

ORIGINAL ARTICLE

The influence of the planting scheme on the dynamics of the accumulation of the biomass, tuberization and productivity in the potato sorts

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In the article the results of the research on the influence of the planting scheme on the dynamics of the biomass accumulation, tuberization, and productivity were described in the potato sorts Amiri-600 and Sevinj. It was determined that to obtain the high product of the early-ripening potato in the irrigated areas of the Absheron economic region of the Azerbaijan Republic, it is necessary to plant the tubers according to the 70 × 20 and 70 × 25 cm schemes, taking into account the bushiness of the sorts. It is expedient to plant in the second half of February, taking into account the weather conditions of the year on the Absheron peninsula. It was revealed that, in late plantings, the accumulation of biomass and tuberization occurs during the period of the hot weather conditions, which significantly influence significantly to the productivity of the potato plants.

Keywords: Biomass, Tuberization, Sort, Potato, Planting schemes, Productivity.

Introduction

The early ripening potato is a valuable food product that differed from the tubers of the last year with good taste, excellent culinary properties, and increased content of organomineral substances. In early June, freshly harvested potatoes are very rich with such valuable vitamins such as C, B1, B2, B6, A, PP and K. To ensure the daily requirement of vitamin C of the human organism, 200-300 grams of fried or boiled spring-summer potatoes are enough (Allahverdiyev, et al., 2020; Turko, 2007).

Due to the dated June 6, 2014, decision (Decision No. 182) of the Cabinet of Ministers of the Republic of Azerbaijan, the annual norm of potato consumption per capita is 46.7 kg. In the potato republic, the planting area of the potato varied between 56988 and 64000 hectares from 2015 to 2020, and the harvested crop was 839.8 and 993.8 thousand t (Cabinet of Ministers, 2014; SSCA, 2016).

Taking into account the agronomic characteristics of potatoes and the natural soil and climatic conditions of Azerbaijan, both in the mountainous and foothill and low-lying regions, it is possible to grow this valuable crop and expand the sown area and productivity per hectare in order to provide the population with their own products.

It should be noted that the state, farmer, and private subsidiary farms of the Absheron economic region are located in the low lands reliefs and the advantage of these farms is that they are located near the big cities of Baku and Sumgait, where more than two million of the population of the republic live.

According to data from the State Statistics Committee of the Republic of Azerbaijan for the years 2015-2020, for all categories of the farms of the Absheron economic region, potatoes were grown only 50-60 hectares and the actual crop harvested crop from these areas was 352.3-493.2 tons, that is, the average productivity per hectare was 70.9 centners (SSCA, 2016).

Since the local potato production does not ensure completely the increased annual requirement to both food and seed potatoes of the population of the republic, that is why they are brought to the republic from the different countries of the world, mainly from Russia, Ukraine, Belarus, Turkey. In the republic, the absence of the high-yielding early-ripening sorts of the potatoes which are sustainable to the diseases, pests and abiotic environmental factors is also one of the main causes of the low productivity.

And it should also be noted that in the country the lack of theof potatoes is felt both at the end of spring and at the beginning of summer period. That is why in vegetable growing the early-ripening potatoes are cultivated, the harvest of which suitable both for ensure the requirement of the population in May-June, aswell as for obtain seed material for summer plantings, which are used for growing two crops in one year. On the other hand, the early-ripening potato crop is also of great agrotechnical and economic importance, because high monetary incomes are obtained from the sale of the early-ripening potatoes, and after its harvesting, the field is a good predecessor for the subsequent crops, such as grain and technical crops.

The purpose of this work is to provide the population of the Absheron Peninsula of the Republic of Azerbaijan with fresh potatoes considered a valuable product that played an important role in nutrition, as well as to study the dynamics of biomass accumulation and tuber formation in the types of the potatoes differed according to the ripeness in the different planting schemes.

Materials and Methods

To obtain a high harvest of the early ripening potatoes, we studied the planting schemes in the low-lying areas in the Absheron economic region of Azerbaijan. In 2016-2018, three seed material planting schemes were used in the Absheron conditions to determine the best scheme:

1. Planting scheme: 70 20 cm
2. Planting scheme: 70 25 cm
3. Planting scheme: 70 30 cm

Field experiments were carried out at the site of the Absheron subsidiary experimental farm of the Research Institute of Vegetable Growing in Azerbaijan. The objects of the research were the zoned sorts of the mid-ripening Amiri-600 sort Amiri-600 and the early-ripening sort Sevinj type created in the potato-growing department of the above-named Institute. To determine the influence of the planting scheme on the productivity and quality of the early products, the difference in distance difference between the schemes plants was 5 cm in the studied schemes in the rows. The planting period of the early-ripening potatoes was determined by the climatic conditions of spring. The planting was carried out when the soil warmed up to 8°C, that is, in the third decade of February. Plant density in plantings was as follows: 70 × 20 cm-60714 plants/ha; 70 × 25 cm-57143 plants/ha; 70 × 30 cm-40476 plants/ha. Since the density of the planting in the rows influences significantly the productivity of the plant, including potatoes that are early ripening, and the optimal thickening can increase productivity about 20%, that's why we chose the indicated planting schemes and studied the natural influence of the thickening on the productivity of the varieties of potatoes (Galimov, 2007; Serderov, 2014; Sidorka, 2014). And it should also be noted that early-ripening potatoes, or rather their abundant harvest, can only be obtained when the sort is selected correctly for the planting, as confirmed by the data of many researchers (Galimov, 2007; Serderov, 2014). The potato plantings were carried out in one period (February 21-26) and, as indicated above, according to the 3rd schemes. For this purpose, in autumn, plowing was carried out at a depth of 25-30 cm and before planting, repeated plowing was carried out at a depth of 20 cm, then the plot was harrowed and the furrows were cut. 2.8 m in width and 15 m in length plots were prepared for both sorts, each scheme is repeated 3 times.

The preparation of the potato tubers for planting

We used seed material of both types grown under mountainous conditions at an altitude of 800-1000 m above sea level (Tovuz Zonal Experimental Station and Shamkir stronghold of the Azerbaijan Research Institute of Vegetable Growing) for early ripening potatoes planting early-ripening potatoes in the Absheron conditions. When the seed materials of Amiri-600 and Sevinj were brought in January, the tubers that are typical for each sort with a mass of 50-80 g were sorted and selected, so the growth and development of the small and large tubers, as a rule, occur with unequal intensity.

The obligatory stage of the vernalization of the early ripening potatoes is the germination of the tubers, during which the thermal and light modes are maintained. During vernalization, seed potatoes for prophylaxis were processed with potassium manganese and copper sulfate (1% solution). The tubers had thick seedlings with 1.0-1.5 cm in length of green or green-violet flowers and root rudiments. The seeds that did not sprout, as well as the tubers with the thread-like seedlings, were discarded during planting (Mikhov, 1980).

The planting and agrotechnical measures

Manure at a rate of 40 tons per hectare, 120 kg of phosphorus and 150 kg of potash fertilizers (taking into account the influential substance) were applied before the plowing in autumn to the area for the planting of the early-ripening potatoes. The main plowing was carried out after the application of the fertilizers. The area was divided into plots, the shale and ditches were opened for the irrigation there in our experiment before the planting of the early-ripening potatoes. Humus and 25% phosphorus fertilization of the total norm were applied between the furrows before planting. Manual planting of the kinds sprouted tubers of the studied sorts were carried out by us after these measures.

The single shoots appeared early in April, and the massive ones-in the second decade of April according to the sorts in the experimental plot. The first loosening was carried out with growth of 12-15 cm, the second loosening and bushes were lowered after the expiration of 14-16 days. Due to the bud formation and flowering of the plants (and the tuberization also occurs during this period), they are the most responsible periods in the life of the plants, that's why during this period the irrigation of the early-ripening potatoes was carried out once a week, about 50 liters of water per square meter of the soil. Throughout, 6 irrigations were carried out during the vegetation period of the plants. Air humidity also plays an important role during the growth of the fresh potatoes, which should be in the range of 60-70 percent. Potato plants need mineral nutrition during this period, that's why both kinds were fed 25% of the total nitrogen norm, the NPK (16:16:16) was applied during the flowering. It is also very important to observe a certain relation between nitrogen, phosphorus and potassium during the period of the bud formation and flowering. This relation should be 1:0.7-0.9:1.2-1.4 for the early-ripening sorts. Only then can a high quality early-ripening harvest be ensured. Potatoes absorb well nitrogen from any form of the nitrogen fertilizer. The superphosphate and others (and in different forms) from phosphorus fertilizers can be used for it. The chlorine-free potassium sulfate, potassium-magnesia, potash, etc. are considered the best form of potassium fertilizers for the potatoes. It is better to apply potash fertilizers in autumn or early in spring, if chlorine-containing fertilizers are necessary, so that the chlorine-containing part of the chlorine reach to wash out into the lower layers of the soil.

Protective measures were carried out against weeds, diseases and pests in the experimental plot during vegetation. Due to the appearance of the Colorado potato beetle that was observed in the second decade of May, that's why the preparations "Supermetrin+Asetoprid and Rodamil" which were used at the rate of 2.5 kg per 1 ha were used for the fight against them.

Results and Discussion

Phenological observations were made, the time of the initial and mass germination, budding, flowering, formation of botanical fruits, massive yellowing of the plants, and the harvest date of the potato tubers were noted in both potato varieties during the vegetation. Biometric and weight measurements were also performed.

After planting the tubers, about 60-70 days later, we carried out a study of dynamics of the biomass accumulation of the aboveground and underground parts in the different planting schemes of the early ripening potatoes. Plant samples were taken by the digging method during the flowering period depending on the weather conditions and the state of the plants. For the analyzes indicated by us, 5 bushes of the plants were dug out in the diagonal direction of the plot by the package method from each variant. The total mass of the plants, the number and mass of the stems, the number and mass of the tubers were noted for each variant (Table 1). The results are processed according to S.S. Litvinov (2011).

As can be seen from the data presented in Table 1, the planting schemes significantly influence significantly to the dynamics of the biomass accumulation of the above-ground and underground parts of the Amiri-600 and Sevinj potato types to obtain the early-ripening harvest.

Table 1. The dynamics of biomass accumulation and tuberization in Amiri-600 and Sevinj potato types (the average for 2016-2018 in the Absheron SEF).

Sort name	Plsnting scheme, cm	Digging date	Total mass, g	The mass of the aboveground part, g	The mass of the underground part, g	Tuber mass, g	Root mass, g	Stem number, pcs.	Tuber number, pcs.
Amiri-600	70 × 20	23-25.05	770	395	375	350	25	2	8
		07-10.06	1625	660	965	935	30	2	9
		23-25.06	1480	415	1065	1040	25	2	14
	70 × 25	23-25.05	1045	475	570	520	50	4	8
		07-10.06	1630	610	1020	995	25	1	8
		23-25.06	1285	410	875	840	35	2	14
	70 × 30	23-25.05	852	385	467	445	22	2	6
		07-10.06	1760	725	1045	1015	30	2	17
		23-25.06	810	160	650	640	10	2	7
Sevinj	70 × 20	23-25.05	1150	395	755	740	15	7	8
		07-10.06	1425	305	1120	1095	25	6	15
		23-25.06	1015	120	895	885	10	4	12
	70 × 25	23-25.05	775	240	535	525	10	5	6
		07-10.06	1010	235	775	765	10	2	9
		23-25.06	1050	125	925	915	10	6	22
	70 × 30	23-25.05	450	220	230	220	10	4	17
		07-10.06	1260	285	975	955	20	5	21
		23-25.06	1605	255	1350	1330	20	3	26

The data presented in Table 1 show that in all the Amiri-600 potato type planting schemes of the potato sort Amiri-600, the increase in the mass of both aboveground and underground parts was observed, as a result of which the total mass of the plants increased in the second period (07-10.06) of digging. At this time, the biomass of the bushes was increasing and accumulating. Furthermore, some decrease in the mass of the aboveground part and some increase in the mass of the underground part of the plants were recorded on the third date (23-25.06) of digging, i.e. the mass of the tubers increases. The decrease in the mass of the aboveground part of the bushes until the end of the vegetation is apparently associated apparently with the withering away and drying of the vegetative parts (leaves and stems). In Amiri-600 sort the total mass and number of the tubers were higher relative when were planted with a scheme of 70 × 25 cm than in the schemes of 70 × 20 and 70 × 50 cm.

And in terms of dynamics of the biomass accumulation and tuberization in the Sevinj sort, it should be noted that in all 3 planting schemes, the mass of the underground part of the bushes is more comparatively than that of the aboveground part, and an increase of the total biomass of the plant was observed in all 3 digging periods. In this sort, the relation of the mass of the underground part of the plant to the mass of the aboveground part is 1.045-7.46, while this indicator is 0.95-4.06 in the Amiri-600 sort. The comparison of the data obtained according to the total mass of both sorts showed that the biomass of the Amiri-600 sort is higher relative to that of Sevinj sort (approximately 1.032-1.392 times), which can be explained with the peculiarities of the sort.

The Sevinj sort also concedes the sort Amiri-600 according to the mass of the roots, and surpasses rather the mid-ripening sort Amiri-600 according to the quantity of the stems and tubers, perhaps the high productivity of the sort Sevinj was explained with these.

During the research in the experimental plots, the harvest of the early-ripening potatoes was carried out at the end of June (Table 2).

Table 2. The productivity of early-ripening potatoes depending on the planting scheme (the average for 2016-2018).

Variables	Planting schemes, cm	Area repeats, in m ²	The harvest of 3 repeats, in kg	Productivity c/ha
Sort name	70 × 20	75	189	251.4
	70 × 25	75	198	256.7
	70 × 30	75	171	227.4
Amiri-600	70 × 20	75	218	289.9
	70 × 25	75	202	268.6
	70 × 30	75	194	258.0

The data given in Table 2 show that the planting schemes of the zoned potato types Amiri-600 and Sevinj influence significantly their productivity in the irrigation conditions in Absheron. Therefore, the highest potato productivity was observed in Sevinj sort in the 70 × 20 cm scheme, and in Amiri-600 sort in 70 × 25 cm scheme. It should be noted that the lowest productivity was recorded in the 70 × 30 cm scheme in both sorts. It should be noted that in the Sevinj sort the productivity was more relative according to all 3 planting schemes compared to the Amiri-600 sort.

Conclusion


Based on the research carried out by us, we were determined that due to the obtain a high harvest of early ripening potatoes in the irrigated areas of the Absheron economic region of the republic, it is necessary to carry out depending on the varietal characteristics of the plants, that is, according to the scheme 70 × 20 cm and 70 × 25 cm, taking into account the bushiness of the kinds. It is reasonable to plant in the second half of February, taking into account the weather conditions of the year. It should be taken into account that in late plantings, the accumulation of biomass and the tuberization occur in hot weather conditions, which significantly influence significantly to the productivity of the plant.

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