Effect of Stimulators and Biofertilizer on Dry Matter Accumulation and Productivity of Sweet Plants

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Abstract. The harvest from agricultural crops is formed in the leaves of plants due to the process of photosynthesis, all the technological activities that affect the development of leaves in the cultivation of crops are studied, the accumulation of dry matter in the smooth licorice plant is analyzed. In this experiment, the effects of various stimulants and biofertilizers on the development of smooth licorice were studied and analyzed.
Key words: Glycyrrhiz glabra L, Geohumate, Aminomax Stimulant and Caliphos, Green Leaf, Combing, Flowering, Podulation, Leaf Level

1 Introduction

Today, medicinal sweet licorice plants are planted on 43,181 million hectares of land worldwide, and the biological raw material reserve is 128,109 million tons. The product obtained from this plant is widely used in medicine [1], food [2], cosmetics, light industry and agriculture. Due to the high demand for smooth sweet raw materials in the world market, its natural growing areas have decreased. In particular, 2,200 in Azerbaijan (3.6 of the total area), 902 in Kyrgyzstan (1.4), 27,315 in Kazakhstan (62.6), 1,763 in Russia (2.9), 10,776 in Turkmenistan (17, 7%), 142 ha (0.24%) in Tajikistan, 2180 ha (3.59%) in Mongolia, 37.4 ha in Uzbekistan, 6370.1 ha in Karakalpakstan, or 3.83% of the total area [4,5,6].

The efficiency of the accumulation of dry matter and the productivity of sugar plants are influenced by a large number of different factors, among which the main ones can be distinguished: the rapid development of digital technologies, the formation of a stable legal system and other socio-economic and technological factors[7,8].

2 Materials and methods

In the conditions of the saline soils of the Republic of Karakalpakstan, it consists in the development of sowing of seeds of the Glycyrrhiz glabra L crop using geohumus, aminomax stimulants and califos biofertilizer.

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3 Results and discussion

Determining the effect of geohumate, aminomax stimulants and califos biofertilizer on the germination of smooth licorice (Glycyrrhiza glabra L) seeds;

to increase the germination of smooth sweet potato using a seed stimulator, to determine the effect on root and hay productivity;

determination of its economic efficiency as a result of the use of stimulants in the cultivation of sweet licorice seeds.

As the object of the study, medium-salt meadow-alluvial soil of the northern region of the Republic of Karakalpakstan, geohumat, aminomax stimulants and kalifos biofertilizer, and wild sweet licorice plant were taken[9,10].

The subject of the study is the germination of smooth sweet in field conditions and the effect of stimulants on it, the growth and development of the plant, photosynthetic activity, and the accumulation of root and above-ground vegetative mass of the plant.

Research methods. Laboratory and field studies were carried out according to approved methods. Conducting research, biometric measurements and their analysis "Methods of conducting field experiments" (UzPITI, Tashkent, 2007); Microsoft Word and Excel computer programs were used based on the methods.

Results of the research: The field experiment was conducted in the "Khalqabat" farm of the Kegayli district of the Republic of Karakalpakstan[11].

The suspension of stimulators and biofertilizer had a positive effect on the accumulation of dry matter in the plant when it was sprayed when the leaf appeared in the first year of flowering and the plant reached a height of 50-60 cm.

In the conditions of 2018, when the suspension was sprayed with various stimulants and biofertilizers in the specified periods of sweet potato, in the observations carried out on September 1, the weight of the sweet potato stalk in the control variant (sprinkled with water) was 38.5 g, the leaf was 15.4 g, and the root was 14.1 g. When spraying the suspension prepared on the basis of geohumate, the above indicators were proportionally 45.5: 33.0: 21.5 g.

When the suspension prepared on the basis of Aminomax was sprayed, the dry mass of the stem was 42.3 g, the leaf was 31.3 g, and the root was 20.3 g. When using a suspension prepared on the basis of Kaliphos, the weight of the stem was 40.9 g, the leaf was 30.9 g, and the root was 20.0 g.

During the first year of the life of the smooth licorice plant, the total amount of dry matter accumulated in one bush is 68 g in the control version; 100.0 g in the version using geohumate biostimulator; 93.9 g of dry matter was accumulated in one plant under the effect of aminomax stimulator and 91.8 g of califos biofertilizer. A positive effect of stimulants is visible[12,13].

In the conditions of 2019, in the second year, it was 87.5 g, leaves 39.4 g, root 37.5 g. Compared to the control variant, geohumat stimulator 23.2 g/ha, leaf 17.1 g/ha root 5.4 g/ha and aminomax stimulator stem height 17.6 g/ha leaf 10.9 g/ha root 3.0 g/ha ha, it was found that the height of the stem was 13.3 g/ha, the height of the leaf was 7.9 g/ha, and the root was 2.5 g/ha.

In the second year of the life of the sweet licorice plant, the total amount of dry matter accumulated in one bush is 164.4 g in the control version; 210.1 g in the variant with geohumate stimulator; 195.9 g of dry matter was accumulated in one plant under the influence of aminomax stimulator and 188.1 g of califos biofertilizer. A positive effect of the used preparations is visible.

In the conditions of 2020, in the period of flowering, flowering and fruiting of the third-year sweet potato in the control variant, it is equal to 80.1 g, the leaf is 35.6 g/ha, and the root is 40.2 g/ha. The dry weight of licorice stem when sprayed with geohumat stimulator

suspension was 20.6 g, leaves 15.2 g/root 11.7 g compared to the control option. These indicators are 10.6 g/ha when aminomax suspension is used; 11.1 g/ha; 9.8 g/ha; it was determined that the total was higher than 192.1 g/ha. (Table 1).

Table 1. Effects of stimulants and biofertilizers on dry matter accumulation of smooth sweet (2018-2020)

	Options	**First year plant, gram/bush**			
		stem	**leaf**	**root**	**total**
1	Control	38,5	15,4	14,1	68
2	Geogumat	45,5	33,0	21,5	100,0
3	Aminomax	42,3	31,3	20,3	93,9
4	Kaliphos	40,9	30,9	20,0	91,8
Plant in the second year					
		stem	**leaf**	**root**	**total**
1	Control	87,5	39,4	37,5	164,4
2	Geogumat	110,7	56,5	42,9	210,1
3	Aminomax	105,1	50,3	40,5	195,9
4	Kaliphos	100,8	47,3	40,0	188,1
Third year plant					
		stem	**leaf**	**root**	**total**
1	Control	80,1	35,6	40,2	155,9
2	Geogumat	100,7	50,8	51,9	203,4
3	Aminomax	95,4	46,7	50,0	192.1
4	Kaliphos	90,7	45,1	49,8	185.6

During the third year of life of the smooth licorice plant, the amount of dry matter accumulated in one plant is 155.9 g in the control version; 203.4 g in the variant with geohumate stimulator; 192.1 g of dry matter was accumulated in one plant under the effect of aminomax stimulator and 185.6 g of califos biofertilizer.

In the third year of life of Shirinmia, the accumulation of dry matter was slightly reduced compared to the second year[14].

It was determined that the composition of dry matter accumulation of Shirinmia varies over the years. In the first year, the proportion of the stem was high, 45.0-56.7%, the proportion of the leaf was 22.6-33.7%, and the proportion of the root was 20.7-21.8% (Table 2).

Table 2. Effect of preparations on dry matter content of smooth sweet (2018-2020) %

	Options	**First year plant**			
		stem	**leaf**	**root**	**total**
1	Control	56,6	22,6	20,7	100
2	Geogumat	45,5	33,0	21,5	100
3	Aminomax	45,0	33,3	21,6	100
4	Kaliphos	44,6	33,7	21,8	100
Plant in the second year					
		stem	**leaf**	**root**	**total**
1	Control	53,2	24,0	22,8	100
2	Geogumat	52,7	26,9	20,4	100
3	Aminomax	53,6	25,7	20,7	100
4	Kaliphos	53,6	25,1	21,3	100
Third year plant					
		stem	**leaf**	**root**	**total**
1	Control	51,4	22,8	25,8	100
2	Geogumat	49,5	25,0	25,5	100
3	Aminomax	49,7	24,3	26,0	100
4	Kaliphos	48,9	24,3	26,8	100

In the second-year licorice plant, the percentage of stems was 52.7-53.6%, 24.0-26.9%, and the percentage of roots was 20.4-22.8%.

In the third year, it was observed that the percentage of stems decreased by 48.9-51.4% and the percentage of leaves by 22.8-25.0%, while the percentage of roots increased by 25.5-26.8%. According to the results of the experiments, a positive effect of the use of stimulants and biofertilizers on the productivity of stems and roots was determined in the conditions of the territory of Karakalpakstan. For this purpose, at the end of the effective period of productivity, the yield of the roots dug from the layer at a depth of 0-50 cm according to variants was determined by layers[15].

In the experiment, the first, second and third year data on hay yield when treated with geohumat, amionomax stimulants and califos biofertilizers during the growth and development of smooth sweet (table 3) are presented.

According to the results of the research, during the period of 2018-2020, the average hay yield was 16.4 t/ha in the first year, 43.1 t/ha in the second year, and 47.8 t/ha in the third year. (Table 3)[16].

Table 3. Hay yield of smooth licorice by years of development under the influence of stimulants and biofertilizers, ts/ha (2018-2020)

	Options	**Years of research**			**Total**
		2018	2019	2020	
1	Control	16,4	43,1	47,8	107,3
2	Geogumat	20,2	49,9	56,5	126,6
3	Aminomax	19,5	47,2	51,6	118,3
4	Kolifos	18,7	46,1	49,7	114,5
	$EKF_{05,\ s/ha}$	0,58	0,99	0,74	2,31
	$EKF_{05,\ \%}$	1,31	2,10	1,45	4,86

The total yield was 107.3 tons/ha. Under the influence of geohumate stimulator, in the second option, 20.2 tons/ha of hay was obtained in the first year, 49.9 tons/ha in the second year, and 56.5 tons/ha in the third year, and a total of 126.6 tons/ha of hay was obtained. 19.5 years, respectively, under the influence of the aminomax stimulant; 47.2; and hay yield of 51.6 t/ha was obtained. In this option, the total yield was 118.3 tons/ha. 18.7 years respectively in the fourth option when Kalifos biofertilizer is used; Hay yield was 46.1 and 49.7 t/ha, total 114.5 t/ha of hay was obtained[18,19].

If in the first, second and third years of the options, compared to the control option, under the influence of the geohumat stimulator, it was found that 3.8 t/ha, 6.8 and 8.7 t/ha additional hay was obtained, respectively, aminomax stimulator and kaliphos biofertilizer hay of smooth sweet had a positive effect on the yield, but less hay yield was obtained compared to the variant with geohumate stimulator.

Therefore, it was determined that the use of geohumic stimulator during the growth and development period of smooth sweet potato has a positive effect on hay yield[20].

Also, changes in the total dry weight of sweet potato under the influence of drugs, and an increase in hay yield were observed. The mathematical correlation between these two indicators was calculated according to the method of BA Dospekhov (1979)[21]. According to mathematical calculations, it was observed that the results of dispersion analysis have a positive correlation between these indicators. In particular, the correlation coefficient between the two indicators was equal to r=0.969 (R2=0.9385), which showed the existence of a high level of connection (Figure 1).

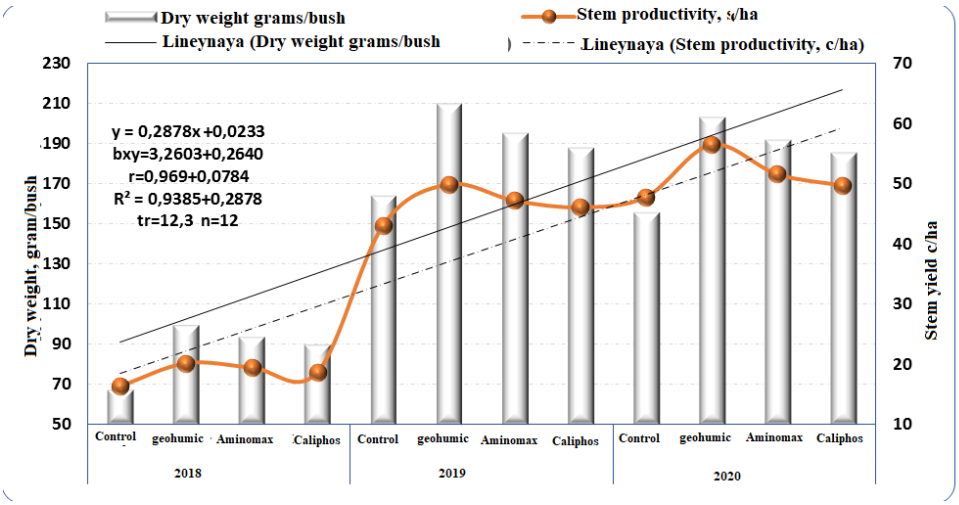

Fig. 1. Under the influence of stimulants and biofertilizer during the development period of sweet
Correlation between dry matter accumulation and hay yield connection, 2018-2020

In order to study the effect of stimulators on root productivity, the data obtained by the options when the root dug from the layer to the depth of 0-50 cm was washed and analyzed every year according to the options are presented in Table 3.4.4. When digging and cleaning root yield was analyzed by options, in the first year, in the first option, an average root yield of 1.1 t/ha was obtained, while in the second option, an average of 2.8 t/ha was obtained.

When Aminomax stimulator was applied to the first-year smooth sweet potato, 2.3 t/ha root yield was obtained, and 1.2 t/ha more root yield was obtained compared to the control option. 0.5 t/ha less root yield was obtained compared to the option using geohumate stimulator.

When Kalifos biofertilizer was used, an average root yield of 2.0 t/ha was obtained, compared to the control option, an additional 0.9 t/ha root yield was obtained, and a 0.8 t/ha less yield was obtained compared to the option with geohumate biostimulator (Table 4). .

Table 4. Effect of stimulants and biofertilizer on root yield, t/ha (2018-2020)

	Options	Years of research			Total
		2018	2019	2020	
1	Control	1,1	3,0	4,4	8,5
2	Geogumat	2,8	4,1	5,4	12,3
3	Aminomax	2,3	4,0	5,2	11,5
4	Kolifos	2,0	3,9	4,6	10,5
	$EKF_{05,\ c/ha}$	0,7	0,27	0,90	1,87
	$EKF_{05,\ \%}$	0,03	0,7	1,75	2,48

Therefore, the use of geohumate stimulator during the period of smooth sweet potato gives a high result. Depending on the biological characteristics of sweet licorice, the growth

development in the second and third years was much higher and affected root accumulation.

At the end of the second year of operation of the smooth sweet potato, when the accumulation of roots at a depth of 0-50 cm was determined, the root yield was 3.2 tons per hectare in the control option. 4.1 tons of roots per hectare were obtained when we used the geohumic stimulator, and 0.9 t/ha additional yield was obtained compared to the control option. In the variant with Aminomax stimulator, 4.0 tons of root crop was obtained per hectare, and 0.8 t/ha additional root yield was obtained compared to the control variant. In the fourth option, where Kalifos biofertilizer was used, 0.7 t/ha additional root yield was obtained compared to the control option.

So, it was found that the use of geohumic stimulator during the second year of operation of smooth sweet potato gives a good result.

At the end of the third-year period of smooth sweet potato, when we determined the root yield at a depth of 0-50 cm, the root yield was much higher than in previous years, and the effect of the stimulators on the options was determined.

According to the obtained data, in the control variant, 4.4 tons of root crops per hectare were obtained according to average returns. In the variant with Geohumat stimulator, the average root yield was 5.4 tons per hectare, that is, an additional root yield of 1.0 tons per hectare was obtained compared to the control variant. When Aminomax stimulator was used during the period of operation of smooth sweet potato, 5.2 tons of root crop was obtained per hectare, and 0.8 tons of additional yield was obtained compared to the control option. In the fourth option, where Kalifos biofertilizer was used, 4.6 tons of roots per hectare were obtained.

Therefore, as a result of the use of geohumic stimulator during the growth and development period of smooth sweet potato, compared to the control option, 1.7 tons per hectare in the first year, 0.9 t/ha in the second year, and 1.0 tons per hectare in the third year created the basis for obtaining an additional root crop.

In the experiment, the seed yield is obtained only in the third year, and usually the seed yield is higher in the 3rd year. Also, as a result of the effect of stimulants on sweet potato, an increase in the total yield of hay was observed, and the yield of roots also increased. The mathematical correlation between these two indicators was calculated according to the method of BA Dospekhov (1979). According to mathematical calculations, it was observed that the results of variance analysis have a positive correlation between these indicators. In particular, the correlation coefficient between the two indicators was equal to r=0.936 (R^2=0.8760), which showed the existence of a high level of connection (presented in Figure 2).

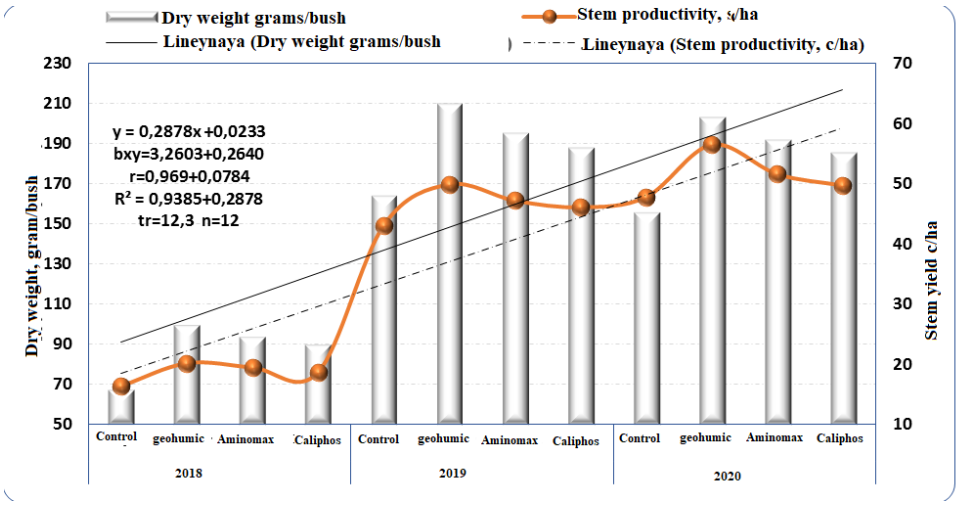

Fig. 2. Correlation between sweet potato hay yield and root yield under the influence of stimulants and biofertilizers, 2018-2020.

A total of 8.5 t/ha in the control option in three years; 12.3 t/ha under the influence of geohumate; root yield was 11.5 t/ha under aminomax and 10.5 t/ha under califos. Root yield due to stimulators and biofertilizer is 44.7; 35.3; increased by 21.%.

4 Conclusion

1. Under the influence of stimulators, the weight of dry matter accumulated in one plant was 47.5 grams more than the control, due to geohumat, 36.2 grams due to aminomax, and 29.7 grams due to califos. The dry matter of the plant stem is on average 51.3-48.9% stem, 22.8-24.3% leaf and 25.9-26.8% root.

2. The applied new agrotechnical measures activated the photosynthetic activity of sweet potato. In particular, under the influence of geohumate stimulator, the leaf surface is 43.3 thousand m^2/ha; planting rate of 15 kg/ha and $N_{100}R_{140}K_{80}$ fertilizer rate was 54 thousand m^2/ha.

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