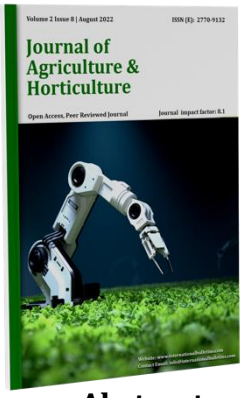

CHOOSING VARIETIES AND HYBRIDS OF WHITE CABBAGE FOR CULTIVATION IN SALT-IMPACTED FIELDS IN KARAKALPAKSTAN

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Abstract.

In 2021-2023, 6 varieties and 14 hybrids of white cabbage were studied to select promising varieties and hybrids suitable for cultivation in salt-affected fields. The Tashkent 10 variety and the Fresko F_1 hybrid served as the standard.

Among the studied hybrids, the yield of the Magnus F_1 hybrid (92.0%) was 100.2% compared to the standard Fresko F_1 hybrid. All other hybrids had yields 30.0-70.0% lower than the standard Fresko F_1 hybrid. The marketable yield of the Navruz variety (91.0%) was 3.0% higher than the standard Tashkent 10 variety, and the heads of cabbage were harvested 20 days earlier. The heads of the Magnus F_1 hybrid ripened 6 to 45 days earlier than all other varieties studied.

Introduction. Currently, the total volume of cabbage production worldwide exceeds 82.8 million tons, with white cabbage production led by: the People's Republic of China (with a per capita consumption of 25.2 kg, a total cultivated area of 1.0 million ha, a yield of 35.0 t/ha, and a total production of 35.1 million tons), India (7.2 kg, 388.0 thousand ha, 23.2 t/ha, 9.56 million tons), South Korea (47.9 kg, 68.2 t/ha, 2.47 million tons), Russia (16 kg, 67.9 thousand ha, 34.7 t/ha, 2.35 million tons), and Uzbekistan (20.8 kg, 12.6 thousand ha, 54.0 t/ha, 680,640 tons).

Research on the selection and cultivation technology of white cabbage (*Brassica capitata*) varieties in salt-affected soils was conducted in 2021-2023 at the experimental field of the Institute of Karakalpakstan Agricultural and Agrotechnological Sciences located in the Nukus district of the Republic of Karakalpakstan and at the “Alako‘z” farm.

In 2021-2023, our research aimed to select varieties and hybrids of white cabbage suitable for cultivation in salt-affected soil conditions, studying 20 varieties. The Tashkent 10 variety was taken as the standard for varieties, and the Fresko F_1 hybrid was taken as the standard for hybrids.

White cabbage varieties and hybrids were planted as 40-day-old seedlings in the open field on March 29-30 in a 70x30 cm scheme, and phenological and biometric observations were made, comparing them with standard varieties. When studying the phenological indicators of the growth period of the variety samples, it was found that the standard Tashkent 10 variety began to form heads of cabbage 37 days after planting the seedlings. In the second control, this process began 39 days after planting in the Fresko F_1 hybrid.

Among the variety samples, the Nadejda and Golden Acre varieties and the Jubilee 217 F_1, Bucharest F_1 hybrids began the head formation stage between 37-38 days, showing little difference from the standard varieties. The Vestri F_1 and Mishutka F_1 hybrids started this process 2-4 days earlier than the standard varieties, taking 35 days. The Gregorian F_1, Green Presto F_1, and Polka F_1 hybrids began head formation 32-33 days after planting, being 6-7

days earlier than the standard Fresko F_1 hybrid and 4-5 days earlier than the Tashkent 10 variety. The Navruz variety and Green Flash F_1, Blue Jays F_1, and Amore F_1 hybrids began head formation 30-31 days after planting, 6-9 days earlier than the standard varieties.

The Emili F_1, Magnus F_1, Start F_1, and Ortus F_1 hybrids formed heads of cabbage between 27-29 days, distinguishing themselves by being earlier than the standard varieties and other samples (10-19 days). Among the studied variety samples, the Begabad variety began head formation 46 days after planting, which was 7-9 days later than the standard varieties.

In salt-affected soil-climatic conditions, white cabbage varieties planted in the spring require 105 days to reach maturity in the standard Tashkent 10 variety. The second standard Fresko F_1 hybrid heads matured in 91-92 days and also belonged to the early-maturing group (Table 1).

Table 1

Phenological indicators of white cabbage varieties grown in salt-affected fields (2021-2023).

№	Varieties and hybrids	Country of origin	Days after planting 40-day-old seedlings			Maturity of yield
			until head formation	first yield	growth period	
1.	Tashkent 10 (n)	Uzbekistan	37±2	105±2	135±2	early-maturing
2.	Nadejda	Russia	38±3	98±3	138±3	early-maturing
3.	Begabad	Uzbekistan	46±2	96±2	136±2	early-maturing
4.	Navruz	Uzbekistan	30±3	85±3	125±3	medium-early.
5	Golden Acre 1432	Russia	37±2	84±2	124±2	medium-early.
6.	Fresko F_1 (n)	Netherlands	39±3	92±3	132±3	early-maturing
7.	Gregorian F_1	Netherlands	32±2	76±2	116±2	medium-early.
8.	Emili F_1	Netherlands	28±3	67±3	107±3	early-maturing
9.	Magnus F_1	Netherlands	27±4	60±2	100±3	early-maturing
10.	Green Flash F_1	Netherlands	30±3	66±3	106±3	early-maturing
11.	Blue Jays F_1	Italy	30±2	70±3	110±3	early-maturing
12.	Green Presto F_1	Japan	32±3	76±2	116±3	medium-early
13.	Amore F_1	Germany	31±2	75±2	115±2	medium-early.
14.	Jubilee 217 F_1	Russia	38±2	98±3	138±2	early-maturing
15.	Polka F_1	Ukraine	33±3	80±2	120±3	medium-early.
16.	Start F_1	Russia	28±3	68±2	108±2	early-maturing
17.	Ortus F_1	Japan	29±3	66±3	106±3	early-maturing
18.	Vestri F_1	Netherlands	35±2	95±2	135±2	early-maturing
19.	Bucharest F_1	Netherlands	38±2	98±3	138±2	early-maturing
20.	Mishutka F_1	Russia	35±3	100±3	140±3	early-maturing

The varieties created in different soil-climatic conditions may not fully express their specific characteristics when cultivated in other regions. The closer the soil-climatic

conditions are to the biological requirements of the plants, the higher the growth period and productivity; conversely, if the soil-climatic conditions do not meet the biological requirements of the plants, the growth period may change, and productivity may decrease or even cease altogether.

Among the studied variety samples, the Mishutka F_1 hybrid heads matured in 100 days, being 5 days earlier than the standard Tashkent 10 variety and 9-10 days later than the standard Fresko F_1 hybrid, and belonged to the early-maturing group. The Nadejda and Begabad varieties and the Jubilee 217 F_1, Vestri F_1, Bucharest F_1 hybrids had heads that matured in 95-98 days, being 7-10 days earlier than the standard Tashkent 10 variety and 4-7 days later than the standard Fresko F_1 hybrid. The Navruz and Golden Acre 1432 varieties had this indicator at 84-85 days, being earlier than the standard Fresko F_1 hybrid by 7-8 days and 20-21 days earlier than the standard Tashkent 10 variety.

The Gregorian F_1, Green Presto F_1, and Amore F_1 hybrids required 75-76 days for head formation. These hybrids also belonged to the medium-early group, being 15-17 days earlier than the standard Fresko F_1 hybrid. The Emili F_1, Green Flash F_1, Start F_1, and Ortus F_1 hybrids required 66-68 days after planting 40-day-old seedlings. These hybrids were also 24-25 days earlier than the standard Fresko F_1 hybrid. Among the variety samples, the Magnus F_1 hybrid heads matured in 60 days after planting, being 6 to 45 days earlier than the standard and other varieties, distinguishing itself with its early maturity.

When studying the number of free leaves in the plants at the time of head formation, the indicators for all variety samples ranged from 14.5 to 19.7 leaves. In the standard Tashkent 10 variety, the number of free leaves counted during head formation was 19.7 leaves. Among the studied varieties, the number of leaves in the Nadejda and Golden Acre varieties was slightly lower than the standard Tashkent 10 variety by 6.1 - 4.6%, while the Navruz variety was lower by 7.7% and the Begabad variety (16.7 leaves) was lower by 15.3%.

In the standard Fresko F_1 hybrid, the number of free leaves during the harvest period was 17.8 leaves. Among the studied hybrids, the number of leaves during the harvest period for the Green Presto F_1, Vestri F_1, and Bucharest F_1 hybrids was 17.5, 17.3, and 17.4 leaves, respectively, showing little difference from the standard variety, being 2.7 - 3.8% lower. The heads of the Gregorian F_1, Magnus F_1, Green Flash F_1, Amore F_1, Jubilee 217 F_1, and Mishutka F_1 hybrids had a number of leaves ranging from 16.5 to 16.9 leaves, which was 7.4 - 5.1% lower than the standard Fresko F_1 hybrid.

In 2021-2023, the average weight of heads in the standard Tashkent 10 variety was 1249.5 g. Among the studied varieties, the weights of heads in the Nadejda (430.5 g), Golden Acre 1432 (853.0 g) varieties were 31.6 - 65.5% lower, while the Begabad variety (1056.3 g) was 15.6% lower. The average weight of heads in the Navruz variety was 1162.8 g, which was close to the standard variety indicator (93.0%).

When analyzing the hybrids, the average weight of heads in the standard Fresko F_1 hybrid was 1379.0 g, while the fastest-growing Magnus F_1 hybrid had heads weighing 1260.0 g, which was close to the standard indicator (91.3%). The heads of the Gregorian F_1, Emili F_1, and Green Presto F_1 hybrids were 30.4 - 32.8% lower than the standard Fresko F_1 hybrid, while the Vestri F_1, Bucharest F_1, and Mishutka F_1 hybrids were 36.8 - 42.9% lower, and all other hybrids were lower by 36.9 - 83.1% compared to the control.

When analyzing the weight indicators of the heads of the variety samples, the difference in EKF_{05} was on average 25.8 g. The accuracy of the experiment $Sx_{\%}$ was 3.2%, which was reliable.

Soil fertility, optimal climatic conditions, and the application of high agrotechnology can increase the yield of all crop types and varieties by 40-65% or, conversely, decrease it, as stated in scientific sources. White cabbage varieties are classified by the size of their heads: small – 0.5-1.5 kg; medium – 1.5-2.5 kg; and large – over 2.5 kg.

Among the studied variety samples, except for the Nadejda (430.5 g) variety and the Amore F_1 (233.5 g), Jubilee 217 F_1 (321.0 g) hybrids, all other variety samples had heads classified as small (0.5-1.5 kg).

Based on the weight of the heads of white cabbage varieties, the total yield per hectare was determined. In determining the yield, according to the VIR methodology, all plants in the plot were harvested, and heads that were not mature or harvested were separated into marketable and non-marketable. When calculating the yield of the variety samples by years, the regularity in the weight indicators of the heads was repeated. The average yield of the variety samples in 2021 was 40.5 t/ha, in 2022 it was 36.0 t/ha, and in 2023 it was 37.6 t/ha. The difference in yield between the variety samples over the years was 4.3 - 12.0%.

In 2021-2023, the average total yield per hectare ranged from 11.1 to 65.6 t/ha. Some variety samples grew and developed very slowly in salt-affected fields, recording low indicators of productivity over the years.

The average yield of the standard Tashkent 10 variety was 59.5 t/ha. The yield of the Nadejda variety was 20.5 t/ha, which was 65.6% lower than the standard, while the Golden Acre 1432 (40.6 t/ha) variety was 31.8% lower, and the Begabad variety (50.3 t/ha) was 15.5% lower. The yield of the Navruz variety was 55.4 t/ha, which was close to the standard variety yield (93.1%) (see Table 3.9).

When calculating the yield from the hybrids, the highest yield was obtained from the standard Fresko F_1 hybrid (65.6 t/ha), while the lowest yield was obtained from the Amore F_1 (11.1 t/ha) and Jubilee 217 F_1 (15.3 t/ha) hybrids. The Green Flash F_1 (27.4 t/ha), Polka F_1 (27.7 t/ha), Start F_1 (26.3 t/ha), Blue Jays F_1 (25.4 t/ha), and Ortus F_1 (24.0 t/ha) hybrids had total yields that were 57.8 - 64.4% lower than the standard Fresko F_1 yield, while the Vestri F_1 (39.2 t/ha) and Mishutka F_1 (37.4 t/ha) hybrids were 40.3 - 42.9% lower. The Gregorian F_1 (44.6 t/ha), Emili F_1 (45.7 t/ha), Green Presto F_1 (44.1 t/ha), and Bucharest F_1 (41.5 t/ha) hybrids were 30.4 - 36.8% lower than the standard indicator.

The Magnus F_1 hybrid had an average yield of 60.0 tons per hectare over three years, which was close to the total yield of the standard Fresko F_1 hybrid (91.3%) (Table 2).

Table 2

Yield of white cabbage varieties grown in salt-affected fields (2021-2023)

Variety samples	Total yield, t/ha		Marketable yield, t/ha		Non-marketable yield, %
	average	compared to standard, %	t/ha	compared to standard, %	
Tashkent 10 (st)	59.5	100.0	48.9	100.0	18.0
Nadejda	20.5	34.4	10.6	21.7	48.0
Begabad	50.3	84.5	38.7	79.1	23.0
Navruz	55.4	93.1	50.4	103.0	9.0

Golden Acre 1432	40.6	68.2	30.8	62.9	24.0
Fresko F_1 (st)	65.6	100.0	55.1	100.0	16.0
Gregorian F_1	44.6	67.9	37.4	67.8	16.0
Emili F_1	45.7	69.6	38.8	70.4	15.0
Magnus F_1	60.0	91.3	55.2	100.2	8.0
Green Flash F_1	27.4	41.7	17.8	32.3	35.0
Blue Jays F_1	25.4	38.7	15.4	27.9	39.0
Green Presto F_1	44.1	67.2	34.4	62.4	22.0
Amore F_1	11.1	16.9	5.6	10.2	50.0
Jubilee 217 F_1	15.3	23.2	7.7	14.0	50.0
Polka F_1	27.7	42.2	18.1	32.8	34.5
Start F_1	26.3	40.1	16.9	30.7	35.6
Ortus F_1	24.0	36.6	15.3	27.7	36.0
Vestri F_1	39.2	59.7	30.0	54.4	23.5
Bucharest F_1	41.5	63.2	33.6	61.0	19.0
Mishutka F_1	37.4	57.1	27.6	50.0	26.0
EKF_{05}	1.2	-	1.2	-	-
$Sx_{\%}$	3.2	-	4.2	-	-

When analyzing the yield by years, the difference in EKF_{05} was 1.9 - 1.6 - 1.5 tons, with an average of 1.2 tons, and the accuracy of the experiment $Sx_{\%}$ was 4.8 - 4.3 - 4.1%, with an average yield of 3.2% being reliable.

In the standard Tashkent 10 variety, from the yield of 59.5 tons per hectare, 18.0% of the non-marketable yield was separated, resulting in a marketable yield of 48.9 tons. The yield of the Nadejda variety was on average 430.5 g, with the non-marketable yield being more than 48.0%, and the marketable yield was 10.6 t/ha, which was 78.3% lower than the standard indicator. In the Begabad and Golden Acre 1432 varieties, the non-marketable yield was 23.0 - 24.0%, with marketable yields of 38.7 - 30.8 t/ha, which were 20.9 - 37.1% lower than the standard yield. The total yield of the Navruz variety was 6.9% lower than the standard yield, but due to the lower non-marketable yield (9.0%), the marketable yield per hectare was 3.0% higher (50.4 t/ha).

When separating the non-marketable yield from the total yield of the studied hybrids, the standard Fresko F_1 hybrid had a marketable yield (86.0%) of 55.1 t/ha. Although the Magnus F_1 hybrid had a total yield 8.7% or 5.6 tons lower than the standard, due to the lower non-marketable yield (8.0%), the marketable yield was equal to 55.2 t/ha, the same as the standard Fresko F_1 hybrid.

Emili F_1 (45.7–15%=38.8 t/ha), Gregorian F_1 (44.6–16%=37.4 t/ha), Green Presto F_1 (44.1–22.0%=34.4 t/ha), Bucharest F_1 (41.5–19.0%=33.6 t/ha), and Vestri F_1 (39.2–23.5%=30.0 t/ha) hybrids had marketable yields that were 30.0-39.0% lower than the standard Fresko F_1 hybrid. All other hybrids had marketable yields that were 40.0-70.0% lower than the standard Fresko F_1 hybrid.

Conclusion. In salt-affected fields, by analyzing the productivity and yield indicators of early-maturing, medium-early, and medium varieties and hybrids of white cabbage, the following conclusions were drawn. Among the studied varieties and hybrids, the Navruz variety had a total yield that was 6.9% lower than the yield of the standard Tashkent 10 variety, but the marketable yield (91.0%) was 3.0% higher. The heads of cabbage were harvested 20 days earlier.

Among the studied hybrids, the Magnus F_1 hybrid was found to be resistant to salt-affected soil conditions. Although its total yield was 8.7% lower than the standard yield, the marketable yield was higher (92.0%), resulting in a marketable yield per hectare that was 100.2% compared to the standard Fresko F_1 hybrid.

The heads of the Magnus F_1 hybrid ripened 6 to 45 days earlier than all other variety samples studied.

Based on the results of the research conducted on the selection of white cabbage varieties suitable for cultivation in salt-affected fields, it is recommended to plant the early-maturing Magnus F_1 hybrid, Navruz, and the medium-maturing Tashkent 10 variety, and Fresko F_1 hybrid. These varieties and hybrids stand out for their resistance to salt-affected soil-climatic conditions.

References:

1.Mirziyoev Sh. PF-4947 “On the Strategy of Actions for Further Development of the Republic of Uzbekistan”. Presidential Decree. – Tashkent, February 7, 2017.

2.Ibragimov S.B., Shokirov A.J., Selection of white cabbage varieties for summer planting. “Uzbekistan Agricultural Science Bulletin” journal. // “Uzbekistan Agricultural Science Bulletin” journal – Tashkent, 2014. - No. 2 (56). – P. 35-39.

3.Lapasov S.S., Shokirov A.J., The effect of planting dates and optimal planting schemes on the yield of cabbage planted in repeated terms / Innovative approaches in modern science: collection of articles based on the materials of the XLVII International Scientific and Practical Conference “Innovative Approaches in Modern Science”. No. 11 (47). – Moscow, “Internauka”, 2019. – P. 115-119.

4.Shokirov A.J., Lapasov S.S. Establishing the timing and schemes for planting white cabbage (Brassica capitata Lizg.) in late cultivation // Integrated plant protection system against pests and diseases. Plant Protection. Monograph. Germany, 2019. – P. 177-185.

Lapasov S.S., Shokirov A.J., Azimov B.J. Selection of White Cabbage Variety Samples Those are Cultivated in Uzbekistan Conditions // International Journal of Science and Research (IJSR) ISSN (Online): 2319–7064. Volume 6 Issue 11, November 2017. – P. 1999–2002.