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## SELECTION OF HIGH-YIELDING VARIETIES OF LEAFY GREEN VEGETABLE CROPS

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### Abstract

Field experiments conducted in 2022–2023 evaluated 11 varieties of dill, parsley, celery and coriander under early open-field sowing in Uzbekistan. Germination, growth, maturity and yield were assessed. Alligator dill, Nilufar parsley, Atlant stalk celery and Orzu coriander achieved the highest marketable yields within their respective crops, indicating their potential for early-season production.

**Keywords:** Leafy vegetables, early sowing, variety selection, plant growth, maturity, marketable yield.

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### Introduction

In Uzbekistan, it is important to expand the range of leafy green vegetables and to supply the population with fresh vegetable products. Annual leafy greens and aromatic spice plants mature early and tolerate cold well. These features create more opportunities for growing them. To provide the population with fresh greens without interruption, these crops can be sown several times (successive sowing) both in the open field and in protected ground.

Tasks related to this activity are defined in Decree No. PF-36 of the President of the Republic of Uzbekistan of 16 February 2024 "On additional measures to ensure food security in the Republic" and in Resolution No. PQ-136 of 8 April 2025 "On additional measures to increase the export potential of agricultural products and to develop the processing chain".

The export of leafy green vegetables from Uzbekistan to neighbouring countries such as Russia, Kazakhstan and Turkmenistan is increasing. Leafy greens grown in our country are rich in vitamins. To supply fresh, high-quality products in the off-season, it is necessary to select high-yielding varieties for early and late sowing dates, to evaluate the effect of biofertilizers on them, and to determine the optimal planting patterns for transplants. The development of such agrotechnologies is one of the most relevant tasks today.

### Methodology

Experiments were carried out to select promising variety samples of leafy green vegetable crops (dill, parsley, celery and coriander) with valuable economic traits. The research was conducted according to the following methodological guidelines: "Methodology of State Variety Testing of Agricultural Crops", Issue IV: Potatoes, Melons and Vegetable Crops (Moscow: Kolos, 1975); "Methodology of Experimental Work in Vegetable and Melon Growing" (Belik V.F., 1992); "Methodology of Conducting Experiments in Vegetable, Melon and Potato Growing" (Azimov B.J., Azimov B.B., 2002); and "Methodological

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Guidelines for Studying the Collection of Cabbage and Leafy Green Crops (lettuce, spinach, dill)" (1969).

In this experiment, a total of 11 varieties were studied in order to select promising varieties for early-season growing from seed: four dill varieties – Uzbekskiy 243 (st), Orom, Anet and Alligator; two parsley varieties – Nilufar (st) and Saxarnaya; three celery varieties of the leaf, root and stalk types – Serbarg (leaf celery) (st), Kornevoy Gribovskiy (root celery) and Atlant (stalk celery); and two coriander varieties – Orzu (st) and Yantar.

The experiment was conducted in four replications. The recorded plot area was 4.9 m<sup>2</sup> (plot length 3.5 m, width 0.7 m). Seeds were broadcast-sown in two rows on top of the ridge. Depending on the crop, 1.5 to 4 g of seeds per square metre were sown in the first ten days of March.

### Results

Seeds of the leafy green vegetables were sown in the open field in the first ten days of March. They were broadcast-sown in furrows with a row spacing of 70 cm. After sowing, irrigation and crop care were carried out. Until seedlings emerged, the crops were irrigated every 3–4 days.

The growth and development of the plants in the field were monitored through phenological observations and biometric measurements. During the phenological observations, we recorded the field germination of seeds, the appearance of true leaves, the technical maturity of the greens, the first harvest and the length of the growing season up to seed ripening (see Table 1).

The field germination of seeds differed between the crops. Our experience shows that crops with small seeds that are rich in essential oils germinate relatively slowly. According to the observations, field germination of dill varieties ranged from 77 to 82%. Compared with the standard variety Uzbekskiy 243 (77%), the variety Alligator had the highest result (82%), while in the other varieties field germination was 79–81%.

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Field germination of parsley varieties ranged from 78 to 81%. The variety Nilufar showed a result 3% higher than the standard variety Saxarnaya.

**Table 1 Results of phenological observations of leafy green vegetables grown at an early sowing date (2022–2023)**

| №         | Variety                    | Field germination of seeds, % | Days from sowing to:      |                              |               | Growing season (to seed ripening), days |
|-----------|----------------------------|-------------------------------|---------------------------|------------------------------|---------------|-----------------------------------------|
|           |                            |                               | appearance of true leaves | technical maturity of greens | first harvest |                                         |
| Dill      |                            |                               |                           |                              |               |                                         |
| 1         | Uzbekskiy 243 – st         | 77                            | 12                        | 30                           | 32            | 90                                      |
| 2         | Orom                       | 79                            | 11                        | 28                           | 31            | 88                                      |
| 3         | Anet                       | 81                            | 10                        | 28                           | 28            | 86                                      |
| 4         | Alligator                  | 82                            | 10                        | 25                           | 25            | 82                                      |
| Parsley   |                            |                               |                           |                              |               |                                         |
| 1         | Saxarnaya – st             | 78                            | 18                        | 53                           | 56            | 106                                     |
| 2         | Nilufar                    | 81                            | 15                        | 47                           | 50            | 97                                      |
| Celery    |                            |                               |                           |                              |               |                                         |
| 1         | Serbarg (leaf) – st        | 75                            | 26                        | 65                           | 70            | 124                                     |
| 2         | Kornevoy Gribovskiy (root) | 79                            | 25                        | 82                           | 85            | 145                                     |
| 3         | Atlant (stalk)             | 80                            | 24                        | 75                           | 80            | 138                                     |
| Coriander |                            |                               |                           |                              |               |                                         |
| 1         | Yantar – st                | 80                            | 12                        | 35                           | 38            | 94                                      |
| 2         | Orzu                       | 81                            | 11                        | 32                           | 34            | 88                                      |

In our observations of field germination of three celery varieties – Serbarg (leaf) (st), Kornevoy Gribovskiy (root) and Atlant (stalk) – seed germination ranged from 70 to 82%. Compared with the standard variety Serbarg (leaf) (70%), the

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variety Atlant (stalk) had the highest germination rate (80%). In the variety Kornevoy Gribovskiy (root), field germination was 79%.

Field germination of coriander varieties was 80–81%. The variety Orzu showed a result 1% higher than the standard variety Yantar. The relatively low field germination of leafy green vegetable seeds also depends on the year of seed harvest and on storage conditions.

Based on field emergence, the varieties with relatively high seed germination (80–82%) were Alligator (dill), Nilufar (parsley), Atlant (stalk celery) and Orzu (coriander).

Observations of the appearance of true leaves showed that, depending on the variety, true leaves appeared after 10–12 days in dill, 15–18 days in parsley, 24–26 days in celery and 11–12 days in coriander. For this indicator, too, the best results were shown by Alligator (dill), Nilufar (parsley), Atlant (stalk celery) and Orzu (coriander).

We also determined the technical maturity of the greens, that is, the period when the crops become ready for consumption. Depending on the crop and variety, it was reached after 25–30 days in dill, 47–53 days in parsley, 65–82 days in celery and 32–35 days in coriander.

The number of days from sowing to the first harvest is one of the valuable economic traits. It shows whether a crop is early- or late-maturing.

In the experiment, the first harvest of dill varieties took place 25 to 32 days after sowing. The variety Alligator (25 days) matured 7 days earlier than the standard variety Uzbekskiy 243 (32 days). The variety Orom (31 days) was close to the standard, and the variety Anet (28 days) matured 4 days earlier than the standard. The first harvest of parsley took place 56 days after sowing in the standard variety Saxarnaya and 50 days after sowing in the variety Nilufar. Thus, Nilufar matured 6 days earlier than the standard.

In celery, the first harvest of the three varieties took place after 70–85 days. The standard variety Serbarg (leaf) was harvested after 70 days and was the earliest-

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maturing celery variety, because it is a leaf celery. The root variety Kornevoy Gribovskiy was harvested after 85 days, that is, 15 days later than the standard, because it forms a root crop of 200–220 g. The stalk variety Atlant gave its first harvest after 80 days, 10 days later than the standard.

The first harvest of coriander took place 38 days after sowing in the standard variety Yantar and 34 days after sowing in the variety Orzu. This is a good result: Orzu matured 4 days earlier than the standard.

Based on the time of the first harvest, the early-maturing varieties were Alligator in dill (7 days earlier), Nilufar in parsley (6 days earlier), the standard variety Serbarg (leaf) in celery (10–15 days earlier) and Orzu in coriander (4 days earlier).

We also determined the length of the growing season, that is, the period from sowing to seed ripening. In dill varieties, the growing season ranged from 82 to 90 days. The growing season of the variety Alligator (82 days) was 8 days shorter than that of the standard variety Uzbekskiy 243 (90 days). The variety Orom (88 days) was close to the standard, and the growing season of the variety Anet (86 days) was 4 days shorter than the standard.

The growing season of parsley was 106 days in the standard variety Saxarnaya and 97 days in the variety Nilufar. Thus, Nilufar had a growing season 9 days shorter than the standard.

In celery, the growing season of the three varieties ranged from 124 to 145 days. It was 124 days in the standard variety Serbarg (leaf) and 145 days in the root variety Kornevoy Gribovskiy, which is 21 days longer than the standard. In the stalk variety Atlant, it was 138 days, 14 days longer than the standard.

The growing season of coriander was 94 days in the standard variety Yantar and 88 days in the variety Orzu. This means that the growing season of Orzu was 6 days shorter than that of the standard variety.

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Thus, a shorter growing season was found in Alligator in dill (8 days shorter), Nilufar in parsley (9 days), the standard variety Serbarg (leaf) in celery (21 days) and Orzu in coriander (6 days).

During the study of leafy green vegetables grown in the open field, biometric measurements were also carried out (see Table 2). Plant height, weight of one plant, number of leaves and leaf area were measured.

Plant height was measured separately for each crop and variety. In dill, the average plant height ranged from 20.4 to 22.6 cm, and the highest value (22.6 cm) was recorded in the variety Anet. The lowest value (20.4 cm) was recorded in the standard variety Uzbekskiy 243, and in the other varieties it was 21.7–22.5 cm. In parsley, plant height was 25.7 cm in the standard variety Saxarnaya and 30.4 cm in the variety Nilufar, so Nilufar was 4.7 cm taller than the standard.

In celery, plant height of the three varieties ranged from 29.8 to 38.4 cm. It was 31.6 cm in the standard variety Serbarg (leaf) and 29.8 cm in the root variety Kornevoy Gribovskiy, which is 1.8 cm shorter than the standard. The stalk variety Atlant reached 38.4 cm, which is 6.8 cm taller than the standard.

In coriander, plant height was 22.5 cm in the standard variety Yantar and 25.3 cm in the variety Orzu. This shows that Orzu was 2.8 cm taller than the standard variety.

In the experiment, the weight of one plant was also determined. For this, 10 plants were taken and weighed on electronic scales. The results differed between crops and varieties. In dill, the highest value was recorded in the variety Alligator (17 g) and the lowest in the standard variety Uzbekskiy 243 (11 g). In the other varieties, it ranged from 13 to 15 g.

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**Table 2 Results of biometric measurements of leafy green vegetables grown at an early sowing date (at the first harvest) (2022–2023)**

| №                       | Variety                    | Plant height, cm | Weight of one plant, g | Number of leaves, pcs | Leaf area, cm <sup>2</sup> |
|-------------------------|----------------------------|------------------|------------------------|-----------------------|----------------------------|
| <b><i>Dill</i></b>      |                            |                  |                        |                       |                            |
| 1                       | Uzbekskiy 243 – st         | 20.4             | 11                     | 8.6                   | 76.5                       |
| 2                       | Orom                       | 21.7             | 13                     | 9.7                   | 79.8                       |
| 3                       | Anet                       | 22.6             | 15                     | 10.4                  | 80.2                       |
| 4                       | Alligator                  | 22.5             | 17                     | 11.3                  | 84.6                       |
| <b><i>Parsley</i></b>   |                            |                  |                        |                       |                            |
| 1                       | Saxarnaya – st             | 25.7             | 14                     | 10.7                  | 106.4                      |
| 2                       | Nilufar                    | 30.4             | 18                     | 12.4                  | 135.8                      |
| <b><i>Celery</i></b>    |                            |                  |                        |                       |                            |
| 1                       | Serbag (leaf) – st         | 31.6             | 22                     | 12.5                  | 186.5                      |
| 2                       | Kornevoy Gribovskiy (root) | 29.8             | 384                    | 11.7                  | 190.8                      |
| 3                       | Atlant (stalk)             | 38.4             | 108                    | 9.4                   | 195.4                      |
| <b><i>Coriander</i></b> |                            |                  |                        |                       |                            |
| 1                       | Yantar – st                | 22.5             | 10                     | 9.7                   | 110.2                      |
| 2                       | Orzu                       | 25.3             | 12                     | 13.4                  | 121.7                      |

In parsley, the weight of one plant was 14 g in the standard variety Saxarnaya and 18 g in the variety Nilufar, so Nilufar was 4 g heavier than the standard.

In celery, the weight of one plant differed greatly between the three varieties, because each type has its own typical weight. The standard variety Serbag (leaf) weighed 22 g, the root variety Kornevoy Gribovskiy had the highest weight (384 g), and the stalk variety Atlant weighed 108 g. Both varieties were 86–362 g heavier than the standard variety.

In coriander, the weight of one plant was 10 g in the standard variety Yantar and 12 g in the variety Orzu. This shows that Orzu was 2 g heavier than the standard variety.

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The number of leaves per plant in dill varieties ranged from 8.6 to 11.3. The highest number was recorded in the variety Alligator (11.3 leaves), while in the other varieties it was 8.6–10.4.

In parsley, the number of leaves was 10.7 in the standard variety Saxarnaya and 12.4 in the variety Nilufar, which is 1.7 leaves more than the standard. In celery, the difference in leaf number between the three varieties was not large: 12.5 leaves in the standard variety Serbarg (leaf), 11.7 in the root variety Kornevoy Gribovskiy and 9.4 in the stalk variety Atlant. Both varieties had 0.8–3.1 fewer leaves than the standard.

In coriander, the number of leaves was 9.7 in the standard variety Yantar and 13.4 in the variety Orzu. This shows that Orzu had 3.7 more leaves than the standard variety.

Thus, the largest number of leaves per plant compared with the other varieties was found in Alligator in dill (2.7 more), Nilufar in parsley (1.7 more), the standard variety Serbarg (leaf) in celery (0.8–3.1 more) and Orzu in coriander (3.7 more).

Leaf area was also determined in the experiment. For this, the leaf blade of each variety was placed on graph paper and measured. In dill varieties, leaf area ranged from 76.5 to 84.6 cm<sup>2</sup>, with the highest value in the variety Alligator (84.6 cm<sup>2</sup>). In the other varieties, it was 79.8–80.2 cm<sup>2</sup>.

In parsley, leaf area was 106.4 cm<sup>2</sup> in the standard variety Saxarnaya and 135.8 cm<sup>2</sup> in the variety Nilufar, which is 29.4 cm<sup>2</sup> larger than the standard. In celery, leaf area was 186.5 cm<sup>2</sup> in the standard variety Serbarg (leaf), 190.8 cm<sup>2</sup> in the root variety Kornevoy Gribovskiy and 195.4 cm<sup>2</sup> in the stalk variety Atlant. Both varieties exceeded the standard by 4.3–8.9 cm<sup>2</sup>.

In coriander, leaf area was 110.2 cm<sup>2</sup> in the standard variety Yantar and 121.7 cm<sup>2</sup> in the variety Orzu. This shows that Orzu had a leaf area 11.5 cm<sup>2</sup> larger than the standard variety. It should be noted that plant height, leaf number and leaf size of

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some varieties were higher in 2022, while in other varieties they were higher in 2023. Therefore, the analysis is based on average values for the two years.

When the leafy greens were grown from seed in the open field, yield indicators and yield quality were also evaluated. Over the study years, we determined the first harvest of each crop and variety, the number of cuttings per season, the total yield per hectare, the marketable yield and its percentage relative to the standard (see Table 3).

The first harvest of each variety was collected and weighed. The results show that the first harvest differed between crops and varieties. In dill, the first harvest ranged from 1.4 to 2.1 kg/m<sup>2</sup>. The highest value among dill varieties was recorded in Alligator (2.1 kg/m<sup>2</sup>), while in the other varieties it was 1.4–1.9 kg/m<sup>2</sup>.

**Table 3 Yield indicators of leafy green vegetables grown at an early sowing date (2022–2023)**

| №                | Variety                    | First harvest, kg/m <sup>2</sup> | Number of cuttings per season | Total yield, t/ha | Marketable yield, t/ha | Relative to standard, % |
|------------------|----------------------------|----------------------------------|-------------------------------|-------------------|------------------------|-------------------------|
| <b>Dill</b>      |                            |                                  |                               |                   |                        |                         |
| 1                | Uzbekskiy 243 – st         | 1.4                              | 2                             | 27.0              | 26.2                   | 100                     |
| 2                | Orom                       | 1.6                              | 3                             | 28.6              | 28.0                   | 107                     |
| 3                | Anet                       | 1.9                              | 3                             | 29.5              | 28.9                   | 110                     |
| 4                | Alligator                  | 2.1                              | 3                             | 32.0              | 31.0                   | 118                     |
| <b>Parsley</b>   |                            |                                  |                               |                   |                        |                         |
| 1                | Saxarnaya – st             | 1.7                              | 3                             | 33.4              | 32.4                   | 100                     |
| 2                | Nilufar                    | 2.2                              | 4                             | 36.5              | 35.8                   | 110                     |
| <b>Celery</b>    |                            |                                  |                               |                   |                        |                         |
| 1                | Serbarg (leaf) – st        | 1.9                              | 3                             | 38.8              | 38.0                   | 100                     |
| 2                | Kornevoy Gribovskiy (root) | 4.0                              | 1                             | 40.7              | 39.5                   | 104                     |
| 3                | Atlant (stalk)             | 4.2                              | 1                             | 42.8              | 41.8                   | 110                     |
| <b>Coriander</b> |                            |                                  |                               |                   |                        |                         |
| 1                | Yantar – st                | 1.3                              | 2                             | 26.4              | 25.6                   | 100                     |
| 2                | Orzu                       | 1.5                              | 3                             | 29.0              | 28.4                   | 111                     |

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In parsley, the first harvest was 1.7 kg/m<sup>2</sup> in the standard variety Saxarnaya and 2.2 kg/m<sup>2</sup> in the variety Nilufar, which is 0.5 kg/m<sup>2</sup> higher than the standard.

In celery, the first harvest was 1.9 kg/m<sup>2</sup> in the standard variety Serbarg (leaf), 4.0 kg/m<sup>2</sup> in the root variety Kornevoy Gribovskiy and 4.2 kg/m<sup>2</sup> in the stalk variety Atlant. Both varieties yielded 2.1–2.3 kg/m<sup>2</sup> more than the standard.

In coriander, the first harvest was 1.3 kg/m<sup>2</sup> in the standard variety Yantar and 1.5 kg/m<sup>2</sup> in the variety Orzu, which is 0.2 kg/m<sup>2</sup> more than the standard. This indicator is also one of the factors that affect product quality: the larger the first harvest, the greater its share in the total yield.

The number of cuttings per season was also recorded. In dill, the crop was harvested twice in the standard variety Uzbekskiy 243 and three times in all other varieties. In parsley, it was harvested three times in the standard variety Saxarnaya and four times in the variety Nilufar during the growing season.

The number of cuttings per season also differed between celery varieties: the standard variety Serbarg (leaf) was harvested three times, while the other varieties were harvested only once. In coriander, the standard variety Yantar was harvested twice and the variety Orzu three times.

The total yield of the leafy green crops was also determined. In dill, the total yield was 27.0 t/ha in the standard variety Uzbekskiy 243, 28.6 t/ha in Orom, 29.5 t/ha in Anet and 32.0 t/ha in Alligator. Alligator gave the highest yield, 5.0 t/ha more than the standard variety.

In parsley, the total yield was 33.4 t/ha in the standard variety Saxarnaya and 36.5 t/ha in the variety Nilufar, which is 3.1 t/ha more than the standard.

In celery, the total yield was 38.8 t/ha in the standard variety Serbarg (leaf), 40.7 t/ha in the root variety Kornevoy Gribovskiy and 42.8 t/ha in the stalk variety Atlant. Atlant yielded 4.0 t/ha more than the standard variety.

In coriander, the total yield was 26.4 t/ha in the standard variety Yantar and 29.0 t/ha in the variety Orzu, which is 2.6 t/ha more than the standard.

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It is important to determine the share of marketable yield, because the marketable part is the part of the harvest that is suitable for consumption and has good quality for sale. At each harvest, the yield was divided into marketable and non-marketable parts, and each part was weighed. Deformed, rotten and yellowed leaves were separated and weighed as non-marketable yield.

The marketable yield per hectare was calculated as follows: each year, the marketable yield from each plot was weighed and then converted to one hectare. The marketable yield of dill varieties grown from seed in the open field ranged from 26.2 to 31.0 t/ha. It was 26.2 t/ha in the standard variety Uzbekskiy 243, 28.0 t/ha in Orom (107% of the standard), 28.9 t/ha in Anet (110%) and 31.0 t/ha in Alligator (118%). The highest marketable yield was obtained from Alligator: 31.0 t/ha, or 3.8 t/ha (118%) more than the standard.

In parsley, the marketable yield was 32.4 t/ha in the standard variety Saxarnaya and 35.8 t/ha in the variety Nilufar, which is 3.4 t/ha (110%) more than the standard.

In celery, the marketable yield was 38.0 t/ha in the standard variety Serbarg (leaf), 39.5 t/ha (104%) in the root variety Kornevoy Gribovskiy and 41.8 t/ha in the stalk variety Atlant. Atlant gave 3.8 t/ha (110%) more marketable yield than the standard variety.

In coriander, the marketable yield was 25.6 t/ha in the standard variety Yantar and 28.4 t/ha in the variety Orzu, which is 2.8 t/ha (111%) more than the standard.

The results of the study show that, when leafy green vegetables are grown at an early sowing date, a higher marketable yield is obtained from the dill variety Alligator (31.0 t/ha, or 3.8 t/ha more than the standard), the parsley variety Nilufar (35.8 t/ha, or 3.4 t/ha more), the stalk celery variety Atlant (41.8 t/ha, or 3.8 t/ha more) and the coriander variety Orzu (28.4 t/ha, or 2.8 t/ha more).

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### Conclusions

1. At an early sowing date, the following varieties were found to be early-maturing based on the time of the first harvest: Alligator in dill (7 days earlier), Nilufar in parsley (6 days earlier), the standard variety Serbarg (leaf) in celery (10–15 days earlier) and Orzu in coriander (4 days earlier).
2. The largest number of leaves per plant compared with other varieties was found in Alligator in dill (2.7 more), Nilufar in parsley (1.7 more), the standard variety Serbarg (leaf) in celery (0.8–3.1 more) and Orzu in coriander (3.7 more).
3. When leafy green vegetables are grown at an early sowing date, a higher marketable yield was obtained from the dill variety Alligator (31.0 t/ha, or 3.8 t/ha more than the standard), the parsley variety Nilufar (35.8 t/ha, or 3.4 t/ha more), the stalk celery variety Atlant (41.8 t/ha, or 3.8 t/ha more) and the coriander variety Orzu (28.4 t/ha, or 2.8 t/ha more).

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