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THE INFLUENCE OF INTRODUCING ORGANIC NUTRIENTS AND GROWTH STIMULANT INTO THE SOIL IN DIFFERENT PERIODS ON THE GROWTH, DEVELOPMENT AND FORMATION OF POTATO TUBERS IN ARID CONDITIONS OF THE FOOTHILL ZONE

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Abstract

In post-forest, pebbly, carbonated, medium strength, brown soils of the foothill zone, where the annual rainfall is 531 mm (of which 111 mm falls in May and 13 mm in December), the humus content in the soil ranges from 3,5 to 4,5%, the average annual temperature is 11,8º C, under dry conditions, the effect of introducing equivalent amounts of organo-mineral fertilizers and growth-promoting bio-liquid into the soil at different times on the growth, development, transition periods of phenological stages, intensity of potato tuber formation and yield of early potatoes was investigated.

Experimental research has revealed the high efficiency of using a relatively small fractional amount of organomix (from sow and in the form of nutrition), and the full amount of bio-liquid in the form of soaking the planting material (3 days before planting), the same or more amount of one-time use, as well as equivalent amounts of mineral fertilizers accepted in the zone compared to the application.

Key words: organomix, mineral fertilizer, bio-liquid, potato, growth and development, potato tuber formation intensity.

Intriduction

Artsakh, being a typical mountainous country, has various climatic conditions and a variegated land cover formed under these conditions. 30% of the arable land lies on gently sloping (up to 5º) plains, and the rest on medium and strong slopes. The 11,709 thousand hectares of arable land of this administrative region are spread at heights of 300-1100 m above sea level, where soil types of various strength and fertility have arisen due to various climatic conditions [1]. Despite significantly high soil fertility and favorable bioclimatic conditions, crop yields in the region remain low.

Due to its biological characteristics, potato is cultivated from the lowland zone up to 2025 m above sea level. According to the data of the Statistical Service of the Republic of Artsakh [2] in 2016-2022, the cultivated areas of this important crop in the potato-growing regions of the republic amounted to 641.5 ha, the average yield was 69.4 c/ha.

In the studied region, the potato cultivation area is 156.6 ha or 24.8% of the total cultivation area. The yield is low and does not exceed the average of the republic. The main reasons for low yields are the wrong selection of varieties and the lack of a scientifically based fertilization system. The role of mineral fertilizers in increasing the yield of crops, including potatoes, is well known. However, the one-sided use of their (especially nitrogenous) high amounts (without organic matter) while increasing crop yield, has a negative effect on the quality properties of the crop, contributes to the acceleration of humus decomposition rates, environmental pollution, acceleration of soil degradation, and increase in costs. Reasonable doses of joint application of mineral and organic fertilizers enable the farmer (in waterless conditions) to obtain a high yield at a low cost, while maintaining soil fertility and keeping the environment free from pollution [3,8,10].

In order to obtain high yields from crops under the conditions created by global warming, the introduction of early maturing varieties with short vegetation is more important. In that case, there is a need to develop and implement a scientifically based fertilization system [4,5]. Based on the above mentioned, in the brown soils of the foothills and post-forests of Artsakh, were investigated the effects of separate and joint application of organomix organic fertilizer, growth-promoting bio-liquid and equivalent amounts of mineral fertilizers, as well as the dates of their introduction into the soil, on the quality characteristics and costs of potato growth, development, tuber formation, yield and yield quality characteristics of the obtained crop and on cost reduction [5,6,7,9,11].

Conflict Setting

In order to solve the problem, field experiments and laboratory studies were carried out. Field experiments were conducted in 2021-2022 on a gently sloping plot 500m above sea level with 3 replications. The following options were studied:

1. Checker (without fertilization).
2. Organomix 8t/ha one-off, in sowing.
3. Organomix 10t/ha one-off, in sowing.
4. Organomix 5t/ha (in sowing) + $N_{30}P_{40}K_{40}$ (in sowing) + N_{30} with nutrition.
5. Organomix 5t/ha in sowing + organomix 3t/ha (with nutrition) + bio-liquid 14 l/ha (nutrition).
6. Bio-liquid 14l/ha soaking planting material + organomix 5t/ha (in sowing)+organomix 3t/ha (nutrition).
7. $N_{80}P_{80}K_{80}$ (in sowing) + N_{40} nutrition.

During the vegetation period, phenological observations, biometric measurements and censuses were performed. The effect of the above-mentioned soil conditioners on the growth of above-ground and below-ground organs, the intensity of tuber formation and the change in the amount of the obtained crop was calculated. The object of the experiment was the impala variety of potatoes, the planting rate was 3300 kg/ha, the size of the experimental fields was 20 m^2. Cultivation and harvesting operations were carried out according to the agro-rules accepted in the region. 8 t/ha of the organomix according to the experiment scheme was introduced into the soil in the spring in the 2nd and 3rd versions by sowing, in the 5th and 6th versions fractionally by sowing and nutrition, at the same time in the 5th and 6th versions 14 liters of bioliquid /ha dose was given in one case by root nutrition, in the other case by soaking the potato planting material 3 days before planting. Equivalent doses of mineral fertilizers N80P80K80 (per effective substance) were given in sowing and N40 with nutrition (version 7),

and in version 4, as indicated in the scheme, N30P40K40 was introduced into the soil with organomix in sowing and N30 with nutrition.

The yield data were subjected to mathematical analysis, analysis of variance, experimental error (Sx, %) and the most significant difference (MSD 0.95 c) by decision. [12].

Research results

According to the average data of two years of field experiments, the adequate doses and application dates of organo-mineral fertilizers, as well as the growth-promoting bio-liquid had a certain effect on potato germination, growth and development. Compared to the no-fertilization (checker) version, both single and fractional application of organomix, the germination of potato seedlings (in all repetitions of studies) was accelerated by 2 to 3 days on average, and in the version where the seedlings were treated with bioliquid before planting, the germination of potatoes was accelerated for 4-5 days.

The effects of organomix, mineral fertilizers separately and together, and growth promoter are more obvious during the transition period of potato phenostages.

If this effect is not pronounced at the initial stages, then the influence of organomix and bioliquid at the final stages (flowering and maturation) is more pronounced, in the variants of organomix and growth stimulator, especially root nutrition, the duration of plant vegetation is somewhat reduced.

Table 1

Effects of equivalent doses of organomineral fertilizers and growth promoter on potato phenostages transition, above-ground mass and stolons (average data)

n/n	Variants	From germination to (day)			Plant height,, cm	Number of stems, pc	The weight g/plant		Number of stolons , pcs
		sprout/end/	Cocooning	Blooming	Ripening			Stems	Leaves
1	Checker (without fertilization)	24.04	34	51	92	43,2	3,7±0,6	195±6	67±4	10,2±0,3
2	Organomix 8t/ha one-off in sowing	22.04	35	48	86	51.2	5.7±0.4	305±4	105±6	13,6±0,6
3	Organomix 10t/ha one-off in sowing	22.04	36	50	87	51.3	6.0±0.3	315±5	104±3	13,4±0,2
4	Organomix 5t (in sowing) N30P40 K40(in sowing)+ N30 with nutrition	23.04	34	52	86	50,9	6.7±0.6	319±4	108±5	14,4±0,3
5	Organomix 5t/ha in sowing+organomix 3t/ha (with nutrition)+bio-liquid 14l/ha (nutrition)	22.04	35	52	89	55,8	6,9±0,4	325±6	109±5	14.8±0.5
6	Bio-liquid14l/ha soaking planting material +organomix 5t/ha (in sowing)+organomix 3t/ha (nutrition)	19.4	33	51	88	54,9	7,4±0,2	345±5	126±4	16,6±0,4
7	N80P80K80 (in sowing)+ N 40 (nutrition)	23.04	36	54	90	51,2	6,6 ±0,3	318±6	107±4	14,8±0,3

Potatoes were planted on March 29 in 2021, and on March 31 in 2022.

In the course of the research, it was revealed that in the single fraction application of organomix, as well as in the versions that received 40% norm of mineral fertilizers and bio-liquid, the plants grew more lushly compared to the checker, had a dark green color, more branching of the stems and provided a powerful photosynthetic surface. If the plant height increased by 8.0 and 8.6 cm, the number of stems by 2.9 and 3.0 cm, respectively, compared to the checker, in the versions of the one-off application of equivalent doses of organomix and mineral fertilizers, then the same doses of organo mix in fractional application options, where the planting material was also treated with bio-liquid or extra-root nutrition was performed, the height of the plants increased by 3.7-4.6 cm compared to the one-off treatment (Table. 1). From the data of the same table, it can be seen that similar changes were made in the weight mass of stems and leaves and the number of stolons. Everywhere, compared to the version without fertilization, the weight of the stems increased by 130-150 grams, the leaves by 38-59 grams, and the number of stolons by 3.4-6.4 pieces in the versions that received organomix and growth promoter (Fig.1).

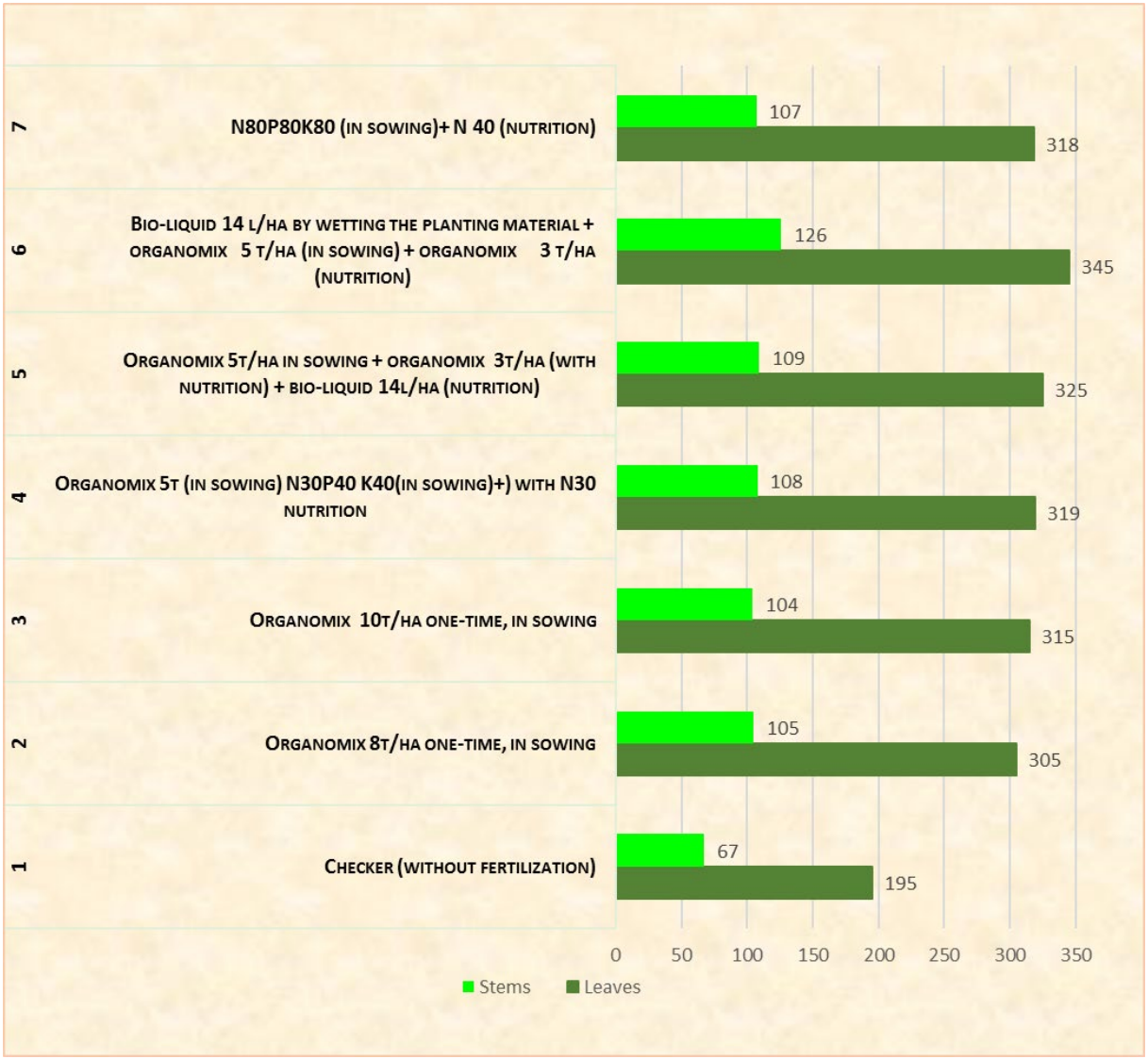

Fig. 1 Effect of equivalent doses of organomineral fertilizers and growth promoter on above-ground mass and stolons of potato phenostages transition (average data) weight of stems and leaves, g/plant

The number of stolons in the versions fertilized with equivalent doses of organic mineral is almost the same as compared to the checker (13.6-14.8 pieces), while the average number of stolons in the versions of the planting material moistened with bio-liquid 14 l/ha 3 days before sowing was 16.6 pieces. It is assumed that the bio-liquid in this case acts as a growth stimulator under the influence of which the apical dominance of the planting material is suppressed.

That is the main reason that compared to the variant of extra-root nutrition of the same rate of 14 l/ha of bio-liquid, on the same background of fertilization, the average tuber accumulation per day in the versions soaked with bio-liquid is 2 grams more per bush, and the yield increase is 210.8 c/ha or 144.2%, while in the extra-root feeding version, compared to the checker, the yield increase was 167.3 c/ha or 114.4%.

Fractional application of organic and mineral fertilizers and their combined equivalent doses have a more beneficial effect on the above-mentioned indicators of potato growth, development, above-ground and underground organs, as a result, providing favorable conditions for potato tuber accumulation and increasing the yield of potatoes (Table 2).

Table 2

Effects of equivalent doses of organomineral fertilizers and growth promoter according to phenostages, tuber accumulation and yield (average data)

n/n	Variants	The weight of tubers according to development stages, g.			From cocooning to ripening		Average yield of tubers by year c/ha		Average yield of two years. c/ha	The extra crop	
		cocooning	blooming	ripening	day	average tuber accumulation per	2021	2022		c /	%
1	Checker (without fertilization)	50,6±6,0	247,0±3,0	387,0±4,0	58	5,8	142,4±2	150,0±3	146,2±2,5	-	-
2	Organomix 8t/ha one-off in sowing	64,0±4,0	345,0±5,5	512,0±5,5	51	8,8	290,0±6	301,0±4	295,5±5,0	149,3	102,1
3	Organomix 10t/ha one-off in sowing	66,2±4,2	348,0±6,0	515,0±4,5	51	8,8	296,0±7	315,±5	305,5±6	159,3	109,0
4	Organomix 5t/ha (in sowing)+$N_{30}P_{40}K_{40}$ (in sowing)+ N_{30} with nutrition	63,8±3,5	352,0±7,0	531,8±7,0	52	9,0	300,0±4	307,0±5	303,5±4,5	157,3	107,6
5	Organomix 5t/ha in sowing+organomix 3t/ha (with nutrition)+bio-liquid 14l/ha (nutrition)	64,8±5,0	380,0±5,0	561,6±6,0	54	9,2	307,0±5	322,0±6	313,5±5,5	167,3	114,4
6	Bio-liquid 14l/ha soaking planting material + Organomix 5t/ha (in sowing)+organomix 3t/ha (nutrition)	67,5±5,5	382,0±6,5	584,5±8,0	55	9,4	342,0±7	372,0±6,2	357,0±6,6	210,8	144,2
7	$N_{80}P_{80}K_{80}$ (in sowing)+ N_{40} (nutrition)	63,2±3,5	356,0±5,0	533,0±61	54	8,6	285,0±6	300,0±5,4	292,5±5,7	146,3	100,1

If in case of one-time application of organomix, in sowing, the average tuber accumulation per day was 8.8 grams, from cocooning to the natural death of the bushes, ripening, then in fractional application of organomix and using equivalent doses of organomix and mineral fertilizers, it was 9 and 9.2 grams, respectively, while the average tuber accumulation of the variants that received only mineral fertilizers was 8.6 g/day (Table 2).

The results of such experiments are the basis for assuming that the higher the intensity of tuber accumulation in a given variant, the higher the tuber yield and vice versa.

Fig. 2 The effect of equivalent doses of organic mineral fertilizers and growth promoter on yield /2021-2022/ according to variants

Conclusions

The one-off application of equivalent doses of organic mix and mineral fertilizers in the potato crops grown in post-forest brown soils of the pre-mountain zone is inferior in its efficiency to the fractional application of the same doses. In comparison with organic and mineral one-off fertilization, the effectiveness of fertilization was high even in case of fractional application of these fertilizers. However, the highest data on the tubering index were recorded in the version of fractional application of organomix, where the planting material was treated with a bio-liquid solution before planting. As a result, the highest tuber yield was obtained in this variant. See the yield indicators of other variants in the given diagram [Fig. 2].

Fertilization of the soil with the above-mentioned technology makes it possible to obtain more than 350-360 c/ha of high-quality harvest from potato seeds cultivated under arid farming conditions, while improving the ecological condition of the environment.

References

1. Aleksanyan V.A. (2016) Agro-productive properties of NKR agricultural lands, ways of improvement //Stepanakert, 2016.- p. 224.
2. Yearbook of Statistical Service of the Republic of Armenia, c. Stepanakert: p. 215-222 http://www.stat-nkr.am/hy/2010-11-24-11-18-12/2021-/1344--2021
3. The Biodiversity and Climate Change Virtual Laboratory: Where ecology meets big data https://www.sciencedirect.com/science/article/pii/S1364815215300839
4. Galstyan M.H. (2007) Fertilization efficiency of winter wheat and potatoes in the conditions of the Sevan basin //Yerevan 2007.-p.158. https://koha.anau.am/cgi-bin/koha/opac_detail.pl?biblionumber=92537&query_desc=an%3A41279
5. Galstyan M.H., Markosyan M.A., Simonyan L.L., Nalbandyan L.T., Aleksanyan V.A. (2020) The effect of application periods of different amounts of organic fertilizers and growth promoters on the dynamics of nutrient accumulation in potato plants and their removal with the crop //Hymenical Journal of Biology, LXXII, 1-2, 2020.- p. 9-16. https://arar.sci.am/dlibra/publication/284238/edition/260884/content?ref=L3B1YmxpY2F0aW9uLzI2MDU0Ni9lZGl0aW9uLzIzODU4NQ
6. Effects of Different Organic Fertilizers on Sweet Potato Growth and Rhizosphere Soil Properties in Newly Reclaimed July 2022, Agronomy doi.org/10.3390/agronomy12071649 https://www.researchgate.net/publication/361900864_Effects_of_Different_Organic_Fertilizers_on_Sweet_Potato_Growth_and_Rhizosphere_Soil_Properties_in_Newly_Reclaimed_Land
7. Mineev V.G. Agrochemistry (2004) //M: Kolos, 2004.- p. 719. https://myzooplanet.ru/agropochvovedenie-agrohimiya/agrohimiya-uchebnik-izd-pererab-dop-izd-mgu.html
8. Research effort devoted to regulating and supporting ecosystem services by environmental scientists and economists, Published: May 28, Published: May 28, 2021. https://doi.org/10.1371/journal.pone.0252463
9. Biomass contribution and nutrient recycling of organic matter management practices in tropical smallholder annual farming systems https://www.tandfonline.com/doi/full/10.1080/09064710.2022.2134819?src=
10. Galstyan M.A. (2003) Ecological and economic efficiency of the use of increasing doses of zeolite in potato crops against the background of mineral fertilizers near manure, in technogenically polluted soils of Armenia (2003) //Mater Kavkaz. Int. Ecoforum, Grozny, 2003.- p. 170-174. https://core.ac.uk/download/pdf/234656534.pdf
11. Dospeghov.A. Methods of field experience (1973) //M: «Kolos», 1973.- p. 336. https://mf.bmstu.ru/info/faculty/lt/caf/lt1/soil_books/uchebnik9.pdf
12. Xuqing Li, Yao Su, Temoor Ahmed, Haiying Ren, Muhammad Rizwan Javed, Yanlai Yao, Qianli An, Jianli Yan, and Bin Li (2021) Effects of Different Organic Fertilizers on Improving Soil from Newly Reclaimed Land to Crop Soil. http://www.hznky.com/uploadFiles/202111/20211101132634777.pdf

References

1. Ալեքսանյան Վ.Ա. (2016) ԼՂՀ գյուղատնտեսական նշանակության հողերի ագրոարտադրական հատկությունները, բարելավման ուղիները //Ստեփանակերտ, 2016.- էջ 224:
2. ԱՀ վիճակագրական ծառայության տարեգիրք , ք. Ստեփանակերտ.- Էջ 215-222 http://www.stat-nkr.am/hy/2010-11-24-11-18-12/2021-/1344--2021
3. The Biodiversity and Climate Change Virtual Laboratory: Where ecology meets big data https://www.sciencedirect.com/science/article/pii/S1364815215300839
4. Գալստյան Մ.Հ. Աշնանացան ցորենի և կարտոֆիլի պարարտացման արդյունավետությունը Սևանի ավազանի պայմաններում (2007) //Երևան 2007.- Էջ 158: https://koha.anau.am/cgi-bin/koha/opac detail.pl?biblionumber=92537&query_desc=an%3A41279
5. Գալստյան Մ.Հ., Մարկոսյան Մ.Ա., Սիմոնյան Լ.Լ., Նալբանդյան Լ.Տ., Ալեքսանյան Վ.Ա. Օրգանական ծագման պարարտանյութերի և աճի խթանիչի տարբեր չափաքանակների կիրառման ժամկետների ազդեցությունը կարտոֆիլի բույսերում սննդատարրերի կուտակման դինամիկայի և բերքի հետ դրանց օտարման վրա (2020) //Հայաստանի կենսաբանական հանդես, LXXII, 1-2, 2020.- էջ 9-16:https://arar.sci.am/dlibra/publication/284238/edition/260884/content?ref=L3B1YmxpY2F0aW9uLzI2MDU0Ni9lZGl0aW9uLzIzODU4NQ
6. Effects of Different Organic Fertilizers on Sweet Potato Growth and Rhizosphere Soil Properties in Newly Reclaimed July 2022, Agronomy doi.org/10.3390/agronomy12071649 https://www.researchgate.net/publication/361900864_Effects_of_Different_Organic_Fertilizers_on_Sweet_Potato_Growth_and_Rhizosphere_Soil_Properties_in_Newly_Reclaimed_Land
7. Минеев В.Г. Агрохимия (2004) //М: «Колос», 2004, с. 719. https://myzooplanet.ru/agropochvovedenie-agrohimiya/agrohimiya-uchebnik-izd-pererab-dop-izd-mgu.html
8. Research effort devoted to regulating and supporting ecosystem services by environmental scientists and economists, Published: May 28, Published: May 28, 2021. https://doi.org/10.1371/journal.pone.0252463
9. Biomass contribution and nutrient recycling of organic matter management practices in tropical smallholder annual farming systems https://www.tandfonline.com/doi/full/10.1080/09064710.2022.2134819?src=
10. Галстян М.А. Эколого-хозяйственная эффективность применения возрастающих доз цеолита в посевах картофеля на фоне минеральных удобрений у навоза, в техногенно загрязненных почвах Армении (2003) //Матер кавказ. Межд. Экофорума, Грозный, 2003.- с. 170-174. https://core.ac.uk/download/pdf/234656534.pdf
11. Доспехов Б.А. Методика полевого опыта (1973) //М: Колос, 1973.- с. 336. https://mf.bmstu.ru/info/faculty/lt/caf/lt1/soil_books/uchebnik9.pdf
12. Xuqing Li, Yao Su, Temoor Ahmed, Haiying Ren, Muhammad Rizwan Javed, Yanlai Yao, Qianli An, Jianli Yan, and Bin Li (2021) Effects of Different Organic Fertilizers on Improving Soil from Newly Reclaimed Land to Crop Soil. http://www.hznky.com/uploadFiles/202111/20211101132634777.pdf

ՆԱԽԱԼԵՌՆԱՅԻՆ ԳՈՏՈՒ ԱՆՋՐԴԻ ՊԱՅՄԱՆՆԵՐՈՒՄ ՕՐԳԱՆԱՀԱՆՔԱՅԻՆ ՊԱՐԱՐՏԱՆՅՈՒԹԵՐԻ ՀԱՄԱՐԺԵՔ ՉԱՓԱՔԱՆԱԿՆԵՐԻ ԵՎ ԱՃԻ ԽԹԱՆԻՉԻ ՏԱՐԲԵՐ ԺԱՄԿԵՏՆԵՐՈՒՄ ՀՈՂ ՆԵՐՄՈՒԾՄԱՆ ԱԶԴԵՑՈՒԹՅՈՒՆԸ ԿԱՐՏՈՖԻԼԻ ԱՃԻ, ԶԱՐԳԱՑՄԱՆ ԵՎ ՊԱԼԱՐԱԳՈՅԱՑՄԱՆ ՎՐԱ

Միրզոյան Մ.Շ.
Շուշիի տեխնոլոգիական համալսարան

Նախալեռնային գոտու հետանտառային, խճաքարային, կարբոնատացված, միջին հզորության, շագանակագույն հողերում, որտեղ տարեկան թափվող տեղումների քանակը կազմում է 531 մմ (որից՝ 111 մմ թափվում է մայիս, իսկ 13 մմ դեկտեմբեր ամիսներին), հողում հումուսի պարունակությունը տատանվում է 3,5 - 4,0 %-ի սահմաններում, տարեկան միջին ջերմաստիճանը՝ 11,8º C է, անջրդի պայմաններում հետազոտվել է օրգանոհանքային պարարտանյութերի համարժեք չափաքանակների և աճի խթանիչ կենսահեղուկի տարբեր ժամկետներում հող ներմուծելու ազդեցությունը վաղահաս կարտոֆիլի աճի, զարգացման, ֆենոլոգիական փուլերի անցման ժամկետների, պալարագոյացման ինտենսիվության և բերքատվության վրա: Փորձարարահետազոտական ճանապարհով բացահայտվել է օրգանոմիքսի համեմատաբար փոքր չափաքանակի կոտորակային (ցանքակից և սնուցման ձևով), իսկ կենսահեղուկի լրիվ չափաքանակը տնկանյութի թրջման ձևով (տնկելուց 3 օր առաջ) կիրառման բարձր արդյունավետությունը այդ նույն, կամ դրանից ավել չափաքանակի միանվագ, օգտագործման, ինչպես նաև գոտում ընդունված հանքային պարարտանյութերի համարժեք չափաքանակների կիրառման համեմատությամբ:

Բանալի բառեր. օրգանոմիքս, հանքային պարարտանյութ, կենսահեղուկ, կարտոֆիլ, աճ և զարգացում, պալարացման ինտենսիվություն:

ВЛИЯНИЕ ВНЕСЕНИЯ В ПОЧВУ ЭКВИВАЛЕНТНЫХ ДОЗ ОРГАНОМИНЕРАЛЬНЫХ УДОБРЕНИЙ И СТИМУЛЯТОРОВ РОСТА В РАЗНЫЕ СРОКИ НА РОСТ, РАЗВИТИЕ И ПЛОДОНОШЕНИЕ КАРТОФЕЛЯ В ЗАСУШЛИВЫХ УСЛОВИЯХ ПРЕДГОРНОЙ ЗОНЫ

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В бурых почвах предгорных, постлесных, гравийных, карбонатных зон, где годовое количество выпадающих осадков составляет 531 мм (из которых 111 мм выпадает в мае, а 13 мм - в декабре), содержание гумуса в почве колеблется в пределах 3,5 – 4,0 %. Средняя годовая температура – 11,8 ˚ С. В засушливых условиях было исследовано влияние адекватных доз органоминеральных удобрений и внесения в почву биосодержащего стимулятора роста в разные сроки на рост, развитие скороспелого картофеля, сроки прохождения фенологических стадий, на интенсивность

клубнеобразования и урожайность. Экспериментально-исследовательским путем была выявлена относительно небольшая доза органомикса из фракционного посева и в виде питания, а полная доза биогидрата в виде замачивания посадочного материала за 3 дня до посадки.

Ключевые слова: органомикс, минеральное удобрение, биожидкость, картофель, рост и развитие, интенсивность клубнеобразования.

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