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Influence of Introduction of Mineral Fertilizers Under Chestnut Soils on Accumulation of Common Nitrogen, Phosphorus and Potassium on Annual Age of Grape Culture

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Abstract

The article presents the results of studies on the effect of applying organic and mineral fertilizers on irrigated chestnut soils of the Ganja-Gazakh region on the accumulation of total nitrogen, phosphorus and potassium in the development phases of one-year grape crop shoots. It has been established that the application of various norms of mineral fertilizers against the background of manure on irrigated chestnut soils in the phases of the development of a culture of grapes significantly increases the content of total nitrogen, phosphorus and potassium in one-year shoots. Under the influence of mineral fertilizers, the content of total nitrogen, phosphorus and potassium in the shoots in the flowering phase in comparison with the control variant without fertilizer was respectively 0.16-0.50%, 0.08-0.25%, 0.18-1, 52%, in the phase of total fruit formation, respectively, 0.15-0.56%; 0.07-0.29%; 0.12-0.45%, and in the fully matured phase, respectively, 0.13-0.45%; 0.05-0.27% and 0.11-0.50%. The highest content of total nitrogen, phosphorus and potassium was observed in the variant of the background manure (10t/ha) + N90P120K90.

Keywords: Chestnut; Grapes; One-year shoots; Fertilizers; Development phases; Total nitrogen; Phosphorus and potassium

Introduction

It is known that nitrogen is considered the main element of plant nutrition. Therefore, nitrogen fertilizers are the main components of the farming system. However, with improper balancing of nutrients, disruption of the water regime, insufficient lighting and other unfavorable conditions, the introduction of nitrogen fertilizers in high doses can contribute to a decrease in soil fertility and cultivated products. Increasing the dose of nitrogen fertilizer can lead to an increase in the content of nitrates in the crop, as well as a decrease in the content of vitamin "C" and other substances, which in turn can lead to a decrease in the biological value of the product. In areas of intensive cultivation of vegetables, fruit crops and grapes, groundwater pollution by nitrates is observed. Therefore, in such areas, before applying fertilizers, soil liming should be carried out, which helps reduce the acidity of the soil and enhance the process of nitrate recovery. The accumulation of fertilizers has a significant impact on the accumulation of nitrates.

Phosphorus belongs to a number of important biogenic elements. Despite the fact that the demand of living organisms in phosphorus is about 10 times less than nitrogen, this element is not only a source of plant nutrition, but also plays a major role in the process of energy exchange and growth. To create favorable conditions for achieving complete production in the soil should be a sufficient amount of digestible phosphorus. In addition, toxic fluoride compounds are often found in phosphate fertilizers. A significant part of the phosphorus used as fertilizer remains in the soil and combines with the Ca, Al and Fe contained in it. Studies have confirmed the presence of radioactive elements in natural phosphates (uranium, radium).

The most widespread potash fertilizers include potassium chloride, potassium sulfate, natural raw materials of potassium (mainly sylvinite), etc. The potassium fertilizers contain ballast elements (Cl, Na). With the systematic introduction of high doses of potash fertilizers accumulated in the soil ballast elements reduce its fertility.

To prevent large losses of potassium and contamination of surface and ground waters with it, potash fertilizers should be applied for the main plowing. In order to reduce losses occurring by washing away the nutrients of mineral fertilizers, agrotechnical and chemical methods are used. In this case, it is of interest to use gradually operating fertilizers based on the chemical method. At the same time, nutrients are absorbed by plants throughout the

growing season gradually. This is achieved by using capsules with a synthetic coating (based on resin, paraffin, polyethylene, etc.) or even simpler - using sulfur.

Organic fertilizers are of particular importance in the fertilization system. However, the creation of highly productive soil at the expense of only organic fertilizers seems to be a difficult task. When used in the farm in a sufficient amount of organic fertilizers, the balance of humus in the soil can be positive. However, not using mineral fertilizers is not possible to ensure the balance of phosphorus and potassium in the soil. The effect of organic and mineral fertilizers on plants and soil is different. Plants use the nutrients of mineral fertilizers (especially nitrogen, partially potash fertilizers) immediately after their direct application and as much as possible, and the nutrient elements of organic fertilizers are used gradually by them in the process of their mineralization. Therefore, if necessary, mineral fertilizers should be applied to feed the plants. If mineral fertilizers generally improve the nutritional regime of the soil, organic substances along with it enrich the soil with humus, improve its physico-chemical properties, increase the activity of the soil microflora. The combined application of organic and mineral fertilizers in comparison with their separate application in the same amount by its positive effect gives an even more effective result. Only the joint introduction of a system of organic fertilizer and other agricultural and biological methods creates a reliable basis for improving soil fertility, crop yields and the quality of products, as well as minimizing the negative effects on the environment [1].

Strongly increasing the green mass of the plant, nitrogen has a positive effect on its growth, development and increase in the total mass. At the same time, nitrogen is part of the main nutrient - proteins, amino acids and many biologically active substances. With insufficient nitrogen supply, the plants grow poorly and do not grow well, the leaves become light green in color.

The main source of nitrogen for plants are salts of nitric acid. The end product of plant assimilable nitrogen is protein. Having a better effect on the formation of fruits and the development of plants, phosphorus in comparison with nitrogen relatively reduces its vegetation period. Phosphorus not only increases the yield, but also increases the sugar content in the sugary, oil in oilseeds, fiber yield in fibrous cultures improves the quality of the crop.

Potassium also affects the chemical composition of plants. Potassium fertilizer application increases the sucrose, oil and starch content of plants. The lack of nitrogen, phosphorus and potassium in the soil has become a major limiting factor in the development of agriculture as a whole over the past decades. Under conditions of inadequate supply of plants with nutrients, even with the use of seeds of plant varieties with the best performance and with timely agrotechnical measures, it is impossible to achieve high and high-quality yield [2].

According to the results of research by many scientists in order to achieve high yields of agricultural crops and preserve soil fertility, the introduction of nitrogen, phosphorus and potash fertilizers is a mandatory requirement [3,4]. Studies of a number of Russian scientists have established that by participating in biochemical processes occurring at different intensities and directions during the period of plant development, nutrients have a profound effect on their bodies. At different periods of plant development, their need for different nutrients is distinctive. In this regard, the effect of fertilizers on crop formation depends on the timing of their introduction.

For proper and rational fertilization, it is important to know the need of different crops for nutrients in different periods of their development. Timely fertilization changes the course of plant development, has a profound effect on its yield and product quality. Depending on the period of plant development, their absorption of nutrients is also different [5].

In conducted in some years, FG Akhundovym [6], AP Aliyeva [7] and FG Alizadeh [8] studies in various regions of Azerbaijan studied the effect of organic and mineral fertilizers on the accumulation of nutrients in various organs of grape culture. According to the authors, organic and mineral fertilizers significantly increase the content of nutrients in the green organs of the vine [6-8].

In the studies conducted by MI Mamedov [9], the effect of mineral fertilizers on the accumulation and removal of nutrients in berries, shoots and leaves of Madras grapes has been studied. It was found that, according to the variants, the content of total nitrogen in the dry mass varies within 0.68-1.06%, phosphorus 0.32-0.46%, and potassium 1.524-2.048% [9].

To determine the nutrient needs of a grape culture in irrigated chestnut soils, we studied the effect of mineral fertilizers on the accumulation of nitrogen, phosphorus, and potassium on vine shoots. Research work was carried out in 2015-2017. on the Tabrizi variety cultivated on irrigated chestnut soils in the Amin production company located in the village of Karari of the Samukh region, part of the Ganja-Kazakh region of Azerbaijan.

The experiments were laid down according to the following scheme:

a. Control (without fertilizers).

b. Manure 10t/ha (background).

c. Background + N60 + P150 + K60.

d. Background + N90 + P120 + K90.

e. Background + N120 + P150 + K120.

The repetition of experience options 4-fold.

On the experimental plot, the area of each 4-row (one extreme protective, three internal accounting) is 240m2 (20m x 12m), the accounting area is 180m2 (20m x 9m), in each plot 39 bushes were counted. The scheme of planting bushes 3.0 x 1.5m, the age of the vineyard is 7 years. Grape bushes are raised to the wire, attached to the vertical reinforced concrete pillars, the location of the bushes is multiple, fan-shaped.

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Nitrogen-ammonium nitrate (34.7%), phosphorus-simple superphosphate (18.7%) and potassium-potassium sulfate (46.0%) were used on the experimental plot of mineral fertilizers, and rotted manure (0.5%) in the form of organic fertilizer. -a nitrogen, 0.25% phosphorus, 0.6% -a potassium). Manure, phosphate and potash fertilizers were applied in full norm in the autumn-winter period before inter-row processing for plowing, 50% of nitrogen was introduced during the formation of buds, and the remaining 50% in the form of top-dressing at the beginning of the budding-flowering stage in inter-row stripes. The agrotechnical measures adopted for the Ganja of the Kazakh region were held at the pilot site.

To study the agrochemical characteristics of the soil of the experimental plot before applying fertilizer from 5 points of the plot from 0-30; 30-60; 60-100cm-s layers were taken soil samples in the form of an envelope. Soil samples in layers were respectively mixed, dried, crushed in a porcelain dish and passed through a 1mm sieve under laboratory conditions and analyzed. During the years of research, soil samples were used to determine the amount of mobile nutrients in the phases of mass flowering, fruit formation and full ripening of the clusters) in all variants of the experiment, soil samples were taken from 0-30 and 30-60cm-2 layers for analysis on 25 bushes during the growing season held phenological observations.

In the soil samples taken, the following parameters were determined

pH - potentiometer, total humus according to IV Tyurin, absorbed ammonia according to DP Konev, water-soluble ammonia on the calorimeter using Nesler's reagent, nitrate nitrogen along Grandval-Lyazhu, total nitrogen, total phosphorus according to K Ye Ginzburg and GM Shcheglovoy, mobile phosphorus by the B.P. Machigin method, water-soluble phosphorus according to Deniz, total potassium by the Smith method, water-soluble potassium according to Aleksandrov, exchangeable potassium by the P.B.

Plant samples were determined

absolute dry mass in a thermostat at 105 ˚C, total nitrogen, phosphorus, and potassium according to KE Ginzburg, GM Scheglova and EV Wolfe. To determine the amount of nutrients in the experimental plot, before setting up the experiments with the soil samples taken, potential reserves of nutrients, total humus, nitrogen, phosphorus and potassium contents, as well as effective fertility, easily digestible by plants, were determined. Analyzes of soil samples showed that the irrigated chestnut soils of the experimental plot are poorly provided with digestible forms of nitrogen, phosphorus and potassium. In an aqueous solution of the soil layer of 0-30cm, the pH is 7.6, and lower in the layer of 60-100cm, the pH is 8.0. Indicators of total humus, nitrogen, phosphorus and potassium in the 0-30cm layer were respectively 2.08; 0.13; 0.14; 2.35%. However, going down to the lower layers, these indicators gradually decrease, and in the layer of 60-100cm, they are respectively 0.83; 0.06; 0.07; 1.45%. the amount of absorbed ammonia nitrogen ranges from 16.5 to 7.3; nitrate nitrogen 10.3-3.1; mobile phosphorus 17.8-8.5 and exchangeable potassium 270.5-115.3mg/kg.

The results of our research are shown in the table below. Samples of one-year shoots of the culture were taken from the experimental site together with the leaves in the phases of mass flowering, fruit formation and full ripening, then the collected material was dried in an open place, washed and analyzed.

Table 1: The effect of fertilizers on the accumulation of total nitrogen, phosphorus and potassium on the shoots of vine (% in dry matter).

No	Experience Options	Bloom			Fruit Formation			Full Maturity		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
2015										
1	Control (Without Fertilizer)	2,5	0,55	2,07	1,78	0,51	1,48	1,15	0,38	1,27
2	Manure 10t/ha (Background)	2,41	0,63	2,25	1,93	0,58	1,60	1,28	0,43	1,38
3	Background + $N_{60}P_{90}K_{60}$	2,53	0,71	2,33	2,15	0,67	1,73	1,37	0,49	1,49
4	Background + $N_{90}P_{120}K_{90}$	2,68	0,80	2,45	2,28	0,76	1,85	1,54	0,61	1,61
5	Background + $N_{120}P_{150}K_{120}$	2,61	0,75	2,38	2,21	0,71	1,78	1,48	0,55	1,57
2016										
1	Control (Without Fertilizer)	2,21	0,51	2,01	1,75	0,49	1,43	1,12	0,36	1,21
2	Manure 10t/ha (Background)	2,45	0,65	2,31	1,96	0,60	1,65	1,31	0,45	1,45
3	Background + $N_{60}P_{90}K_{60}$	2,56	0,73	2,38	2,18	0,69	1,78	1,40	0,51	1,58
4	Background + $N_{90}P_{120}K_{90}$	2,71	0,83	2,53	2,31	0,78	1,88	1,57	0,63	1,71
5	Background+ $N_{120}P_{150}K_{120}$	2,65	0,78	2,45	2,23	0,73	1,83	1,51	0,58	1,63

As can be seen from the table, the maximum number of nutrients was observed in the phase of mass flowering, and the minimum in the phase of full maturity. The minimum amount of total NPK was noted in the control (without fertilizers) variant in the mass flowering phase, where the indicator of total nitrogen was 2.21-2.25%, total phosphorus 0.51-0.55% and total potassium 2.01-2, 07% -a, in the phase of mass fruit formation, these figures were respectively 1.75-1.78%; 0.49-0.51%; 1.43-1.48%, and in the phase of full maturity, respectively, 1.12-1.15%; 0.36-0.38% and 1.21-1.27% (Table 1).

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In comparison with the control variant (without fertilizers), the studied parameters in the manure variant 10t/ha (background) were significantly high. Thus, in the mass flowering phase in the manure variant 10t/ha (background), the total nitrogen content was 2.41-2.45%, and in the fruit formation phase, respectively, 1.93-1.96%; 0.60-0.58%; 1.60-1.65%, and in the phase of full maturation 1.28-1.31%; 0.43-0.45% and 1.38-1.45%.

The introduction of mineral fertilizers for the cultivation of grapes against the background of manure in each of the three phases of development significantly increases the accumulation of nutrients in one-year shoots. So, in the phase of mass flowering in the variant background + N60P90K60, the content of total nitrogen in one-year shoots was 2.53-2.56%, total phosphorus 0.71-0.73%, and total potassium 2.33-2, 38% -a, in the phase of full ripening, respectively, 1.37-1.40%; 0.49-0.51% and 1.49-1.58%, and the highest amount of nutrients is noted in the variant background + N90P120K90, where in the mass flowering phase the total nitrogen content was 2.68-2.71% -a, total phosphorus 0.80-0.83% -a and total potassium 2.45-2.53%, in the phase of full ripening, these figures were respectively 1.54-1.57%; 0.61-0.63% and 1.61-1.71%.

Thus, we can conclude that the introduction of mineral fertilizers against the background of manure in irrigated chestnut soils significantly increases the content of total nitrogen of phosphorus and potassium in the development phases of one-year shoots of vine. In comparison with the indicators of the control variant, under the influence of fertilizers on single-year shoots in the flowering phase, a significant increase in total nitrogen was 0.16-0.50%, phosphorus was 0.08-0.25%, potassium was 0.18-1.52% in the phase of fruit formation, respectively, 0.15-0.56%; 0.07-0.29%; 0.12-0.45% and in the phase of full ripening, respectively, 0.13-0.45%; 0.05-0.27% and 0.11-0.50%. There is a correlative relationship between the amounts of total nitrogen, phosphorus and potassium in the composition of a one-year shoot, and this relationship regularly changes over the years in the following order: between yield (c/ha) and total NPK (%) contained in the shoots in the fully matured phase equal to r = + 0.916 ± 0.072 and r = + 0.962 ± 0.031.

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