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ВІННИЦЬКИЙ НАЦІОНАЛЬНИЙ АГРАРНИЙ УНІВЕРСИТЕТ

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FORMATION OF BUSHINESS OF SPRING TRITICALE VARIETIES DEPENDING ON THE PREDECESSOR AND FERTILIZER

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The article highlights the influence of precursors and levels of mineral fertilization on the formation of productive bushiness of spring triticale of different varieties. Depending on the influence of meteorological factors and weather, the influence of the studied elements of winter triticale cultivation technology, the indicators of the level of bushiness changed. The highest productive bushiness was formed by plants in the variants in which the best conditions were created for this. Triticale is an artificially bred crop that has not been studied enough in the global economy and requires research, but in Ukraine it is a well-known crop that takes its share in the overall crop structure. For example, the use of different norms of nitrogen fertilizers on the background of $P_{60}K_{60}$ *contributed to an increase in the number of productive stems per unit area, and, accordingly, in the productive bushiness in general. When applying phosphorus and potassium fertilizers (*$P_{60}K_{60}$*), the number of productive stems did not exceed 585-591 pcs./m2, and the productive bushiness was 1.58-1.59, respectively.*

Triticale consumes a lot of nutrients from the soil to form a crop, which requires additional fertilization. It is not customary to apply organic fertilizers to this crop. only under its predecessors. Depending on the soil fertility, 60 to 90 kg of nitrogen, phosphorus and potassium are applied. Phosphorus and potash fertilizers are scattered under the main cultivation. And nitrogen fertilizers are divided into three fertilizing sessions during the phases of active plant growth. Experts also advise to apply superphosphate 10-15 kilograms per hectare during sowing with seeds.

Triticale is very sensitive to sowing dates, which roughly coincide with the middle of the optimal sowing period for winter wheat. For sowing, it is necessary to select seeds with a germination rate of at least 92% and a purity of at least 98%. Treatment with compositions designed for winter wheat has a good effect on the yield. In most farms, the crop is sown using intensive technology in a row with the skipping of technological paths. Some farms use a cross-row or narrow-row sowing method. The seeding rate is usually between 1.5 and 5.5 million germinating grains per hectare. The recommended sowing depth is 4-6 cm, reduced on heavy soils and increased by 1-2 cm on light soils.

By selecting the best predecessors, namely soybeans, sunflower and corn, we created optimal conditions for the productivity of this crop. In addition, mineral fertilizers had a positive effect on the formation of bushiness of spring triticale.

Key words: *variety, spring triticale, agrocenosis, predecessor, doses of mineral fertilizers, bushiness.*

Table 3. Lit. 16.

Introduction. Triticale is a cereal that has only recently become widespread. The first samples of this plant were created by breeders at the end of the XIX century by crossing wheat and rye. Triticale has several hybrid varieties obtained on a two- or three-species basis. Two-species triticale usually inherit genes of rye and durum wheat, while three-species triticale also inherit soft wheat. The main feature of triticale is its high protein content of 13 to 18%, with a complete amino acid composition. The main use of triticale grain is as a raw material for the production of highly efficient compound feed. It is also often planted for green fodder or silage. The main elements of winter triticale cultivation technology are soil cultivation, selection of predecessors, fertilizers and soil conditions [1]. One of the most important elements of the technology of growing spring triticale seeds is the creation of optimal conditions before sowing, which is provided by the previous crop and is associated with the subsequent plant nutrition system. They are provided by the best previous crops that were sown before sowing spring triticale, which provides an appropriate aftereffect on the further cultivation of plants, taking into account the biological characteristics of varieties, as well as soil, climatic and agroecological conditions of specific regions [2,3].

Thus, modern varieties of spring triticale, in addition to high yield potential, have enhanced adaptive properties, including less demanding soil conditions, high drought tolerance, as well as immunity to fungal diseases and the ability to withstand pests. In addition, its high resistance to spring frosts guarantees almost complete preservation of crops after unfavorable conditions in spring. It is also believed that under conditions of minimal energy and material inputs, spring triticale is the most adapted to the biologization of agricultural production and can guarantee a high-quality grain harvest [4].

Today, one of the important reserves for increasing yields and stabilizing grain production is a thorough, scientifically based approach to the selection of precursors [5].

Thanks to its valuable biological characteristics (increased winter hardiness, drought resistance, disease and pest resistance), as well as its high ability to absorb nutrients from the soil, triticale can be grown after worse predecessors: corn, stubble crops, and even after sunflower [6].

For example, winter wheat is demanding of its predecessors. Its productivity decreases especially in case of no-till cultivation. This leads to an increase in weediness of crops, especially with weeds that have adapted to grow in crops of this particular crop. Thus, according to the Myronivsky Institute of Wheat, the number of weeds increases by 2-5 times under no-till winter wheat cultivation, and the negative impact of weeds does not decrease even after fertilizers and herbicides are applied [7,8]. Meanwhile, triticale is less demanding on growing conditions after different predecessors.

Among the main factors of winter crops yield formation, the current place belongs to the predecessors, the value of which is determined not only by the degree of weediness, physical and phytosanitary condition of the arable layer, but also by the level of moisture and nutrients use from the soil. Proper selection of the predecessor makes it possible to improve the phytosanitary condition of crops, increase the productivity of winter crops, while ensuring the restoration of soil fertility and environmental protection without additional costs.

At all stages of agricultural development, crop rotation has been the basis of technology. Intensive technology better realizes the potential of the predecessor than conventional technology. On the other hand, intensive technologies have somewhat reduced the role of the predecessor, as the negative effects of repeated placement of the crop were neutralized by chemical plant protection products against pests.

Statement of the problem. In the current conditions of reforming the agricultural sector of Ukraine's economy, as well as climate warming, there is an urgent need to develop agrotechnological methods that would ensure the efficient use of crop rotations in general. One of the methods to increase the efficient use of arable land in modern business conditions is to grow crops that produce less costly and competitive products. Triticale meets these requirements best of all. By now, many technological methods have been developed that ensure sufficiently high grain yields of this crop both in irrigated and non-irrigated farming. However, the technology of triticale cultivation in the context of climate change remained insufficiently developed and studied. In particular, such important elements of the technology as triticale varieties, precursors and doses of mineral fertilizers have not been determined.

Therefore, the study of the peculiarities of growth and development of high-yielding varieties of spring triticale and the introduction of basic methods of growing the crop, establishing the effect and interaction of the variety and mineral fertilizers, which significantly affect the yield and quality of grain, sowing and yielding qualities of seeds in the conditions of the Right-Bank Forest-Steppe are relevant, which determined the choice of the topic of the master's thesis.

Steady increase in grain production is considered one of the most important tasks for further development of agriculture in all natural and climatic zones of Ukraine. Its solution is crucial not only for meeting the growing food needs of the population, but also for the development of the livestock sector.

Along with the main fodder cycle, the share of triticale grain is increasing, as it is a valuable crop in field crop rotation and a good precursor for a number of crops: corn, sunflower, beetroot, and others. Triticale is also of great organizational and economic importance.

The main reserve for increasing the efficiency of crop cultivation is the rational use of bioenergy resources of the soil, environmental conditions, nutrients and maximum realization of the genetic potential of spring wedge for fodder. In agrotechnical terms, the technology of growing grain crops involves: strict adherence to crop rotations, placement of crops after the best predecessors that vacate the field no later than one month before sowing, optimal supply of nutrients to plants, integrated plant protection, and maximum use of the potential of crop varieties and hybrids.

In years when spring crops are exposed to atypical growing conditions, significant shortcomings in agricultural practices can occur, which is not uncommon on many farms. First of all, this concerns the correct choice of predecessors, sowing dates and varietal composition.

Given the prospect of increasing grain production, it is extremely important to comply with the full range of grain growing technologies. Violation or simplification of many of the recommended elements of agricultural technology leads to lower yields, product quality and profitability.

The purpose of the research was to improve the technology of spring triticale cultivation and obtain high-quality products when growing intensive-type varieties, to identify the best predecessor and to apply mineral fertilizers.

Research methodology. The sowing period is the first decade of April. The total area of the sowing plot is 50 m2, the accounting plot is 25 m2. Replication was three times. Agrotechnical measures and the level of mechanization in the experiment are typical for the Right-Bank Forest-Steppe zone, except for the factors under study.

Phenological observations and relevant records, measurements, calculations, and sampling were carried out according to the Methodology of the State Service for the Protection of Plant Variety Rights (now the State Veterinary and Phytosanitary Service of Ukraine) [9,10]. The date when 10-15% of the plants entered the phase was taken as the beginning of the phase, and 75% as the full phase. The duration of the growing season was calculated from the date of germination to the waxy ripeness of the grain.

The variety Boriviter. The originator is the V.Y. Yuriev Institute of Plant Industry of the National Academy of Agrarian Sciences of Ukraine. Created in 2012 and included in the State Register of Plant Varieties Suitable for Distribution in Ukraine in 2015 for cultivation in the Steppe, Forest-Steppe and Polissya.

The variety Boriviter was created by the method of two-time individual selection in F2 and F3 from the hybrid population ЖЗРАС29ГП2/Х10ГАС7//Х10ПГСвТ6б [11].

The variety is erythrospermum. It is mid-season, vegetation period - 92 days, medium-sized, plant height - 100-110 cm. Increased resistance to lodging - 9 points, resistant to shedding, germination. Cold-resistant, increased drought resistance - 8 points. Resistant to major leaf diseases. Resistance to smut diseases - 9 points, resistance to leaf septoria - 8 points, resistance to brown leaf rust - 8 points, resistance to powdery mildew - 9 points.

Yield potential of 8 t/ha. The average yield is 4.24 t/ha with fluctuations over the years from 4.08 to 5.32 t/ha. The grain is well-filled, large - weight of 1000 grains is 46.0 g, with a high natural content (764-788 g/l). The grain is hard (178-181 H). The protein content in the grain is 12.6%. It has good baking properties. Group I gluten is 20.5-21.0%, bread volume is 400-530 ml from 100 ml of flour. The overall baking score is 8-9 points.

Variety Darkhliba. The originator is the V.Y. Yuriev Institute of Plant Industry of the National Academy of Agrarian Sciences of Ukraine. Created in 2011 and included in the State Register of Plant Varieties Suitable for Distribution in Ukraine in 2015 for cultivation in the Steppe, Forest-Steppe and Polissya. Created by the method of double individual selection in F2 and F5 from a hybrid population obtained from a triple interline cross of lines СЛ4-3+8р1, Х10ГАС8 and Х2ПГАС29П.

The variety is erythrospermum. Mid-season, vegetation period - 90-98 days, medium-sized, plant height - 95-105 cm. Increased resistance to lodging, resistant to shedding, germination.

Cold-resistant, drought-resistant. Resistant to major foliar diseases. Resistance to smut diseases - 9 points, resistance to leaf septoria - 8 points, resistance to brown leaf rust - 8 points, resistance to powdery mildew - 9 points.

The yield potential is 8.5 t/ha. The average yield is 4.16 t/ha with fluctuations over the years from 4.08 to 5.16 t/ha.

The grain is large, smooth, and has high cereal properties. It has a natural weight of 768 g/l, protein content of 13.0-14.0%, starch 66%, gluten 22.5% of group I (IDK 55-60 units), flour strength 196 units. Seeding rate of spring triticale seeds of Darkhlib Kharkivskyi is 4.5-5.0 million germinating grains per 1 ha. Sowing is carried out in the earliest possible time as the soil ripens. In southern Ukraine, sowing is possible in the «February window».

Lebed variety. The originator is the V.Y. Yuriev Institute of Plant Industry of the National Academy of Agrarian Sciences of Ukraine. Created in 2011 and included in the State Register of Plant Varieties Suitable for Distribution in Ukraine in 2014 for cultivation in the Steppe and Polissya.

The variety was created by individual selection from a complex hybrid population obtained at the third level using drought-resistant spring wheat Prokhorivka and pollination of an intergeneric hybrid with Kharkiv Lark - Х10ГАС21//СЛ13М3-1/ПрІМ10-1/3/Прох/4/Ж. The pedigree of this variety contains comprehensively valuable lines of spring triticale Х10ГАС21, СЛ13М3-1, ПрІМ10-1., and ПриМ10-1. The peculiarity of creating this variety was that individual selection was carried out from F2 and allowed to immediately obtain a leveled family.

Vegetation period of the variety is 89 - 90 days Potential yield is 82 - 83 c/ha. The weight of 1000 grains are 42.7 - 42.8 g. Plant height 94 - 95 cm. Resistance to lodging 8/9. Drought resistance 8/9. Disease resistance 9/9. The overall baking score is 8.5 - 8.6 points.

Summary of research results. The optimization of nitrogen fertilizer application rates and timing is based on plant and soil diagnostics data by triticale development stages. Retail application of nitrogen fertilizers provides significant increases in grain yield and significantly affects the protein content of grain. The effectiveness of foliar fertilization of triticale plants with urea on the establishment of productivity elements was confirmed by research conducted at the Institute of Agriculture of the Carpathian Region of NAAS. It was found that the yield, triticale in the Western Forest-Steppe, plant structure and grain quality increased with foliar fertilization of plants with urea against the background of mineral fertilizers N30P30K30 before sowing + N30 in the second stage of organogenesis [12].

Significant differences in the magnitude of the influence of grain structure elements, in particular the number of productive stems, grains per ear, and weight of 1000 seeds on the formation of seed yield were found. The maximum response to intensive cultivation technologies is characterized by varieties less resistant to plant lodging and disease, which should be taken into account when choosing a variety and its cultivation technology [13, 14, 15].

The agriculture of each region of the country faces an important task: to achieve a significant improvement in grain quality in a short time with an increase in yields and gross harvests of spiked cereals, and this problem applies to triticale [16].

With the average supply of soil with mobile nutrients and the application of only nitrogen fertilizers for the main tillage, grain yields increased by 3.22 t/ha, and phosphorus alone by 0.22 t/ha. However, the need for mineral fertilizers in today's business environment is very high. The reason for this is that insufficient use of mineral fertilizers, especially in recent years, has led to a decline in soil fertility and a variation in the content of nutrients in soils.

The yield of agricultural products and their quality depend on soil and climatic conditions, the availability of nutrients in the soil and their ratio. The specifics of plant nutrition are clearly manifested not only in the application of nitrogen, phosphorus and potassium doses, but also in the correct ratio between nutrients, which are much more important than the amount of fertilizer applied.

Consumption of mineral nutrients depends on their content in the soil, plant condition, growth rate, root development capacity, weather conditions, etc. To produce 5.0 t/ha of grain with the appropriate amount of straw, it absorbs an average of 150 kg of nitrogen, 60 kg of phosphorus and about 130 kg of potassium. The plants' need for mineral nutrients is met by mobilizing soil fertility and applying fertilizers.

On all soil types, triticale responds best to nitrogen fertilizers, which increase its yield by 1.2-1.5 t/ha. The increase from phosphorus fertilizers on the dark chestnut soils of the Southern Steppe does not exceed 0.2-0.3 t/ha. Compared to the variant without fertilizers, the application of nitrogen-phosphorus fertilizers at a dose of N30P60 ensures an increase in productivity and efficiency of triticale grain production.

A characteristic biological feature of cereal grain crops is their ability to bush. In this case, a distinction is made between total and productive tillering. General bushiness refers to the number of stems per plant, while productive bushiness refers to the number of stems that ensure grain yield.

However, there are two opposing opinions in the literature regarding triticale bushiness. Some researchers see a positive side in higher tillering; others see a negative side, i.e., an inverse relationship between tillering and grain yield per unit area.

Obviously, the highest yield of triticale can be obtained with more favorable predecessors, taking into account the biological characteristics of individual varieties. The optimum number of plants per unit area is one of the main factors in the formation of highly productive cereal crops, which depends mainly on the meteorological conditions of the year, the allopathic effect of the residues of predecessors and the biological characteristics of the variety.

The results of scientific research indicate that plants of different varieties of spring triticale in the conditions of the central part of the Forest-Steppe zone depend on the biological characteristics of the variety, which reacted differently to the level of mineral nutrition and cultivation of previous crops. This was manifested, as a rule, in the formation of elements of their productivity. Observations proved that spring triticale varieties formed different densities of productive stems.

It was established that the largest number of plants and the number of productive stems (375 and 690 pcs./m2) on average for the variety Boriviter was formed in 2019. Due to the worse weather conditions in 2020, the number of plants and productive stems was 329 and 633 pcs./m2. On average, over two years of research, the variety Boriviter, when eliminating the influence of predecessors and mineral fertilizers, formed 352 pcs./m2 of plants and 662 pcs./m2 of productive stems (Table 1).

Table 1

Productive tillering of spring triticale of Boriviter variety depending on the predecessor and application of mineral fertilizers (average for 2019-2020)

Predecessor	Total number of plants, pcs./m²	Number of productive stems, pcs./m²	Productive bushiness
$P_{60}K_{60}$ Control			
sunflower	352	486	1,38
corn for grain	353	505	1,43
soybean	354	528	1,49
$N_{30}P_{60}K_{60}$			
sunflower	357	640	1,79
corn for grain	358	645	1,80
soybean	358	660	1,84
$N_{30}P_{60}K_{60}$ + N_{30} earing			
sunflower	357	645	1,81
corn for grain	358	653	1,82
soybean	358	662	1,85

source: formed on the basis of own research

The ability of varieties to form productive bushiness, which determines the size of the crop, should be emphasized. The coefficient of productive bushiness in the Boriviter variety was the highest in 2020, reaching 1.86, but this figure was slightly lower in 2019 - 1.83. On average, for the studied varieties, regardless of the predecessor and the use of mineral fertilizers, the productive bushiness of the Boriviter variety was 1.69 (Table 1).

The increase in the level of mineral nutrition of spring triticale of the Boriviter variety from P60K60 to N30P60K60 contributed to a significant increase in such indicators as the total number of stems, which on average in 2019-2020 varied from 486 to 662 pcs./m².

According to the results of the conducted research, it was found that the formation of productive stems and productive bushiness of spring triticale significantly depended on the use of mineral nitrogen fertilizers.

On average, over three years of research, when P60K60 was applied, the number of productive stems in the Boriviter variety was at the level of 486-528, and the productive bushiness was 1.38-1.49, respectively. When applying N30P60K60, the number of productive stems increased to 640-660 pcs./m2, and productive bushiness to 1.79-1.84, which significantly affected the yield of triticale plants. According to the results of the conducted research, it was found that the influence of the studied factors on the conditions of growing triticale varieties was different. Due to its biological characteristics, the Lebed variety, compared to the Boriviter and Darkhliba varieties, formed a larger number of productive stems (Table 2).

Table 2

Productive tillering of spring triticale of the Lebed variety depending on the predecessor and the use of mineral fertilizers (average for 2019-2020)

Predecessor	Total number of plants, pcs./m²	Number of productive stems, pcs./m²	Productive bushiness
$P_{60}K_{60}$ Control			
sunflower	368	585	1,59
corn for grain	368	583	1,58
soybean	372	591	1,59
$N_{30}P_{60}K_{60}$			
sunflower	371	658	1,77
corn for grain	370	665	1,80
soybean	377	690	1,83
$N_{30}P_{60}K_{60}$ + N_{30} earing			
sunflower	371	662	1,78
corn for grain	370	673	1,82
soybean	377	697	1,85

source: formed on the basis of own research

In 2019, the spring triticale variety Lebed had a number of plants of 372-379 pcs./m2, productive stems of 577-696 pcs./m2 and productive tillering of 1.55-1.84. In 2020, these indicators were slightly better: the total number of plants was 363-374 pcs./m2, respectively, productive stems - 592-697 pcs./m2 and productive bushiness 1.63-1.86. On average, in 2019-2020, the total number of plants in the Lebed variety did not exceed 368-377 pcs./m2 and, compared to the Boriviter variety, was 12-19 pcs./m2 higher. The number of productive stems, respectively, was 585-697 pcs./m2 or 17-99 pcs./m2 more than in the variety Boriviter. Productive bushiness was 1.59-1.85 (Table 3).

The use of different norms of nitrogen fertilizers on the background of $P_{60}K_{60}$ contributed to an increase in the number of productive stems per unit area, and, accordingly, productive bushiness in general. When applying phosphorus and potassium fertilizers ($P_{60}K_{60}$), the number of productive stems did not exceed 585-591 pcs./m2, and the productive bushiness was 1.58-1.59, respectively. The use of N30P60K60 contributed to an increase in the number of productive stems to 690 pcs./m2 and productive bushiness to 1.83.

Table 3

Productive tillering of spring triticale variety Darkhliba depending on the predecessor and mineral fertilizers (average for 2019-2020)

Predecessor	Total number of plants, pcs./m²	Number of productive stems, pcs./m²	Productive bushiness
$P_{60}K_{60}$ Control			
sunflower	352	557	1,59
corn for grain	353	557	1,58
soybean	355	573	1,62
$N_{30}P_{60}K_{60}$			
sunflower	356	633	1,78
corn for grain	358	639	1,79
soybean	358	649	1,82
$N_{30}P_{60}K_{60}$ + N_{30} earing			
sunflower	356	636	1,79
corn for grain	358	640	1,79
soybean	358	657	1,84

source: formed on the basis of own research

The Darkhliba variety showed lower performance in terms of productive bushiness than the Boriviter and Lebid varieties. The total number of plants and the number of productive stems in 2019 was 374-378 pcs./m^2 and 552-674 pcs./m^2. In 2020, the total number of plants per unit area was 330-339 pcs./m2, and the number of productive stems did not exceed 558-639 pcs./m^2. Productive bushiness in 2019 was 1.49-1.79, respectively, in 2020 - 1.69-1.89. The latter indicates that the spring triticale variety Darkhliba, compared to the varieties Boriviter and Lebid, is characterized by lower indicators of the elements of the yield structure.

On average, over the two years of research, the total number of plants of the Darkhliba variety was 352-358 pcs./m2, which corresponds to the Boriviter variety, and was 12-19 pcs./m^2 less than the Lebid variety. The number of productive stems was 567-657 pcs./m^2, which is 45-71 pcs./m^2 more than in Boriviter and 1 8-40 pcs./m2 less than in Lebid (Table 3).

The use of nitrogen fertilizers $N_{30}P_{60}K_{60}$, compared to $P_{60}K_{60}$, slightly changed the indicators of productive stem, while the predecessors did not have a significant impact on their productivity.

The optimal dose of fertilizer for the variety Darkhliba was, as in other studied varieties, $N_{30}P_{60}K_{60}$. The total number of plants of the variety Darkhliba when

N60P60K60 was applied was 356-358 pcs./m² and productive stems - 633-649 pcs./m². The introduction of mineral fertilizers at the rate of $P_{60}K_{60}$ led to a partial decrease in these indicators of the elements of the crop structure, respectively, to 352-355 pcs./m² of the total number of plants and 557-573 pcs./m² of the number of productive stems.

Conclusion. Thus, the formation of the main elements of productivity and bushiness of winter triticale varieties depended on the influence of the use of individual elements of the technology of growing this crop, for example, as a variety, fertilizer and sowing method, rather than on other factors that are in some way interrelated with weather conditions during the years of research. It was noted that on average for two years of research, the total number of triticale plants of the Darkhliba variety was in the range of 352-358 pcs./m^2, for the Boriviter variety, and, accordingly, was 12-19 pcs./m2 less than that of the Lebed variety. The number of productive stems was 567-657 pcs./m^2, which is 45-71 pcs./m^2 more than in Boriviter and 1 8-40 pcs./m^2 less than in Lebid.

And when applying nitrogen fertilizers $N_{30}P_{60}K_{60}$, compared to $P_{60}K_{60}$, the indicators of productive stem slightly changed, while the predecessors did not have a significant impact on their productivity. Thus, to meet the needs of Ukraine with the required amount of triticale raw materials, it is necessary to expand the land area under this crop, as well as to apply the latest approaches in its production, in particular, to introduce zoned new varieties and intensive technologies for their cultivation.

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АНОТАЦІЯ
ФОРМУВАННЯ КУЩИСТОСТІ СОРТІВ ТРИТИКАЛЕ ЯРОГО ЗАЛЕЖНО ВІД ПОПЕРЕДНИКА ТА УДОБРЕННЯ

У статті висвітлено вплив попередників та рівнів мінерального удобрення на формування продуктивної кущистості тритикале ярого різних сортів. Залежно від впливу метеорологічних факторів та погодних, впливу досліджуваних елементів технології вирощування тритикале озимого, змінювалися показники рівня кущистості. Найвища продуктивна кущистість була сформована рослинами у варіантах, в яких для цього були створені кращі умови.

Тритикале є штучно виведеною сільськогосподарською культурою, не досить ще вивченою у світовому господарстві та потребує досліджень, проте в Україні це досить знана і відома сільськогосподарська культура, яка займає свою частку у загальні структурі культур. Скажімо, використання різних норм азотних добрив на фоні $P_{60}K_{60}$ сприяло збільшенню кількості продуктивних стебел на одиниці площі, а відповідно й продуктивної кущистості в цілому. При внесенні фосфорних та калійних добрив ($P_{60}K_{60}$) кількість продуктивних стебел не перевищувала 585-591 шт./м2, а продуктивна кущистість складала 1,58-1,59 відповідно.

Тритикале споживає з ґрунту для формування врожаю безліч поживних речовин, що вимагає додаткового внесення добрив. Органічні добрива не прийнято вносити цю культуру. тільки під її попередники. Залежно від родючості ґрунту вносять від 60 до 90 кг азоту, фосфору і калію. Під основний обробіток розкидають фосфорні та калійні добрива. А азотні розподіляють на три підгодівлі протягом фаз активного росту рослин. Також *фахівці радять під час посіву разом насінням вносити суперфосфат 10-15 кілограм на гектар.*

Тритикале дуже чутлива до термінів посіву, вони приблизно збігаються з серединою оптимального періоду посіву озимої пшениці. Для посіву необхідно відібрати насіння зі схожістю не менше 92% і чистотою не менше 98%. Добре позначається на врожаї протруювання складами розрахованими на озиму пшеницю. У більшості господарств культуру сіють за інтенсивною технологією в рядок з пропуском технологічних шляхів. Деякі господарства застосовують перехресний або вузькорядного метод посіву. Норма висіву зазвичай становить від 1,5 до 5,5 мільйона схожих зерен на гектар. Рекомендована глибина закладення 4-6 см, на важких ґрунтах її зменшують, а на легких збільшують на 1-2 см.

За рахунок підбору кращих попередників, а саме: сої, соняшника та кукурудзи на зерно ми створили оптимальні умови для формування продуктивності цієї культури. Крім того на формування кущистості тритикале ярого мали позитивний вплив мінеральні добрива.

Ключові слова: *сорт, тритикале яре, агроценоз, попередник, дози мінеральних добрив, кущистість.*

Табл. 3 Літ. 16.

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