Title: The influence of water stress on photosynthetic activity and productivity of potato varieties

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Abstract
The article comparatively studied the photosynthetic activity, productivity and structural elements of the produced product of various potato varieties in the mountainous and foothill irrigated areas of the Ganja-Gazakh region. As a result of the research, it was determined that the dynamics of accumulation of biological mass, productivity and structural elements of the product in different variety samples - the number and average weight of tubers on the root of a plant - differ depending on their biological characteristics and water regime. It was also found that in plants cultivated in mountainous and foothill conditions, many physiological and biochemical processes weaken due to water shortage, and as a result, the growth and development of plants slow down, which leads to a decrease in the biological mass and productivity of plants. These decreases are significantly higher in the Dutch variety Monolyza than in the local varieties Sevinj and Amiri – 600 (42.7%), that is, this variety is more drought-resistant. During the study, the highest yield in the irrigated area was recorded in the Dutch variety Monolyza.

Keywords: Potato, variety, biomass, productivity, structural elements, tubes.

Introduction

The basis of our Republic's climate indicators is heat and the soil and air drought associated with it. When these indicators are high, the coloring and development of plants becomes poor (Yusifov: 2018, pp. 40-48). It is shown in literature that the productivity of plants is subject to a decrease of 30-50% due to the impact of soil drought (Eyvazov et al.: 2017, p. 116-120; Yusifov: 2018, p. 56-57). This is observed more frequently in the surveyed regions. Accordingly, taking the species and types

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of drought-tolerant mineral plants and cultivating them in large areas is one of the important tasks facing modern selexium.

It is known that the majority (70-95%) of all nutrients in plant organisms is water. Water plays an essential role in all physiological processes, especially the photosynthesis process, with the participation of water (Agaev и др.: p.13). Soil drought stress and the exchange of substances in plants are brought to life through water. During drought, the photosynthetic assimilation of CO2 gas decreases further. Some investigations involve the reduction of photosynthetic assimilation of the CO2 gas, which is related to the reaction of the solidity of the CO2 gas by closing the nozzles that enable transpiration and gas exchange to reduce water repellency during droughts. They explain it with the decrease in the center (Король: 2014, p. 19-20). Other researchers believe that the phosphorylation reaction in xloroplasts is weakened by the weakening of ATF synthesis due to the effect of drought and, in turn, by the decrease in the regeneration of ribulose 1,5-diphosphate, which is the primary acceptor of CO2 gas. They explain (Lowlor: 2002, p. 874-876).

Moreover, as can be seen from what has been recorded, as a result of drought stress, the growth and development of plants deteriorate due to the weakening of many physiological and biochemical processes, which in turn causes In this case, it causes the productivity to decrease.

According to all that has been shown, the effect of soil drought on the growth and development of the carton plant and the productivity of the carton in the Ganja - Qazax region of our republic, which is mainly engaged in cartowing. Learning has become the purpose of the investigation.

Methodology

In order to carry out the cleaning work, the locals Sevinc and Emiri-600, which were based in Kartofun, and the information-trained Dutch sorties Manoliza and Spinta were taken. Experiments were compared with the Tovuz region experimental station of Elmi Tədqiqat İnstitut by taking place in regularly flooded and unirrigated areas of Tala Mountain. It was done in good condition. In order to determine the amount of biological mass, plant samples were viewed and laboratory analyzes were carried out by the AANiciporoviçin (Yusifov: 2018, p. 47-52) method.

The accumulation dynamics and amount of biological mass in Kartof sorties are subject to many changes depending on the biological characteristics of the sorties, water regimes (watering and drying) and vegetation periods. remained (cədvəl 1). However, in the dynamics of biological mass accumulation, a general lawfulness has emerged for all water regimes and types. Therefore, in the early stages of vegetation, the amount of biological mass becomes less, as the weather gets warmer, the coloring of the plants and the accumulation of the biological mass associated with it accelerates, and at the end of the flowering development phase, the essence reaches its maximum level. , then the amount of biological mass begins to decrease towards the end of vegetation, as the lower and middle leaves and all the branches become yellow and dry, and at the end of vegetation, as all organs become yellow and dry, the amount of biological mass is at a minimum. It reaches the level.

In the beginning of vegetation, the amount of biological mass fluctuated between 9.1-14.4 sen/ha in the flooded area and 7.3-9.0 sen/ha in the drying conditions. At this time, the amount of biological mass in the surveyed area was relatively superior to the ancient conditions, starting from the beginning of vegetation. It should be noted that the demonstrated compliance with the law was also evident in the impact of the tubers. Under the water and sailing conditions, its draft was correspondingly 3.7-7.7 and 2.6-3.3 sen. In plants, the biological mass reaches its maximum at the end of the flowering phase of plants. During this period, its amount has been relatively higher in the plants grown in the irrigated field than in the plants grown in the rain conditions, that is, the amount of biological mass has decreased due to the effect of drought. It has therefore been subject to decrease. This decrease was correspondingly 40.9% due to Sevinc, Emiri 600, Monoliza and Spinta types; 34.9; 33.0 and 20.1% were together.

Table 1
Gathering dynamics of biological mass in Kartof sorties

№	Sorts	Delivery dates of samples					
		11-IV		26-VI		12-VII	
		General mass	tubers	General mass	tubers	General mass	tubers
Watered							
1	Joy	10.3	3.3	29.3	13.9	28	27.4
2	Amiri-600	9.1	6.9	25.5	13.8	22.7	30.5
3	Monoliza	14.4	7.7	31.1	17.2	30.0	45.5
4	Spinta	10.5	4.2	23.9	9.2	21.1	27.4
Damian							
		27-VII		10-VIII		25-VIII	
1	Joy	8.1	2.7	20.9	8.9	8.6	16.0
2	Amiri-600	7.3	2.9	18.9	9.2	16.5	17.8
3	Monoliza	9.0	3.3	23.3	11.2	21.1	28.1
4	Spinta	7.6	2.6	19.3	8.3	17.6	15.5

As it seems, the greatest decrease in biological mass due to the effect of drought created in the weather conditions was observed in the local Sevinc and Emiri-600 sorties. This decrease occurs mainly in the leaves and prunes, while in the tubers the increase in biological mass continues and the maximum of its essence is reached around the time of the lump. During this period, the biological mass of the grown plants decreased significantly compared to the flooded area, and this decrease was approximately 51.6% over the years; 37.6; It constituted 42.2 and 21.2%. As shown, at the end of vegetation, unlike leaves and prunes, the mass of tubers has reached the maximum of their essence. Here too, the tubers of the plants grown under the cultivation conditions have decreased relative to the irrigated area. This decrease was correspondingly 41.6% due to Sevinc, Emiri 600, Monoliza and Spinta types; 41.6; 29.7 and 16.6% were together.

The structural elements of the plant crop are essentially the number of tubers on a plant and their central branches.

The results have shown that although the number and median draft of tubers in a plant increase slightly from the beginning to the end of the vegetation, the second ones, i.e. the median draw of tubers in a plant, increase to the maximum extent. It reached its limit at the end of vegetation (chadvel 2).

It should be noted that the number and average size of tubers on a plant were superior to the Monoliza and Spinta varieties originating from Holland. Under Dama conditions, the decrease in the number of tubers relative to the watering area was a small-to-large one. However, there was a significant decrease in the middle size of the tubers and the number was 58.4, respectively; 52.7; 134.6 and 43.2% were together.

Table 2
Number and median density of tubers on a plant of Kartof sorties

№	Sorts	Delivery dates of samples					
		11-IV		26-VI		12-VII	
		Number of tubers	The middle pull of the tubers, q	Number of tubers	The middle pull of the tubers, q	Number of tubers	Medium pull of tubers2 q
Watered							
1	Joy	5	52.0	5	172.0	5	258.0
2	Amiri-600	5	100.0	5	190.0	6	284.0
3	Monoliza	8	124.0	8	240.0	9	420.0
4	Spinta	7	66.0	7	136.0	8	322.0
Damian							
		27-VII		10-VIII		25-VIII	
1	Joy	4	46.0	4	126.0	4	164.0
2	Amiri-600	5	50.0	5	130.0	5	186.0
3	Monoliza	7	54.0	7	160.0	8	179.0
4	Spinta	6	45.0	7	124.0	7	175.0

During this period, the biggest decrease in the average drafts was caused by the Monoliza problem originating from the Netherlands. Compliance with this law has also been observed in plant crops.
In the field of experience, the highest yield (227.4 sen/ha) was collected in the Monoliza sort. The increased productivity of other varieties relative to the Sevinc species has varied over the species. During this period, the most increase in the crop was achieved in the high-crop Monoliza sort. The increase in the productivity of this species relative to the Sevinc region was 87.5 and 70.0% respectively in the surveyed and commercial areas (table 3).

Ruler 3
The impact of watering regimes on the productivity of Kartof sorties

№	Sorts	Productivity is yours/himself	Increment according to joy sort, %-lə	Decrease in the crop yield in the irrigated field relative to the irrigated field, %
Watered				
1	Joy	121.3	-	-
2	Amiri-600	133.5	10.1	-
3	Monoliza	227.4	87.5	-
4	Spinta	131.3	8.2	-
Damian				
1	Joy	77.1	-	36.4
2	Amiri-600	87.4	13.4	34.5
3	Monoliza	131.1	70.0	42.7
4	Spinta	87.3	13.3	33.5

It should be noted that the relative decrease in crop yields due to the effects of soil drought in the agricultural conditions has fluctuated between 33.5-42.7% in some cases. has done. As can be seen from the results, the relative decrease in the productivity of the crop to the irrigated area (42.7%) occurred in the case of high-product Monoliza. With this, it has been proven that its essence belongs to intensive type sorties and can be considered as prospective sort for our republic.
In particular, the study of the biology and conservation characteristics of native and Dutch cartovores comparatively in mountain and plain water areas has shown that mountain Land drought caused by water scarcity during the construction period had a negative impact on the height and development of plants, and as a result, the collection of biological mass, production and its structure. The number of tubers and their average size in a plant from the elements It caused a decreasing effect on the tension. During this period, the biological mass and productivity of the plants grown under the conditions of cultivation were subject to a significant decrease relative to the flooded area. These decreases varied depending on the biological characteristics of the species. Therefore, the decrease in biological mass due to drought occurred in the local Sevinc and Emiri-600 varieties, and the greatest decrease in crop yield occurred in the Hollandia varieties, especially in Monoliza. This decrease shows that the Monaliza variety is an intensive farming variety, because this variety has the feature of giving high yields when optimal skill conditions are created. Accordingly, it may be recommended to be zoned as prospective for our republic.

Conclusion and Discussion

1. Soil drought in Damia conditions caused a decrease in biological mass of the kartof plant. This decrease was relatively higher in the Holland-origin Monoliza and Spinta varieties of cardamom than the local varieties Sevinc and Emiri-600.
2. In plants grown in mountainous conditions, the structural elements of the crop - the number of tubers at the root of a plant and their central shoots are subject to decrease due to the effects of drought. These decreases were even greater in the case of Monoliza originating from the Netherlands.
3. In the experience, the highest crop yield was achieved in the field under Monoliza. So, under optimal watering conditions, this variety grows and develops optimally and produces high yields. According to this feature, the Monoliza sort can be calculated as an intensive farming sort. At the same time, it would be appropriate to present the Monoliza species to the State Service under the Ministry of Health and Toxum, in order to calculate and regionalize the Monoliza species in a perspective manner for our republic.

References:

1. Agaev F.N., Abasov R.A., Askerov A.T. "Variability of photosynthetic indicators in studied sorted potatoes and autonomous plants" / Materials VI International scientific - practical conference 2020"), March 10-11, 2020, p. Круты, Chernigov region, Ukraine. В пяти томах, т.2. Kruty, 2020, p. 12-22.
2. Azizi, A., Abbaspour-Gilandeh, Y., Nooshyar, M., & Afkari-Sayah, A. (2015). Identifying Potato Varieties Using Machine Vision and Artificial Neural Networks. International Journal of Food Properties, 19(3), 618–635. https://doi.org/10.1080/10942912.2015.1038834
3. Driver, C. M. (1974). New potato varieties. New Zealand Journal of Experimental Agriculture, 2(2), 121–124. https://doi.org/10.1080/03015521.1974.10425746
4. Emilsson, B., & Gustafsson, N. (1953). Scab resistance in potato varieties. Acta Agriculturae Scandinavica, 3(1), 33–52. https://doi.org/10.1080/00015125309434217
5. Eyvazov A.G., Agayev FN, Abbasov R.A. physiology of potato, intensive technology with to be skilled and programmed product to be taken ways. Baku: Taraqqi LLC, 2017, 212 p.
6. Gospodarenko G. // Овощеволство . Ukrainian journal. for professionals. 2016, No. 4 (104), p. 34-36.
7. H. Butcher. (1978) Total glycoalkaloids and chlorophyll in potato cultivars bred in New Zealand. New Zealand Journal of Experimental Agriculture 6:2, pages 127-130.

8. Kassaw, A., Abera, M., & Belete, E. (2021). The Response of Potato Late Blight to Potato varieties and Fungicide Spraying Frequencies at Meket, Ethiopia. Cogent Food & Agriculture, 7(1). https://doi.org/10.1080/23311932.2020.1870309
9. Korol V.G. "Working on the harvest" 2014, 2014, No. 5, 18-25
10. Qamar, M. I., Iftikhar, Y., Ali, A., Ullah, M. I., & Mubeen, M. (2016). Disease Severity Index as It Affects Responses in Potato Virus X–Challenged Potato Varieties. International Journal of Vegetable Science, 22(5), 471–479. https://doi.org/10.1080/19315260.2015.1077914
11. Lowlor DW/ «Limitation to photosynthesis in waterstressed leaves – stressed leaves stomata us metabolism and the role of ATF» // Analis of Botanik , 2002, V.89, pp. 871-885.
12. Nigussie, Z., Alemayehu, G., Adgo, E., Tewodros, Y., & Freyer, B. (2016). Reasons for Acceptance of Improved Potato Varieties by Smallholder Producers. International Journal of Vegetable Science, 22(4), 346–352. https://doi.org/10.1080/19315260.2015.1048402
13. R. A. Genet, W. F. Braam, D. T. P. Gallagher, J. A. D. Anderson & S. L. Lewthwaite. (2001) 'Dawn'—a new early-maincrop fresh market/crisping potato cultivar. New Zealand Journal of Crop and Horticultural Science 29:1, pages 67-69.
14. R. A. Genet, W. F. Braam, D. T. P. Gallagher, J. A. D. Anderson & S. L. Lewthwaite. (1997) 'White Delight': A new maincrop fresh market potato cultivar. New Zealand Journal of Crop and Horticultural Science 25:1, pages 93-95.
15. R. A. Genet. (1985) 'Iwa', a new fresh-market potato (Solanum tuberosum L.). New Zealand Journal of Experimental Agriculture 13:4, pages 415-416.
16. Runno-Paurson, E., Williams, I. H., Metspalu, L., Kaart, T., & Mänd, M. (2013). Current potato varieties are too susceptible to late blight to be grown without chemical control under North-East European conditions. Acta Agriculturae Scandinavica, Section B — Soil & Plant Science, 63(1), 80–88. https://doi.org/10.1080/09064710.2012.721389
17. Tiwari, J. K., Buckseth, T., Singh, R. K., Zinta, R., Thakur, K., Bhardwaj, V., ... Kumar, M. (2022). Aeroponic evaluation identifies variation in Indian potato varieties for root morphology, nitrogen use efficiency parameters and yield traits. Journal of Plant Nutrition, 45(17), 2696–2709. https://doi.org/10.1080/01904167.2022.2046080
18. Yusifov MA Dry physiology (physiology on peas). Baku: "Progress" LLC, 2018, 196 p.
19. Yusifov MA Physiology of watermelon. Baku:, NUR-A, 2004, 216 p.