2,0±0,1	1,4±0,1	3,4±0,1	2,3±0,1
	And Dec. October		1,8±0,1	1,6±0,1	3,4±0,1	2,5±0,1
	Dec. III September	Housekeeper	2,2±0,1	1,2±0,1	3,4±0,1	2,2±0,1
	And Dec. October		1,4±0,1	1,4±0,1	2,8±0,1	2,4±0,1
Soy	Dec. III September	Forest Song	2,1±0,1	1,2±0,1	3,3±0,1	2,4±0,1
	And Dec. October		1,5±0,1	1,7±0,1	3,2±0,1	2,6±0,1
	Dec. III September	Housekeeper	2,1±0,1	1,3±0,1	3,4±0,1	2,5±0,1
	And Dec. October		1,4±0,1	1,6±0,1	3,0±0,1	2,6±0,1

There is a tendency to increase the rate of spring and productive tillering rate for sowing in the first decade of October, compared with crops of early sowing dates. Thus, if during sowing in the third decade of September, during the spring growing season the number of shoots increased by 1.1-1.4 pieces, then during the late sowing period, in the first decade of October, the number of shoots increased by 1.6 ± 0.1 pcs. (Table 5). The difference in the indicators of the productive coefficient of tillering between the plants of the first and second sowing dates was insignificant and averaged 0.2 pcs. It is reliably proved that the best conditions for the formation of productive stalked winter wheat by domestic varieties were created by sowing soybeans, after which the plants formed 0.2 productive shoots more than winter rape.

Analyzing the data presented in table 6, we can conclude that on average for 2017-2018 the coefficient of tillering of winter wheat plants depending on the timing of sowing and predecessors was different.

Table 6

Coefficients of tillering of winter wheat plants of foreign varieties depending from the predecessor and the sowing date (on average for the growing season 2017-2018)

Predecessor	Terms of sowing	Sort	Tillering ratio			
			autumn	in the spring	general	productive
Bean ordinary	Dec. III September	Bohemia	2,3±0,1	1,5±0,1	3,8±0,1	2,4±0,1
	And Dec. October		2,0±0,1	1,7±0,1	3,7±0,1	2,5±0,1
	Dec. III September	Mulan	2,1±0,1	1,5±0,1	3,6±0,1	2,3±0,1
	And Dec. October		2,0±0,1	1,7±0,1	3,7±0,1	2,5±0,1
Soy	Dec. III September	Bohemia	1,9±0,1	1,7±0,1	3,6±0,1	2,2±0,1
	And Dec. October		1,6±0,1	1,8±0,1	3,4±0,1	2,4±0,1
	Dec. III September	Mulan	2,0±0,1	1,5±0,1	3,5±0,1	2,3±0,1
	And Dec. October		1,6±0,1	1,8±0,1	3,4±0,1	2,5±0,1

Thus, for sowing in the first decade of October, the rate of tillering in the autumn growing season varied from 1.9 to 2.3 pieces, and in the spring it ranged from 1.5 to 1.7 pieces. shoots. During sowing in the second decade of October, the tillering rate in the autumn period decreases from 1.6 to 2.0 pieces, but in the spring growing season it increased to 1.8 pieces, which is an average of 0.2 ± 0.1 pieces. more than sowing in the first decade of October (Table 6).

According to the indicator of the coefficient of productive tillering of winter wheat plants, the best results were obtained for sowing in the second decade of October. Thus, the highest coefficient of tillering during the spring-summer growing season was obtained in

the variety Mulan and it was 2.5 ± 0.1 pcs. after both studied predecessors (Table 6). Slightly smaller number of productive stems - 2.3 ± 0.1 pcs. formed plants sown in the first decade of October. It has been reliably proved that the best conditions for the general tillering of winter wheat by foreign varieties were created by sowing common beans, after which the plants formed 0.2 shoots more than soybeans.

Thus, we can conclude that in 2017-2018, the best conditions for autumn tillering of winter wheat were created by sowing seeds of all varieties at an early date (September 25, October 1). Whereas the largest number of productive stems during the spring-summer growing season was obtained in late sowing crops (October 5 and 11).

Conclusions

1. Therefore, the sowing of winter wheat in the early stages and on different predecessors did not significantly affect the field germination of seeds of domestic and foreign varieties and averaged 78.5 and 80.8%, respectively. The shift of sowing dates to later ones (October 5-11) led to a decrease in field germination of seeds in domestic varieties by an average of 1-2.2%, and in foreign varieties by 0.5-2.6%, respectively.

2. Growing domestic and foreign varieties of winter wheat after soybeans and beans during sowing in early October leads to improved wintering of plants. Survival of the studied varieties of winter wheat on such predecessors as soybeans and beans for sowing in the third decade of September and the first decade of October contributes to the preservation of plants, improves their phytosanitary condition, and ultimately increase yields.

3. It was found that all varieties of winter wheat were well bushed during the growing season, but there was a trend, for 2017-2018 the best conditions for autumn tillering of winter wheat were created by sowing seeds of all varieties in the early stages (September 25, October 1). Whereas the largest number of productive stems during the spring-summer growing season was obtained in late sowing crops (October 5 and 11).

4. It is reliably proved that the best conditions for the formation of productive stem wheat of winter domestic varieties were created by sowing soybeans, and for foreign beans after which the plants were formed by 0.2 pcs. productive shoots more than winter rape and soybeans.

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