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Management Of Nitrogen Fertilizing Of Winter Wheat In No-Till Technology.

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ABSTRACT

Based on a three-year study on the optimization of nitrogen fertilizing of winter wheat cultivated using no-till technology in dark-chestnut soils in the arid zone of the Stavropol Territory, it has been established that it is economically feasible to use a solution of urea-ammonia mixture in a dose of 87 kg of active ingredient N by the method of intra soil injection using Multiinjector and Duportliquilazer aggregates with the formation of the maximum crop productivity in the experiment at the level of 5.3-5.34 t / ha, and characterized by the highest relative economic efficiency of 73.5%. The use of nitrogen supplements increased the productivity and structure of the crop of winter wheat. The considered dose of nitrogen fertilizers in a dose of 87 kg / ha contributed to an increase in the protein content of grain by 1.7-3.5%, fulfillment of grain (nature) by 66-81 units, grain size or 1000 grain by 5.8-6.9 city, the amount of raw gluten by 2.9-7.6%, the grain obtained in the studied variants corresponded to the 1st quality group (44-77 GSM units). The formation of the highest crop productivity (5.3–5.34 t / ha) was promoted by the use of nitrogen fertilizers in early-spring top dressing using a urea-ammonia mixture by soil subsoil injection, which exceeded the values of the options with the surface application of nitrogen feeds in the form of ammonium nitrate and CAS solution on 0.8-0.18 t / ha. The best indicators of economic efficiency are characterized by the variant with the intrasoil use of a solution of a urea-ammonia mixture in a single dose of 87 kg of active substance / ha or 250 kg / ha in physical weight using Multiinjector unit, the level of profitability was 73.5%.

Keywords: early spring nitrogen fertilization, winter wheat, types of nitrogen fertilizers, application methods, winter wheat yield, no-till technology.

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INTRODUCTION

To solve the food problem in the first quarter of the XXI century, it is necessary to double the gross harvest; this can only be achieved on the basis of intensification of agriculture [1, 2]. To meet the needs of the Russian population in agricultural products and the expanded reproduction of soil fertility, it is required annually to contribute about 16.5 million tons of mineral fertilizers [3]. This requires the development and implementation of optimal (resource and energy-saving) zonal fertilizer systems in typical crop rotations, including in terms of no-till technology, which helps to stop the degradation and preserve soil fertility [4, 5]. In order to achieve optimal performance in increasing the yield and quality of agricultural crops, it is necessary to select the terms, methods and methods of fertilizer application [6, 7]. Methods and technologies of application should ensure the placement of fertilizers in the zone of development of the root system and their minimum fixation by the soil [8, 9, 10, 11, 12].

MATERIAL AND METHODS

The location of the field research - studies were conducted from 2015 to 2017. The field research site is located in the central part of the Stavropol Territory, characterized by arid climatic conditions. The soil cover of land use is mainly represented by southern chernozem, which is currently characterized by an average content of humus (3.4–3.9%), mobile phosphorus (18–21 mg / kg) and increased content of exchangeable potassium (319–350 mg / kg) The reaction of the soil solution in the upper soil horizons is alkaline, is within 7.6-8.0. The average long-term precipitation amount is 506 mm, the average annual air temperature is 10.7 °C.

The main objective of the research was to determine the responsiveness of winter wheat to the early spring nitrogen fertilization using various methods and forms of fertilizers under no-till technology conditions. Studies were conducted from 2015 to 2017.

The object of research is winter wheat cultivar Grom. The subject of research is the reaction of winter wheat plants to the use of various forms of nitrogen fertilizers in early-spring fertilizing.

Experience options

- Ammophos N₁₂P₅₂ - background (control);
- Background + Ammonium Nitrate Naa– 87 kg of active substance / ha (conventional technology) surface spreading with a spreader - AMAZONE ZF-M 1500;
- Background + CAS - 87 kg of active substance / hectare superficial application by AMAZONE UX 4200 Super sprayer;
- Background + CAS 87 kg of active substance / ha in-soil application - Multiinjector TUMAN-2;
- Background + CAS 87 kg of active substance / ha in-soil application – Duportliquilazer.

A complex nitrogen-phosphorus-concentrated fertilizer - ammophos (NH₄)₂HPO₄ at a dose of 100 kg / ha in physical weight was used as a seed fertilizer. In the early spring fertilizing, mineral nitrogen fertilizers were used: ammonium nitrate NH₄NO₃ and urea-ammonia mixture NH₄NO₃– (NH₂)₂CO – H₂O. Top dressing was carried out in the phase of renewal of the spring vegetation of winter wheat plants. Dose of fertilizer 87 kg active substance / ha, once.

The experiment studied the effect of applying the methods of carrying nitrogen fertilizers in the feed on the yield of winter wheat cultivated by the no-till technology in the arid zone.

RESULTS AND DISCUSSION

The weather conditions of 2014-2015 and 2015-2016 were unfavorable for the formation of the harvest. The uneven distribution of precipitation in the spring-summer period had an adverse effect on the formation of the winter wheat crop. For 2014–2015, 440 mm of precipitation fell, which was lower than the average annual indicators by 13%. The increased temperature was noted during the growing season of the culture, the average annual temperature exceeded the long-term indicators by 0.2 ° C. In 2015-2016, 449 mm of precipitation fell, the average annual temperature reached 10 °C.

The most favorable agrometeorological conditions for the formation of a winter wheat crop were formed in 2016–2017. The amount of precipitation during the growing season (511 mm) exceeded the norm by 18%, their distribution contributed to the optimal moisture supply of crops and the formation of the highest yield of winter wheat. The average annual air temperature corresponded to the average long-term values of 10.7 °C.

Used fertilizers and methods of their introduction in the experience had a positive impact on the productivity of winter wheat and the quality indicators of the culture. The use of ammonium nitrate NH_4NO_3 and a carbamide-ammonia mixture $\text{NH}_4\text{NO}_3 - (\text{NH}_2)_2\text{CO} - \text{H}_2\text{O}$ in the experiment contributed to an increase in crop yield relative to the control by 1.86-2.66 t / ha and contributed to the formation of fourth-grade grain. In the control variant, the yield of winter wheat was inferior to the fertilized variants from 40 to 49%.

As a result, on the control variant, the lowest yield was obtained in experiments: 2.68 t / ha with quality indicators corresponding to grain of the fifth class (Table 1).

The ammonium nitrate NH_4NO_3 and the urea-ammonia mixture $\text{NH}_4\text{NO}_3 - (\text{NH}_2)_2\text{CO} - \text{H}_2\text{O}$ used in the experiment as a feeding, regardless of how they were introduced, increased quality indicators: protein content, grain size and grain size of 1000 grains, quantity and quality of gluten. So the use of nitrogen in a dose of 87 kg / ha, introduced into the phase of renewal of the spring growing season of the culture, in various ways, increased the protein indicators by 1.7-3.5%, natures by 66-81 units, the weight of 1000 grains by 5.8 6.9 g., The amount of gluten was 2.9-7.6%, and the deformation index of gluten corresponded to 1 good group.

Considering the methods of applying nitrogen fertilizers to the fertilizer, it can be noted that the highest yield is formed on the variant using the urea-ammonia mixture $\text{NH}_4\text{NO}_3 - (\text{NH}_2)_2\text{CO} - \text{H}_2\text{O}$ at a dose of 87 kg of the active substance using the in-soil injection method using the Multi-Injector and Duportliquilazer 5.3-5-5 units , 34 t / ha.

Table 1: Effect of nitrogen fertilization on the productivity and grain quality of winter wheat

Name	Variant 1	Variant 2	Variant 3	Variant 4	Variant 5
Protein	9,1	10,8	11,0	11,2	12,6
Nature	749	824	825	815	830
1000 grains weight, g	35,9	41,7	42,8	41,8	41,9
The amount of gluten,%	15,2	18,1	18,3	18,9	23,8
GSM indicator	90,6	56	80	53,0	60,3
Group	2 satisfy weak	1 good	1 good	1 good	1 good
Class	5	4	4	4	4
Yield (t / ha)	2,68	4,54	5,16	5,34	5,30

When fertilizers are applied in the early term of top-dressing by the surface method, the liquid form of fertilizers — the urea-ammonia mixture $\text{NH}_4\text{NO}_3 - (\text{NH}_2)_2\text{CO} - \text{H}_2\text{O}$ at a dose of 87 kg of the active substance — 0.54 t / ha, and this the variant is inferior to the in-soil introduction of 0.16 t / ha.

From table No. 3 it can be seen that all nitrogen fertilizers studied in the experiment increased the main indicators of economic efficiency as compared with the control due to higher yield and quality of winter wheat grain. Fertilization reduced the cost of 1 ton of grain by 22-30 euros compared to the control, increased profits by 175-254 euros, the level of profitability - by 48.4-67.6%.

The maximum economic efficiency indicators among all the variants were obtained on the variant using the $\text{NH}_4\text{NO}_3 - (\text{NH}_2)_2\text{CO} - \text{H}_2\text{O}$ carbamide-ammonia mixture at a dose of 87 kg of the active substance using the Multi-injector using the in-soil injection method, which gave the greatest economic efficiency, the level of profitability was 73, five%.

Table 2: Estimation of the economic efficiency of the methods of applying nitrogen fertilizers in the feeding of winter wheat

Item of expenditure	Unit of measurement	Variant 1	Variant 2	Variant 3	Variant 4	Variant 5
Total cost per 1 ha:	euro / ha	266	352	365	368	367
Wages and taxes	euro / ha	46	77	88	91	90
Seeds	euro / ha	26	26	26	26	26
Plant Protection Products	euro / ha	21	21	21	21	21
Rent	euro / ha	57	57	57	57	57
% bank	euro / ha	28	28	28	28	28
Other	euro / ha	12	15	15	15	15
Mineral fertilizers total, incl.	euro / ha	36	86	89	89	89
when sowing	euro / ha	36	36	36	36	36
1 top dressing	euro / ha	-	50	53	53	53
Fuel	euro / ha	11	11	11	11	11
Depreciation	euro / ha	29	29	29	29	29
Yield	t / ha	2,68	4,54	5,16	5,34	5,30
Cost price	euro / t	99	77	71	69	69
Product price	euro / t	105	119	119	119	119
Revenue	euro / t	282	542	616	638	633
Profit	euro / t	16	191	252	270	266
Profitability	%	5,9	54,3	69,1	73,5	72,5

CONCLUSION

All options for the application of nitrogen fertilizers had a positive impact on the yield and structural indicators of winter wheat. The use of nitrogen in a dose of 87 kg / ha in the active substance, introduced by various methods, increased protein indices by 1.7–3.5%, natures by 66-81 units, and the mass of 1000 grains by 5.8–6.9 g. , the amount of gluten was 2.9-7.6%, and the strain index of gluten corresponded to 1 good group. The highest crop yield was obtained by the method of intrasurface injection using the Multi-Injector Tuman-2 and Duportliquilazer 5.3-5.34 t / ha, which exceeded the figures for applying nitrogen fertilizers using the AMAZONE ZF-M 1500 spreader and AMAZONE UX 4200 Super sprayer by 0 , 8-0.18 t / ha.

The maximum indicators of economic efficiency among all the options were obtained on the variant with the use of CAS at a dose of 87 kg of the active substance for nitrogen using Multiinjector, which gave the greatest economic efficiency - the level of profitability was 73.5%.

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