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Full Length Research Paper

Studies of the possibilities of using organic waste to increase soil productivity for grain crops in the conditions of Sheki-Zagatala zone of Azerbaijan

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The article discusses the problems of the use of waste as organic fertilizers help to increase soil fertility, improve the nutritional regime, and also helps maintain ecological balance. The introduction into the soil of various types and doses of organic and ratios of mineral fertilizers for crops (winter wheat, barley, barley, rye, hay, others) both individually and together contributes to the improvement of product quality, in particular, the structure of the crop and, accordingly, soil fertility, thereby reducing the intensity of the development of the erosion process characteristic in the republic. The use of organic and mineral fertilizers in various types and doses for crops has a rather positive effect on the formation of wheat grains and creates the possibility of obtaining high yields, which is proved by the results of the experiment laid down in 7 variants, in a 4-fold repetition, on plots with an area of each plot in the amount of 100m^2. Thus, in the course of the research, the effect of organic and mineral fertilizers on the quality of winter wheat grain was also studied, where the main quality indicator of the protein content in the grain in the application of mineral fertilizers in a dose of $N_{100}P_{50}K_{120}$ was 11.40%, in the version of 10t / ha of compost Zakatala + $N_{50}P_{25}K_{60}$-11.97%, the difference of which compared with the version without fertilizers was 2.28% and 2.85%, respectively, and the increase in grain yield was 10 ts/ha - (42.9%), and straw - 16.4 c / ha (or 41.8%).

Keywords: compost; organic and mineral fertilizer; winter wheat; soil fertility, soil erosion, yield increase

INTRODUCTION

Use of waste as organic fertilizers increase the fertility of soil, increase the improvement of a nutritious mode, and also promotes ecological equilibrium preservation. Entering into soil of various kinds and doses of organic and mineral fertilizers under a winter wheat separately and in common promotes improvement of quality of production, in particular crop structures. Use of organic and mineral fertilizers in various kinds and doses under a winter wheat positively influences formation of grain of wheat and creates possibility of reception of high crops. In Azerbaijan, 8 climatic types have been identified (from humid subtropical to mountain tundra). Of the 8 climatic types, the following are characteristic of the Sheki-Zagatala administrative district:

(a) Moderately warm steppe climate with dry summers.
(b) Moderately warm steppe climate with dry winters.
(c) Moderately warm climate with dry winters.

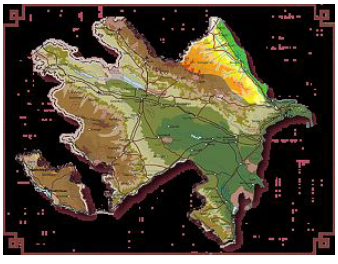

Figure 1. Geographical Map Republic of Azerbaijan

The first two types cover the southern part, the third type - the central and northern parts of the region. Air temperature depends on the height of the area above sea level. Between the lowest point and the watershed, the temperature difference in winter is -20, in summer + 30. A sharp change in temperature both during the day and during the seasons of the year enhances the destruction of the soil surface, and this weakens the development of vegetation, where soil erosion occurs during intense rainfall. In winter, when the air temperature drops below 0°C (especially in the high part of the region), the soil surface freezes in a short time. However, it should be noted that the average monthly soil temperature in the coldest months of winter is positive. On the territory of Sheki-Zakatalsky administrative district, 520 mm of precipitation falls annually, most of them fall in the spring and autumn months. The greatest soil erosion is observed in spring, when maximum precipitation falls. The rapid development of the erosion process in spring is associated with the intensity of precipitation, as they do not have time to be absorbed by the soil and create a surface runoff, exposing the soil to rapid erosion. There is little snow in winter, so soil erosion is also observed in the winter months. Due to the mild winter, there is no permanent snow cover; it is only observed during cooling of the air. The thickness of the snow cover is 8-14 cm, and lasts 15-60 days. The snow cover appears in late November or early December, in March, melting occurs.

Soil sloping plain area

Within the inclined plain (Alazano-Avtaran Valley), meadow-forest and their thin and long-irrigated varieties, meadow-bog, alluvial-meadow and other soils are widespread (Figure 2). **I**t is believed that in the formation of the aforementioned soils, the demolition and sedimentation of products of flushing and erosion from the mountainous part of the southern slope of the Greater Caucasus play an important role. In the indicated soil differences, parent rocks are alluvial deposits. In the zone of distribution of these soils are widely used under agricultural crops. So for example: tobacco, forestry, hazelnuts, chestnuts, dogwoods, orchards, cereals, etc. In these natural economic conditions, for the life and development of organisms, a certain set of conditions is necessary. Conducted of numerous scientific studies over many years, it has been shown that the organic waste common in the Republic and residues after their recycling can be used as fertilizers. At the same time, fertility increases, the amount of nutrients in soils increases and their agrophysical properties improve. Long-term studies have established that the Sheki-Zagatala zone of Azerbaijan contains 1.5 million tons of organic waste and residues that pollute the environment, which, after their processing, can be used as fertilizers. Such waste and residues include: various household waste, residues and tops of agricultural plants, litter and litter of walnut, hazelnut and chestnut plantings, sewage sludge from ponds and ponds, chicken droppings, various types of manure (Aliyev, 2018). These wastes can be processed by bioconversion and used as organic fertilizers, which primarily contribute to increasing soil fertility, serve as a source of abundant energy material for the development of soil microflora, contribute to an increase in the content of humus in the soil, improve the supply of plant roots with water, air and nutrients, activate microbiological processes, improve the structure of the soil, contribute to maintaining ecological balance (Aliyev, 2018, 2017).

METHODOLOGY

On the basis of the waste available in the Zagatala district, compost Zagatala is prepared, which contains 32-35% of organic matter, 1.3-1.6% of nitrogen and phosphorus, as well as 0.9-1.0% of potassium. Based on standardization indicators, this compost can be used for agricultural crops as a valuable organic fertilizer (Denisov et al., 2002).

To determine the sources of stocks of organic waste and residues, to study the effectiveness of the use of new organic fertilizers, to solve the food problem of the population through the production of environmentally friendly products, as well as to increase wheat yields in 2004-2008 at the Bunud farm of the Gabala region, on alluvial meadow In forest soils, field experiments were carried out on the use of manure, plant residues, compost "Zakatala" and mineral fertilizers for winter wheat of the Bezostaya-1 variety. The experiments were carried out in 7 variants, in a 4-fold repetition; the area of each plot was 100 m^2. Studies conducted in conditions of alluvial meadow-forest soils showed that the introduction of 10-20 tons of this compost into the soil creates favorable opportunities for the absorption of nutrients by plants.

The study was conducted in the Vandam farm of the Gabala region (within 3 years) field experience was laid in 7 variants in 4-fold repetition. The plot area was 100 m^2. A variety of winter wheat - "Bezostaya-1". The following fertilizers were introduced into the soil: manure in semi-overripe form from cattle (cattle), which contains 0.54% of total nitrogen, 0.28% of P_2O_5, 0.60% of K_2O, 21% of organic matter; compost "Zagatala" - 32-35% of organic matter, 1.3% nitrogen, 1.6% phosphorus and 1.0% potassium; plant residues - the litter of walnut, hazelnut, chestnut plantations, remains and tops of agricultural plants. Mineral fertilizers: ammonium nitrate-34% (N), simple superphosphate-18% P_2O_5, potassium sulfate-45% K_2O. Fertilizers were applied according to agricultural rules: organic (manure, compost, plant residues), phosphorus, potash - in the autumn-winter period, nitrogen - in the early spring before sowing.

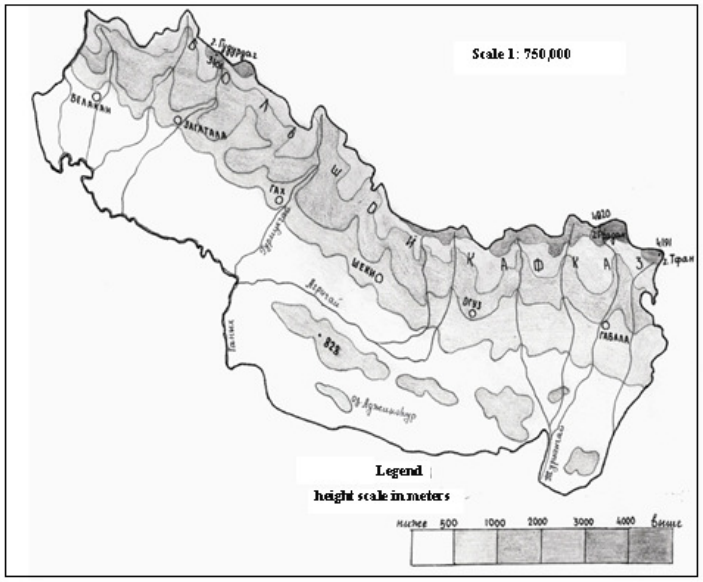

Figure 2. Soil-erosion map of Sheki-Zagatala administrative district.

RESULTS AND DISCUSSION

The results of the influence of various forms and doses of organic and mineral fertilizers individually and together on the structure of the winter wheat crop are given in the (Table 1). As can be seen from the data in the (Table 1), the introduction of organic and mineral fertilizers into the soil under winter wheat helps to improve the structural elements of the winter wheat crop.

The best result was obtained in the variant where manure of 10 t / ha and $N_{50}P_{25}K_{60}$ were introduced together, the height of the plants was 103 cm, which is 18 cm more than the control without fertilizers, the spike length on this option was 8.9 cm, t. e. 1.7 cm more compared to the control without fertilizers, the number of spikelets by 1.1 pcs more in comparison with the control without fertilizers, the number of grains by 2.1 pcs more than control without fertilizer, weight 1000 g. 5.8 grams of grains more compared to control without fertilizer. According to the results of studies, it was determined that the soil reaction is slightly alkaline (pH = 7.2-7.6). The content of total humus in the 0-100 cm layer (0-20; 20-40; 40-60; 60-80; 80-100cm) was 1.45-2.15%, and the total nitrogen was 0.04-0.15 %, total phosphorus-0.02-0.10%, and total potassium -0.39-1.63%. The content of easily digestible nutrients in the soil was: ammonia nitrogen (in a 0-100 cm layer) - 9.2-18.6 mg / kg, nitrate nitrogen-3.3-8.1 mg / kg, mobile phosphorus - 6.2-15 , 2 mg / kg, exchange potassium - 100.0-160.0 mg / kg. During the experiments, the influence of organic and mineral fertilizers used for winter wheat of the Bezostaya-1 variety on the dynamics of nutrients in the soil along the phases of plant development was studied.

According to the results of soil analyzes, in the phase of entering the tube, the amount of exchange ammonium in the 0-40 cm layer was 30.9-51.6 mg / kg according to the options. With the variant of applying fertilizers at a dose of $N_{50}P_{25}K_{60}$ + 10t / ha of compost “Zakatala”, the amount of ammonia nitrogen increased by 20.7 mg / kg compared to the control version and 12.9 mg / kg of nitrate nitrogen. According to the results of the analyzes, the content of mobile phosphorus in alluvial meadow forest soils in the 0-40 cm layer varied from 20.1 mg / kg to 36.4 mg / kg. In the phase of entry into the tube in the $N_{50}P_{25}K_{60}$ + 10t / ha version of the Compost “Zakatala” compost, the amount of mobile phosphorus increased by 16.3 mg / kg compared to the version without fertilizers. The content of exchange potassium was 390 mg / kg, which is 90 mg / kg more than the control variant. In the phase of complete ripening of plants, the amount of nutrients in the soil decreased to a minimum.

A decrease in the amount of nutrients in the soil at the end of the growing season is associated with their assimilation by winter wheat. In addition, the effect of different doses and types of organic and mineral fertilizers on the growth dynamics of winter wheat was studied. In the variant of 10 tons of manure and 10 tons of plant residues per 1 ha, the plant growth increased by 13 cm compared to the control and amounted to 95 cm. When using mineral fertilizers in the norm $N_{100}P_{50}K_{120}$, the plant growth was 98 cm, which gives a difference of 16 cm compared to the control In the variant of the combined use of organic and mineral fertilizers ($N_{50}P_{25}K_{60}$ + 10t / ha of compost “Zagatala”), the plant growth was 100 cm, the difference with the control version was 18 cm. When applying $N_{50}P_{25}K_{60}$ + 10 t / ha of compost

Table 1. The influence of various forms and doses of organic and mineral fertilizers in the conditions of alluvial meadow-forest soils of the Gabala region on the structure of the winter wheat crop for an average of 3 years.

Options	Plant height (sm)	Spike length (sm)	Number of spikelets per spike (pcs)	Number of grains per spike (pcs)	Weight 1000 grains (gr)	Productive tillering coefficient
Used control	85	7.2	13.8	23.0	38.2	1.7
Manure 20 t / ha	94	7.7	14.3	23.2	40.1	1.6
Compost "Zagatala" 20t / ha	99	8.2	14.7	24.9	42.0	1.7
Plant residues 20t / ha	93	8.1	14.4	23.6	39.4	1.6
Manure 10t / ha + rast. rest 10 t / ha	98	8.2	14.5	24.4	42.5	1.7
$N_{100}P_{50}K_{120}$ (equivalent to 20 tons of manure)	101	8.4	14.6	24.2	43.1	1.7
$N_{50}P_{25}K_{60}$ + manure 10 t / ha	103	8.9	14.9	25.1	44.0	1.7

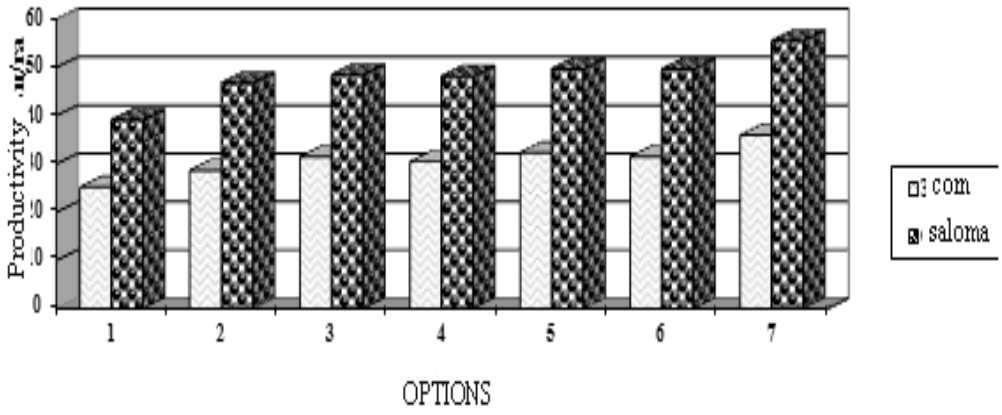

Figure 3. The effect of different types and doses of organic and mineral fertilizers on the grain and straw of winter wheat.
1. Control (without fertilizers)
2. Manure 20t / ha
(Equivalent to 20 tons of manure)
3. Compost "Zagatala" 20 t / ha
4. Plant residues 20t / ha
5. Manure 10t / ha + plant residues 10t / ha
6.N100P50K120
7. N50P25K60 + 10t / ha compost "Zagatala"

Zakatala for winter wheat, plant growth increased by 18 cm compared to the control, the spike length by 1.3 cm, the number of grains in the spike by 2.1 pieces, the weight of 1000 grains by 5.8 gr.

This shows that with the introduction of organic and mineral fertilizers, the formation of grains in the plant improves, plant growth and the number of spikelets increase. In addition, the effect of organic and mineral fertilizers together and separately on the harvest of winter wheat was studied (Figure 3). As can be seen from the graph, when applying 20 tons of manure for winter wheat, the grain yield (on average over 3 years) increased by 3.5 centner / ha (or 13.9%) compared with the control version. With the introduction of 20 tons of Zagatala compost, the increase amounted to 6.3 kg / ha (25.0%), and with the application of 20 tons of plant residues - 5.3 kg / ha (21.0%). In option $N_{100}P_{50}K_{120}$, the increase in grain yield over an average of 3 years amounted to 6.3 c / ha (25.0%). When applying N50P25K60 + 10t / ha of compost "Zakatala" for winter wheat, the increase in grain yield was 10c / ha - (42.9%), and that of straw - 16.4 c / ha (or 41.8%). In the course of research, the effect of organic and mineral fertilizers on the quality of grain of winter wheat was also studied. The main indicator of quality is the protein content in grain in the variant of application of mineral fertilizers in a dose of $N_{100}P_{50}K_{120}$, amounted to 11.40%, in the version of 10t / ha of compost Zakatala + N50P25K60-11.97%, the difference

of which compared with the variant without fertilizers was 2, 28% and 2.85%. Based on the research, it can be argued that the use of organic and mineral fertilizers for winter wheat improves the nutritional regime of soils and ensures a high and high-quality wheat crop.

Conclusion

To increase soil fertility and obtain a high and high-quality winter wheat crop on alluvial-meadow-forest soils of the Sheki-Zakatalsky zone, it is recommended to introduce 10 t / ha of Zakatala compost and mineral fertilizers in a dose of N50P25K60 every year. If in large areas the use of Zakatala compost for winter wheat is insufficient, then 10 t / ha of manure + 10 t / ha of plant residues is recommended.

Authors' declaration

We declared that this study is an original research by our research team and we agree to publish it in the journal.

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