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EFFECT OF MINERAL NUTRITION ON OVERALL LEAF AREA AND YIELD OF STEVIA (STEVIA REBAUDIANA BERTONI)

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Abstract: Maintaining and improving product quality in the cultivation of agricultural crops is one of the most pressing tasks. Due to this, the study of product quality is required in all scientific works. The quality of the product in the stevia crop depends primarily on the chemical composition of the plant, the presence of minerals and vitamins in the plant and their amount. In the experiment, the leaf yield of the stevia crop was 18.6 c / ha in the control variant without the use of mine ral fertilizers. The highest rate of stevia leaf yield was recorded in the variant where 175 kg / ha of phosphorus fertilizers were applied at a high rate of 32.5 c / ha, with an additional yield of 13.9 c / ha due to mineral fertilizers.

***Keywords*:** Stevia, Medicinal Plant, Chemical Composition, Mineral Fertilizers, Calcium, Nitrogen, Phosphorus, Potassium, Iron, Physiological Process, Yield.

Introduction

Maintaining and improving product quality in the cultivation of agricultural crops is one of the most pressing tasks. Due to this, the study of product quality is required in all scientific works. The stevia plant is grown for its leaves, so it is advisable to study the leaf quality of stevia in practice, as well as the factors that affect leaf quality. The quality of the product in the stevia crop depends primarily on the chemical composition of the plant, the presence of minerals and vitamins in the plant and their amount. Scientific research on the product quality, yield and cultivation technology of the stevia plant has been studied mainly in foreign countries in the research work of scientists such as P.J.Larkin, T.A.Thorpe, J.K.Yasil, M.J.Aparajta. However, this research has been conducted in Europe and Russia, Ukraine, Germany, Poland, Sweden, North America in the USA and Canada, and in East Asia in countries such as Japan, China and Korea, Australia and New Zealand. Especially in countries such as Japan, China, Korea, there is a growing interest in the stevia plant. In Japan, stevia cultivation has risen to the level of national value. In Uzbekistan, too, in recent years, interest in the stevia plant is growing. In this regard I.Belolipov, T.M.Duseynov, T.K.Duseynov, J.Tursinov. It has been studied in the scientific works of such a scientist as Baykabilov. The scientific work mainly studied the morphology, systematics and biological properties of the plant. However, the technology of growing stevia in the conditions of our country is not sufficiently studied, there is insufficient scientific data in this regard. Maintaining and improving product quality in the cultivation of agricultural crops is one of the most pressing tasks. Due to this, the study of product quality is required in all scientific works. The stevia plant is grown for its leaves, so it is advisable to study the leaf quality of stevia in practice, as well as the factors that affect leaf quality. The quality of the product in the stevia crop depends primarily on the chemical composition of the plant, the presence of minerals and vitamins in the plant

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Results

According to the results of many years of scientific research, the total leaf area in the field should be at least 30-35 thousand m^2/ ha for sustainable high yields from crops. Academic A.A.Nichiporovich, along with studying the importance of the leaf in plant life, developed the most acceptable and convenient method of determining the leaf surface. Today, in many scientific studies, the "visechka" method, developed by a scientist, is widely used to determine the leaf surface. The photosynthetic activity of the cultivar depends primarily on the formation of a sufficient leaf surface in the field. According to the results of many years of scientific research, the total leaf area in the field should be at least 30-35 thousand m^2/ ha for sustainable high yields from crops. Data on the positive effect of mineral fertilizers on the formation of the overall leaf area o f stevia in the experiment are given in Table 1.

Table 1 Effect of the norm of mineral fertilizers on common leaf area of stevia, thousand m^2/ ha

№	Options	Total leaf area, thausand m^2/ha			Average 3 years thousand m^2/ha
		2017	2018	2019	
1	Control	20.5	20.2	19.5	20.1
2	N_{50} P_{175} K_{50}	34.1	31.9	31.3	32.4
3	N_{50} P_{150} K_{50}	31.9	30.8	30.8	30.1
4	N_{50} K_{50}	27.5	25.3	26.4	26.4

In the first 2017 experiment, in the control variant without the use of mineral fertilizers, the total leaf area of the stevia plant was 20.5 thousand m^2/ha. In the fourth variant, where nitrogen and potassium were given and phosphorus was not given, this figure was 27.5 thousand m^2/ ha.

In the third variant, given the norm of 150 kg / ha of phosphorus, the total leaf area of the stevia plant was 31.9 thousand m^2/ ha. In the second variant, where phosphorus was applied at a rate of 175 kg / ha, the total leaf area of the plant was 34.1 thousand m^2/ ha.

It was observed that the difference in the control option due to the application of phosphorus fertilizers was 7.0-13.6 thousand m^2/ha. In the second year of the experiment, i.e. in 2018, the predominance of stevia on the leaf su rface

was noted in the variants using mineral fertilizers. In all variants using mineral fertilizers, it was found that the total leaf surface area of stevia was higher than that of the control variant.

In the control variant without mineral fertilizers, t he total leaf area of stevia was 20.2 thousand m^2/ ha, in the case of application of phosphorus fertilizers at the rate of 175 kg / ha, at the rate of 31.9 thousand m^2/ ha, in the case of phosphorus fertilizers at the rate of 50 kg / ha, 30.8 thousand m^2/ha, no

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phosphorus fertilizers, only when nitrogen and potassium fertilizers were applied at the rate of 50 kg / ha, 25.3 thousand m^2/ha were observed.

In the experiment, it was noted that the total leaf area of stevia increased by 6.3 -12.3 thousand m^2 / ha due to mineral fertilizers. In particular, it was found that phosphorus nutrition has a positive effect on the formation of the overall leaf surface of the stevia plant.

In irrigated gray soils, it is advisable to apply mineral fertilizers in the amou nt of $N_{50}P_{150}K_{50}$ kg / ha during the season to form a sufficient total leaf layer, which ensures the optimal course of physiological processes in the stevia plant.

This means that in irrigated gray soils, the stevia plant has a high need for mineral nutrients, including phosphorus fertilizers, throughout the growing season. The above data indicate that the level of phosphorus supply in irrigated gray soils is low.

Stevia plant is grown for its leaves. The leaves of the stevia plant contain the substance stivioside, which has a very high level of sweetness, and many valuable minerals.

The sweetness level of stivioside was found to be 200 times higher than that of succharose. Due to this, in recent years in most countries the attention to the crop of stivioside is growing.

There is also a growing interest in the stevia crop in our country, and a number of scientific studies have been conducted in this regard.

However, scientific research on stevia cultivation under irrigated conditions is insufficient and no clear recommendations have been made.

Due to this, the effect of mineral nutrition of stevia plant on leaf yield in irrigated gray soil conditions was studied in the experiment. Data on the effect of mineral nutrition on the mass of a single plant in the stevia plant are given in Table 2.

The table below shows that the productivity of a mineral-fed stevia crop depends on the level of adequate supply of mineral nutrients to the plant during the season.

In the experiment, it was observed that in the variants where all mineral fertilizers were applied, the productivity of stevia was higher than in the control variant without mineral fertilizers.

The biological mass of one plant was 90.3-133.5 grams according to the options. The lowest value was recorded in the 90.3 g/plant control variant, and the highest value was recorded in the variant used at the high 175 kg / ha norms of 133.5 g / plant phosphorus fertilizers.

Table 2 Effect of the norm of mineral fertilizers on mass of per plant

№	Control	Average mass of per plant	Dry mass, gr/plant	
			overall	leaf
1	Control	90.3	32.3	8.1
2	N_{50} P_{175} K_{50}	133.5	43.8	11.2
3	N_{50} P_{150} K_{50}	121.3	38.0	10.1
4	N_{50} K_{50}	108.5	35.2	9.3

In the experiment, no phosphorus fertilizers were used, only nitrogen and potassium fertilizers were used, the mass of one plant was 108.5 g / plant, the difference compared to the control option was 18.2 g / plant. In the experiment, an increase in the mass of one plant by 18.2 -43.2 grams was observed due to mineral nutrition. In practice, the study of the biological mass of a plant, as well as the mass of a plant, is of great scientific and practical importance. In this regard, the positive effect of agro -

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technical measures, including mineral nutrition, on the formation of dry mass of stevia was studied in the experiment.

In the experiment, the dry biological mass of one plant in stevia was 32.3 -43.8 grams according to the options. The lowest value by dry mass was observed in the control variant without the use of 32.3 g / plant mineral fertilizers. The highest value was observed under the conditions of application of 43.8 g / kg of plant mineral fertilizers N_{50} P_{175} K_{50} kg / ha.

Dry leaf mass on options consisted of 8.1-11.2 g / plant. The lowest value was recorded in the 8.1 g / plant control option, only 9.3 g / plant under conditions where nitrogen and potassium fertilizers were used in the $N_{50}K_{50}$ norm. Under the conditions of application of mineral fertilizers $N_{50}P_{150}K_{50}$ norm, the dry leaf mass was 10.1 g / plant. A relatively high rate of dry leaf mass was observed under the conditions of normal application of 11.2 g / plant mineral fertilizers $N_{50}P_{175}$ K_{50} kg/ha.

Therefore, in order to increase the productivity of the stevia plant under irrigated conditions, it is recommended to fully meet the plant‘s need for mineral nutrients, including phosphorus fertilizers, during the season. Experiments have shown that incomplete satisfaction of the plant's need for phosphorus nutrients has a negative effect on the level of stevia accumulation.

Yield is one of the most important indicators in the cultivation of agricultural crops. Productivity is the expected result, the final product. In any scientific work, the main focus is on improving product quality and increasing productivity.

The main consumable product in the stevia crop is the leaf of this plant, i.e. stivioside, a substance that replaces succharose from the stevia leaf. Stevioside is distinguished from succharose by its high sweetness level, low calorie content and easy digestion.

Due to the low potency of stevioside, the human body is not adversely affected. It is recommended to consume stivioside products, especially for patients with sugary diabetes. Because despite of the very high level of sweetness of stevia, it does not pose a risk to people with diabetes. However, because the sweetness equivalent is so high, many foreign countries are gradually switching to stivia cultivation.

Stevia products are widely consumed, especially in Southeast Asian countries. In countrie s such as China, Japan, South Korea, and Vietnam, more than 50% of sugar consumption is found in stevia products.

In recent years, in most developed countries in all regions of the world, there is a growing interest in this crop and the need for its products.

However, in our country there is not enough experience in the cultivation of stevia, the laws of formation of the general leaf layer in this crop, the course of the process of photosynthesis are not sufficiently studied.

In the experiment, the positive effect of mineral nutrition on the leaf yield of stevia plant in irrigated gray soil conditions was studied. The results of the experiments obtained are presented in Table 3.

Table 3 Effect of mineral nutrition on stevia leaf yield

№	Options	Leaf yield		Additional yield, c/ha
		kg/m^2	c/ha	
1	Control	0.17	17.0	-
2	N50 P175 K50	0.32	32.0	15.0
3	N50 P150 K50	0.28	28.1	11.1
4	N50 K50	0.26	26.3	9.3

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In the experiment, mineral nutrition showed a positive effect of stevia plant on leaf yield. In all variants using mineral fertilizers, stevia leaf yields were found to be higher than in the control variant without mineral fertilizers.

In the experiment, the leaf yield of the stevia crop was 17.0 c / ha in the control variant without the use of mineral fertilizers. The highest rate of stevia leaf yield was recorded in the variant where 175 kg / ha of phosphorus fertilizers were applied at a high rate of 32.0 c / ha, with an additional yield of 15.0 c / ha due to mineral fertilizers.

When phosphorus fertilizers were applied at the rate of 150 kg / ha, the yield of stevia was 28.1 c / ha, and 11.1 c / ha was grown due to mineral nutrition. Phosphorus fertilizers were not used, only small amounts of nitrogen and potassium fertilizers were used, the yield of stevia was 26.3 c / ha, and only 9.3 c / ha of additional crops were grown due to mineral fertilizers.

The most important indicator in the cultivation of agricultural crops is productivity, and the reliability of the data obtained on yield depends on the correct performance of the experiment. The reliability of the data will be at such a high level that productivity data will be detected across all iterations.

In the experiment, the effect of mineral nutrition on the yield of stevia was studied in the calculated areas of experiment field in all variants and repetitions according to the standard requirements. Plant productivity records were kept in accordance with the adopted methodology. 2017 year data on the positive effect of mineral nutrition on the overall leaf yield of Stevia plant on the repetitions in the experiment are given in Table 4.

Table 4 Stevia yields by repetitions

№	Options	Yield by repetitions, c / ha				Average yield, c / ha
		I	II	III	IV	
1	Control	18.1	19.0	17.8	19.5	18.6
2	N_{50} $P_{175}K_{50}$	32.1	33.0	31.8	33.1	32.5
3	N_{50} $P_{150}K_{50}$	28.7	29.0	27.5	29.6	28.7
4	N_{50} K_{50}	26.0	27.0	27.3	25.7	26.5

NSR_{05}= 1.13 c / ha

Sx= 4.25 %

Experimental results showed that mineral nutrition had a significant effect on stevia productivity. In all repetitions, the lowest yields were recorded in the control variant without the use of mineral fertilizers.

In the control variant, Stevia's yield on repetitions was 17.8 from 19.5 c / ha. The difference in recurrences of stevia on leaf yield was 0.3–1.7 c / ha. In the control variant, the average leaf yield of stevia was 18.6 c / ha. In all studied variants, stevia yields were higher than in the control variant.

Of the mineral fertilizers used only nitrogen and potassium fertilizers, in the absence of phosphorus fertilizers, the average yield of stevia was 26.5 c / ha, the difference compared to the control option was 7.9 c / ha. Under the conditions of normal application of mineral fertilizers $N_{50}P_{150}$ K_{50} , the yield of stevia was 28.7 c / ha.

In the experiment, relatively high yields of stevia were observed in the second variant of mineral fertilizers $N_{50}P_{175}K_{50}$ norm applied to 31.8-33.1 c / ha. In this variant, the average yield of stevia was 31.0 c / ha.Under conditions of normal application of mineral fertilizers $N_{50}P_{150}K_{50}$, the leaf yield of stevia was 28.6-31.5 c / ha, the average yield was 32.5 c / ha. stevia plant needs phosphorus fertilizers throughout the growing season.

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The results of the experiments showed that the yield of stevia depends on the adequate supply of phosphorus fertilizers to the plant during the growing season.

Therefore, it is recommended to use mineral fertilizers, including phosphorus fertilizers, at a relatively high $N_{50}P_{175}K_{50}$ rate to grow high leaf yields from the stevia plant under irrigated conditions.

Conclusion

1. Soil moisture is a necessary condition for seed germination in the conditions of introduction.

   This feature is related to the origin of the species, i.e. high air humidity (75-80%) and air temperature (25-35 C).

2. It was found that the germination of plant seeds at high temperatures (28°C) under laboratory conditions and in moist sand under the film is 24-8%.

3. In introduction condit ions, soil moisture is a necessary factor for plant growth from seed. In the natural habitat, the influence of air temperature and humidity is also important in the origin of the species.

4. The short day tropical S.rebaudiana introduced in Namangan region has fully passed all stages of ontogeny. Air temperature affects the onset times of vegetation. The onset of budding and flowering depends on the reduction of daylight.

5. S.rebaudiana plant can produce leaf biomass from 3.5-4 tons per hectare, which is a source of high quality raw materials for various sectors of the economy.

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