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Ecology Of Formation Of Potato Crop Structure In Household Farms Of Karakalpakstan

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Abstract: In recent years, special attention has been paid in the Republic of Uzbekistan to such an important food crop as potatoes. According to experts, based on consumption levels, this product is truly considered the "second bread" of the population. In this regard, the President of the Republic of Uzbekistan issued Decree No. 2699 dated 08 September 2025, "On Additional Measures to Increase Potato Production and Further Develop Its Seed Industry."

This Decree provides for increasing the sown area to 253,000 hectares by 2030, raising yields to 25–30 t/ha, and achieving a total production volume of 6.3–7.6 million tons.

At the same time, additional measures are being taken in the Republic to enhance the interest of household farm owners in cultivating potatoes and other agricultural crops. This includes the creation of pilot projects and the further scaling of successful initiatives, strengthening cooperation between science and farmers, training programs, and agronomic support.

Thus, the implementation of this Decree will enable the Republic of Uzbekistan to become fully self-sufficient in potato production by 2030.

Keywords: Variety, sowing pattern, household plot, average tuber weight, average weight per bush, yield.

Introduction: Potatoes are a universal crop used as a food product, as well as a fodder and technical crop. In world agriculture, the potato ranks after wheat, rice, and corn in terms of cultivated area. The biochemical composition of potatoes consists of 75% water and 25% dry matter. The dry matter contains 70–80% starch, 2–3% protein, 1% fiber, 0.2–0.3% fat, 1% sugar, and 0.8–1.0% ash [4, p. 12].

At present, potatoes are one of the most frequently consumed products in the Republic of Karakalpakstan; there is no family that does not use this product, and

therefore it is truly considered the "second bread." Practice shows that under our soil and climatic conditions, obtaining yields in the range of 20–30 t/ha is quite realistic.

However, over the past 30 years, due to the restructuring of agricultural production, water scarcity, the influence of environmental factors, lack of access to innovative technologies, and the loss of cultivation skills, the yield of this crop in the Republic has remained within 16–18 centners per hectare.

According to the Ministry of Agriculture of the Republic of Uzbekistan, the current annual demand for potatoes is 4 million tons. It is worth noting that 80% of this demand is met by domestic production.

According to experts, the implementation of Presidential Decree No. 2699 dated September 8, 2025, will enable farmers and household plot owners to obtain 250–300 kg of potatoes from one sotka (100 m²) of land. This amount can meet the annual needs of 6–8 people, contributing significantly to ensuring food security.

Study location:

The field experiment was conducted in 2024–2025 in the Republic of Karakalpakstan, Khojeyli district, in the village of Samankul, at the household plot of Amin Sharapov, located on Tuba Street, house without number.

The region is characterized by a sharply continental climate, aridity, and medium soil salinity. The soils of the experimental plots were classified as meadow–alluvial with low humus content (0.7–0.8%), and poor availability of nitrogen, phosphorus, and potassium. The soil texture was medium loam. Groundwater lies at a depth of 2.5–3.0 m, and irrigation is carried out using water resources of the Amu Darya River.

The total area of the experimental plot was 120 m², of which 60 m² were accounting (measured) plots. The soil of the experimental area is old-irrigated meadow–alluvial with a low level of organic matter and humus content of 0.8–0.9%.

METHODS

The study was organized as a field experiment following the methodology of B.A. Dospekhov (2011) and the "Methodological Guide for Conducting Field Experiments" (Tashkent, 2007). The experiment was laid out in four replications. All variants in the experiment were arranged sequentially in a single-tier pattern, with protective rows left around the perimeter.

Phenological observations and biometric measurements were carried out according to the methodology (1971) of the State Inspection of Uzbekistan for testing agricultural crop varieties. Statistical analysis of yield indicators was performed according to B.A. Dospekhov (1985).

The experimental design included 4 variants, with the first variant serving as the control:

1. 60 × 25 cm — control
2. 70 × 25 cm
3. 80 × 25 cm
4. 90 × 25 cm

The object of the Study:

The object of the study is the early-maturing hybrid potato variety "Belorussian Early," which is zoned for cultivation in the Republic of Uzbekistan. The vegetation period is 85–90 days. Pre-sowing soil preparation included autumn plowing to a depth of 28–30 cm, spring cultivation, and planting.

Results

According to the study, planting of potato tubers in the plots was carried out once the soil accumulated the required temperature of 7–8°C at a depth of 10 cm. This temperature level was reached on March 17, 2022.

The results showed that before the flowering phase, biomass accumulation in the plants was largely determined by planting density per unit area. The experiment demonstrated that both excessive density and insufficient density had a negative effect on plant height, the number of shoots, and the number of forming leaves (compared to the control).

Table No. 1

Dynamics of Biomass Accumulation under Different Planting Patterns

No.	Variant	Plant Height (cm)	Number of Shoots (per plant)	Number of Leaves (per plant)
I replication				
1	60×25	24	23	250

No.	Variant	Plant Height (cm)	Number of Shoots (per plant)	Number of Leaves (per plant)
	(control)			
2	70×25 cm	29	36	340
3	80×25 cm	27	34	327
4	90×25 cm	25	25	272
II replication				
1	60×25 (control)	19	17	169
2	70×25 cm	20	19	243
3	80×25 cm	21	23	195
4	90×25 cm	23	16	177
III replication				
1	60×25 (control)	22	20	200
2	70×25 cm	23	25	261
3	80×25 cm	23	18	203
4	90×25 cm	22	17	196

Table No. 2

Dynamics of Biomass Accumulation depending on Planting Patterns

No.	Variant	Plant Height (cm)	Number of Shoots (pcs)	Number of Leaves (pcs)
1	60×25 (control)	21.6	20.0	206.3
2	70×25 cm	24.0	26.6	281.3
3	80×25 cm	23.6	25.0	241.6
4	90×25 cm	23.3	19.3	215.0

As can be seen from the table, the 70×25 cm planting pattern demonstrated certain advantages compared to the other planting patterns. With this scheme, the number of leaves exceeded the control variant by 75 leaves, which corresponds to 9.7%; the number of shoots increased by 6 shoots, or 8.2%; and plant height was 2.4 cm higher, corresponding to 1.1%.

Based on these results, it can be concluded that for optimal growth, development, and biomass formation, the 70×25 cm planting pattern is preferable.

Table No. 3

Dynamics of Crop Structure

No.	Variant	Number of Plants	Total Tuber Weight (kg)	Average Tuber Weight (g)	Average Weight per Tuber (g)	Yield (t/ha)
I replication						
1	60×25 (control)	5	2.620	524	38	19.91
2	70×25 cm	5	2.740	548	39	21.37
3	80×25 cm	5	2.600	520	39	20.29
4	90×25 cm	5	2.170	434	41	17.79
II replication						
5	60×25 (control)	5	2.150	430	37	15.91
6	70×25 cm	5	2.500	500	40	20.00
7	80×25 cm	5	2.300	460	35	16.10
8	90×25 cm	5	2.100	420	42	17.64
III replication						
9	60×25 (control)	5	2.180	436	35	15.26
10	70×25 cm	5	2.650	530	39	20.67
11	80×25 cm	5	2.600	520	38	19.76
12	90×25 cm	5	2.300	460	41	18.86

Table No. 4

Crop Structure

No.	Variant	Number of Plants	Total Tuber Weight (kg)	Average Tuber Weight (g)	Average Weight per Tuber (g)	Yield (t/ha)
1	60×25 (control)	5	2.316	463	36.6	17.02
2	70×25 cm	5	2.630	526	39.3	20.68
3	80×25 cm	5	2.500	500	37.3	18.72
4	90×25 cm	5	2.190	438	41.3	18.09

From the table, it can be seen that with the 70×25 cm planting pattern, the total tuber weight exceeded the control variant by 0.314 kg, the average tuber weight increased by 63 g, the average weight per tuber by 2.7 g, and yield by 3.66 t/ha. Thus, the conducted experiment demonstrated that planting potatoes according to the 70×25 cm scheme is the most effective under the soil and climatic conditions of Karakalpakstan.

Conclusions

1. Based on the study results, it was established that the plant's available area for nutrition plays a significant role in the formation of plant biomass. In the 70×25 cm planting scheme, the flowering phase showed the highest values in plant height (24.0 cm), number of shoots (26.6), and number of leaves (281), indicating a significant advantage over the control.

2. The experiment showed that both excessive density and insufficient density of plants per unit area negatively affected plant height, number of shoots, number of developing leaves, and yield compared to the control, indicating the high demand of this crop for sufficient nutritional area.

3. The study revealed that a good crop structure is formed under optimal mineral fertilization and available plant area. In our experiment, the optimal structure was observed in the 70×25 cm planting scheme, suggesting that for the growth, development, and yield formation of the potato variety "Belorussian Early," a nutrition area of 1750 cm^2 per plant is required.

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