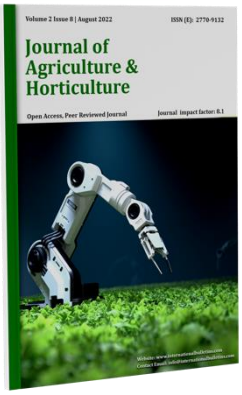

DEVELOPMENT OF RESOURCE-SAVING METHODS FOR QUALITY SEED PRODUCTION OF ONIONS BY LEAVING THE BULBS IN PLACE IN THE CONDITIONS OF TASHKENT REGION, UZBEKISTAN

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https://doi.org/10.5281/zenodo.13893406

Abstract

This article presents the results of experiments conducted on developing a new resource-saving method for producing quality seeds of the onion variety "Istiqbol" by leaving the bulbs in place and burying them. According to the research, the physiological processes in the onion bulbs did not stop, and due to the developed root system, the emergence of flower stalks, flowering time, and seed ripening period extended by 20-34 days compared to the control group. As a result, yields reached 532 kg on August 30, 515 kg on September 9, and 491 kg on September 19, which is 14.2-23.7% higher than the control variety.

Keywords: Istiqbol, variety, onion, seed, germination capacity, productivity, onion bulb, leaf number, yield.

INTRODUCTION

Onion is an important component of the human vegetable consumption ration, known for its healing properties, dietary benefits, digestive aid, bactericidal qualities, and richness in various medicinal compounds and essential oils. Besides daily consumption, it is also among the vegetable types processed in the industry and exported to foreign countries. Onion is a biennial vegetable crop. In the Republic, onions are cultivated on 35,000-40,000 hectares, with an average yield of 25-30 tons per hectare and seed yield of 300-350 kg per hectare.

Considering the high demand for onion seeds and the increasing prices of onion bulbs, it is crucial to develop a resource-saving method for producing seeds from onions. The technology for producing onion seeds typically involves planting seed onions in the spring, with quality care provided based on standard technology. Good quality, large-sized, and characteristic-colored bulbs are selected for seed production. Seed onions are well-stored in dark places at temperatures of 2-8 °C and humidity levels of 70-80%. These well-stored bulbs are then planted.

Of course, significant costs are incurred for sorting, storing, and preparing the land for the produced onions. Our research aims to develop a resource-saving method for seed production to reduce these costs and decrease the price of seed onions.

The purpose of the experiment is to develop a method for producing quality seeds by burying the bulbs without transplanting them at various intervals. According to the research, the mid-ripening variety "Istiqbol," created by the Institute's breeding scientists and registered in the State Registry, was used. The yield and seed quality of the mid-ripening "Istiqbol" variety were determined by leaving the bulbs in place from 2017 to 2024.

RESEARCH CONDITIONS AND METHODS

The research was conducted in the experimental fields of the Scientific Research Institute of Vegetables, Melon Crops, and Potato Farming from 2017 to 2024. The institute is located in the Tashkent district of Tashkent region, north of Tashkent city. The climatic conditions of the area are similar to those of most vegetable-growing farms in Uzbekistan. The unique features of the weather here include sufficient levels of light and warmth, as well as continental variability and dry air. The duration of sunlight is 2700-3000 hours per year, with 360-400 hours in summer and 90-130 hours in winter. The daily temperature fluctuations are high (10-15 °C in winter and 15-20 °C in summer) and can reach up to 30 °C throughout the year.The soil is typical loamy soil that has been irrigated previously, with groundwater located at a depth of 6-7 meters. The humus content in the soil ranges from 0.793% to 0.957%, total phosphorus from 0.131 to 0.157 mg/kg, potassium from 1.843 to 2.195 mg/kg, and nitrogen from 0.131% to 0.092%. The mobile N-NO3 content ranges from 8.1 to 17.9 mg/kg, P2O5 from 12.4 to 28.4 mg/kg, and K2O from 187.5 to 227.4 mg/kg. The soil of the experimental field is not saline.

The objects of this study are onion bulbs and seeds. The research was conducted in both field and laboratory conditions, following methodological guidelines such as "Methodology for Conducting Experiments in Vegetable Growing, Melon Growing, and Potato Cultivation," "Field Experiment Methodology," and "Methods of Agrochemical Soil Analysis in Central Asia."

RESEARCH RESULTS AND DISCUSSION

In the experiments, the seedlings of the "Istiqbol" variety were prepared, and bulbs were produced. Additionally, the method of leaving the maternal bulbs in place and burying them at designated intervals was studied. The maternal bulbs of the mid-ripening "Istiqbol" variety were studied using the following methods from 2015 to 2017 (Table 1).

Table **1**

Dates of burying the maternal bulbs of the "Istiqbol" variety (2017-2024).

Variants	Planting Dates	Experimental Methods
I	30.08	Harvested bulbs left in place and immediately buried
II	09.09	Bulbs left in open field and buried after 10 days
III	19.09	Bulbs left in open field and buried after 20 days
IV	26.09 (control)	The harvested onion bulbs were stored in the warehouse and, after the resting period, were planted in the open field.

Preparation of Onion Seedlings. Onions are primarily grown from seeds. In recent years, the technology for growing onions from seedlings has been developed by the institute's scientists. For preparing onion seedlings for one hectare of land, 3-4 kg of onion seeds are required. In our experiments, we utilized fields that were previously used for late potatoes. After harvesting the late potatoes, the field was thoroughly cleaned of plant residues and

weeds. Good quality organic and phosphorus fertilizers were applied at a rate of 500 m^2. Onion seeds were sown for seedling preparation on November 20-25 in a broadcasting method (scattered) at a spacing of 4x1 cm. Since onion is a cold-resistant plant, its seeds begin to germinate at temperatures of 3-5°C, while seedlings emerge rapidly at 18-20°C. The germinated seedlings can withstand temperatures of 2-3°C, while older plants can endure temperatures of 10-12°C. Nevertheless, to ensure the quality of the onion seedlings, double-layered film covers were placed over the sown seeds. To prevent the emergence of weeds, the soil was treated with the herbicide ENTOSTOP at a rate of 2.3-4.5 l/ha until the seedlings had emerged. Irrigation and fertilization were carried out until the first 10 days of March.

Growing Onions from Seedlings. After 55-60 days of growth, the seedlings, which had a height of 10-12 cm and root length of 2-3 cm, were planted in the ground according to weather conditions between March 10-20. For spring planting of onion seedlings, the land is prepared in the fall. In this case, the experimental field was thoroughly cleaned of residual plants. The soil is loosened to a depth of 20-25 cm, and large clods are crushed. It is then leveled well, and irrigation furrows are laid out. If the preparation work is planned for the spring months, it may be delayed due to the cold weather in March or late spring.

In our experiments, onion seedlings were sown using a three-row tape method based on weather conditions in the first 10 days of March from 2015 to 2017. After the seedlings took well, they were thinned out. The spaces between the rows were loosened to a depth of 15-16 cm, and weeds were removed.

Onion is a root vegetable with a root system located close to the upper layer of the soil. Therefore, it requires a high concentration of essential nutrients near the soil surface. Since the institute's soil is loamy, an average of 300 kg of nitrogen, 220 kg of phosphorus, and 90 kg of potassium were applied per hectare. The water requirement for the crop is especially high during the periods when the seedlings are emerging and the onion bulbs are forming. Only at the end of the growing season and when the onion bulbs are mature does the water requirement decrease slightly. At the institute, due to deep water sources and loamy soil, onions were irrigated every 7-10 days. After the growth of the onion bulbs had stopped, the crop was irrigated twice with a 12-14 day interval, and irrigation was stopped one month before harvest.

Onions are affected by pests and diseases such as onion thrips, tobacco thrips, fall armyworm, false powdery mildew, root rot, mosaic, yellowing, and bulb rot. In our experiments, tobacco thrips and yellowing were observed in onions. For control, the preparations Karate 5% (30-40 ml) and Topaz 10% (12.5-15 ml) were mixed with 60 liters of water and sprayed.

When growing onions from seedlings, the harvest matured in August, yielding 50-60 tons of product per hectare and producing mother onion bulbs. There are several advantages to growing onions from seedlings, including:

- Seed consumption is reduced by 3-4 times.
- The expenses for cleaning and thinning weeds during the growth period of the onions were reduced by 80-90%.
- The total yield harvested from one location in a season increased by two times.
- The water used for irrigation decreased by 2.0-2.5 times.

Typically, when growing onions using the seedling method, they are planted in a four-row tape arrangement (40+10+10+10)/4)x7.5 cm. In this arrangement, 800,000 seedlings are

used per hectare. The continuation of our experiments is related to seed production, and taking into account the retention of onion bulbs in the field, a three-row tape planting scheme (50+10+10):3x7 cm was implemented. This was done because when planting in rows spaced 70 cm apart, it is expected that one bulb from each of the two outer rows and one from the middle row will be harvested in August, while one bulb will be left in the middle row at a spacing of 70x15 cm (Table 2).

Table 2

The performance of the Istiqbol variety of onion bulbs and their germination rates (2017-2024).

Variants	Sowing Dates	Number of Seedlings Planted	Emerged After (days)		Number of Seedlings Emerged		Number of Leaves per Seedling		Leaf Length	
			October-November							
			10 %	75 %	Piece	Control Percentage (%)	Piece	Control Percentage (%)	sm	Control Percentage (%)
I	30.08	160	34	74	158	112,1	4,3	143,3	25	125,0
II	09.09	160	25	62	155	109,9	4,0	133,3	24	120,0
III	19.09	160	21	56	152	107,8	3,3	110,0	23	115,0
IV	26.09 ((Control))	160	17	50	141	100,0	3,0	100,0	20	100,0

The Effect of Different Planting Dates on the Yield and Phenological Indicators of the "Istiqbol" Onion Variety

In all four variants, the residual onion bulbs were irrigated according to the planting dates of the seed bulbs. After the soil was prepared, the ridges were cultivated to a depth of 15-18 cm using machinery, and as a result of re-ridging, the residual onion bulbs were buried at a depth of 6-8 cm.

On September 26, in the control variant, 160 seed bulbs of the "Istiqbol" variety were planted in the 4th row and repeated four times. According to the data, if the germination of onion bulbs planted on August 30 was 10% after 34 days, then 75% germination occurred after 74 days. This means that the time taken for the onion bulbs to germinate in the control variant was 17-24 days longer than in the other variants. In the control variant, on September 26, the number of emerged seedlings was 141; compared to the variant planted on August 30, this was 12.1% higher, 9.9% higher than the variant planted on September 9, and 7.8% higher than the variant planted on September 19.

On September 26, in the control variant, the average number of leaves per onion bulb was 3.0, constituting 100.0%. Compared to the control variant, the number of leaves was higher by 4.3 leaves (43.3%) for the variant planted on August 30, by 4.0 leaves (33.3%) for the variant planted on September 9, and by 3.3 leaves (10.0%) for the variant planted on September 19.

On September 26, in the control variant, the average leaf length per onion bulb was 20 cm (100.0%), whereas it was 25 cm (25% less) in the variant planted on August 30, 24 cm (20.0% less) in the variant planted on September 9, and 23 cm (15.0% less) in the variant planted on September 19. These results were recorded in the experiments. The phenological indicators of the seed onions of the "Istiqbol" variety were studied (Table 3).

Table 3: Phenological Indicators of Seed Onions of the "Istiqbol" Variety (2017-2024)

Variants	Planting Dates	Number of Seedlings Planted	Number of Seedlings Emerged in Spring	Days to Appearance of Flower Stems	Days to Flowering	Days to Seed Maturity
				%	10%	75%
I	30.08	160	155	114.8	214	223
II	09.09	160	151	111.8	205	212
III	19.09	160	148	109.6	202	208
IV (Control)	26.09	160	135	100.0	194	199

The seed bulbs of the "Istiqbol" variety, totaling 160, were planted based on each planting date, and the number of seedlings emerged in March was recorded during the second decade. According to the findings, on September 26, in the control variant, the number of emerged seedlings was 135, constituting 100%. In comparison, the number of seedlings that emerged from the bulbs planted 26 days earlier on August 30 was 155, which was 14.8% higher than the control. This trend was also observed in the variants planted on September 9 and September 19, where the number of seedlings emerged was 9.6-11.8% higher than the control.

The appearance of 10% of flower stems in the "Istiqbol" variety planted on September 26 took 194 days, while 75% appeared after 199 days. Correspondingly, for the variant planted on August 30, the emergence of 10% of flower stems took 214 days, and 75% required 223 days, indicating that the flower stem emergence in this variant took 20-34 days longer compared to the control variant.

For the variant planted on September 9, it took 200 days for 10% of flower stems to appear, and 207 days for 75%. This means that the flower stem emergence for this variant also took 11-13 days longer than the control. In the variant planted on September 19, 10% of flower stems appeared after 198 days, while 75% took 208 days, resulting in 8-9 days longer than the control.

In the control variant planted on September 26, the flowering of 10% required 234 days, and 75% needed 237 days. In comparison, for the variant planted on August 30, 10% of flowering required 256 days and 75% took 261 days, indicating that flowering in this variant took 22-24 days longer than in the control.

For the variant planted on September 9, 10% flowering took 248 days, while 75% took 253 days, resulting in 14-16 days longer flowering duration than the control. This phenomenon was also observed in the variant planted on September 19; however, the flowering duration did not vary significantly compared to earlier planting dates, as 10%

flowering took 239 days and 75% took 242 days, leading to a flowering duration of 4-5 days longer than the control.

In the control variant planted on September 26, 10% of seed maturity took 249 days, while 75% needed 259 days. Correspondingly, for the variant planted on August 30, 10% seed maturity required 274 days and 75% took 285 days, resulting in the seeds from this variant taking 25-26 days longer than the control.

For the variant planted on September 9, it took 265 days for 10% seed maturity and 276 days for 75%, which was 16-17 days longer than the control. In the variant planted on September 19, 10% seed maturity took 257 days, and 75% required 268 days, resulting in 8-9 days longer than the control.

The yield of the seed onions was studied (Table 4).

Table 4 Yield Indicators of the Prospect Variety of Seed Onion (2017-2024)

Variants	Sowing Dates	Harvest Date	Yield, kg/ha	Compared to Control, %
I	30.08	18.06	532	123.7
II	09.09	18.06	515	119.7
III	19.09	18.06	491	114.2
IV	26.09 (Control)	18.06	430	100.0
$НСР_{0,05}$ т/га			**1,5**	
S_x, %			**2,4**	

N.S.R. 0.05 t/ha | | | 1.5 | | **Sx, %** | | | 2.4 | |

The seeds of the Prospect variety of onion were harvested on the 12th of June for seed production. The harvesting times were 258 days for the variant sown on August 30, 249 days for the variant sown on September 9, 238 days for the variant sown on September 19, and 232 days for the control variant sown on September 26.

The seed yield of the Prospect variety, sown on the control date of September 26, was 430 kg, representing 100%. In comparison, the variant sown on August 30 yielded 532 kg, which was 23.7% higher than the control variant. The variant sown on September 9 yielded 515 kg, which was 19.7% higher than the control variant. This trend was also observed in the variant sown on September 19, which yielded 491 kg, representing 14.2% higher yield than the control variant. The higher seed yield in the variants sown earlier can be attributed to a larger number of seedlings that survived the winter, as well as a longer flowering and seed ripening period, resulting in an average yield increase of 14.2% to 23.7% compared to the control variant.

After the seeds were harvested, the germination capacity and viability indicators were determined based on the sowing dates (Table 5).

Table 5 Germination Indicators of the Prospect Variety of Seed Onion (2017-2024)

Variants	Sowing Dates	Weight of 1000 Seeds, g	Compared to Control, %	Germination Capacity, %	Viability, %
I	30.08	3.6	116.1	88.0	98.0
II	09.09	3.5	112.9	86.0	95.0
III	19.09	3.4	109.6	84.0	91.0
IV	26.09 (Control)	3.1	100.0	82.0	88.0

The weight of 1000 seeds in the control variant sown on September 26 was 3.1 grams, representing 100%. In comparison, the variant sown on August 30 had a seed weight of 3.6 grams, which was 16.1% heavier than the control variant. The variant sown on September 9 had a seed weight of 3.5 grams, 12.9% higher than the control variant. This trend was also observed in the variant sown on September 19, with a seed weight of 3.4 grams, 9.6% heavier than the control variant. The germination capacity of the seeds was also determined based on the sowing dates; the control variant sown on September 26 had a germination capacity of 82%, while the variant sown on August 30 had a germination capacity of 88%, which was 6% higher than the control. The variant sown on September 9 had a germination capacity of 86%, 4% higher than the control variant, and the variant sown on September 19 had a germination capacity that was 2% higher than the control variant.

The germination of the seeds of the Prospect variety was carried out in the institute's seed laboratory. For this purpose, 1 kg of seeds, 50 grams of sample, filter paper for germination, and Petri dishes were needed. The temperature in the germination chamber of the thermostat was kept constant at 15-20 °C, with no light present in the internal part of the thermostat. It took 5 days to determine the germination energy and 12 days to determine the viability (Table 6).

Table 6 Determining the Germination of the Prospect Onion Seeds (2017-2024)

Crop	Seed Quantity,	Sample Quantity	Germination Environment	Germination Temperature, +°C		Light Temperature	Determining Time, Days	
				Constant	variable		germination capacity	germinability
Onion	**1,0**	**50**	**F***	**15-20**	**8-12**	**Dark**	**5**	**12**
F* - filter paper								

The yield and effectiveness of onion will only be fully realized when sown with high-quality, selected seeds. Therefore, the institute's seed laboratory is engaged in preparing such seeds and introducing the best varieties. This is why research in this direction was conducted. Seed production is a specialized branch of agriculture aimed at the mass multiplication of high-quality seeds that retain varietal, biological, and yield characteristics. Seed production

performs two interrelated tasks. The first task is the mass multiplication of high-quality seeds of new varieties being introduced into production. However, during the mass multiplication and long-term cultivation process, the variety may weaken, leading to a decrease in its yield quality. Therefore, the second task of seed production is to maintain the varietal purity and yield quality of the seeds of the established crop varieties.

Experiments aimed at developing resource-saving technologies for onion seed production have also emphasized the importance of preserving the varietal purity and yield quality of onion seeds. This method allows for the regular renewal of onion varieties. Variety renewal involves replacing seeds that have weakened in varietal purity and biological quality with new, high-quality seeds characteristic of the variety. The initial seeds produced in the institute for multiplication purposes are elite seeds. The best elite seeds of this variety are derived from selected plants that fully embody the yield properties, high varietal purity, and resistance to diseases and pests, as well as the quality of preparation for sowing. The first generation of seeds obtained from elite seeds is referred to as the first reproduction (R1), while seeds obtained from the first reproduction are referred to as the second reproduction (R2), and so on for the third (R3), fourth (R4), etc.

In variety renewal, the fifth, sixth, and lower reproduction seeds are replaced with elite and first reproduction seeds. High-quality seeds only reveal their advantages when they are of high varietal purity. The sowing and varietal characteristics of seeds are distinguished. The sowing quality of seeds includes indicators such as their purity (degree of contamination), germination capacity, viability, moisture content, weight of 1000 seeds, and degree of susceptibility to diseases and pests. Seed varietal purity refers to the purity and uniformity of the variety.

In our experiments, the weight of 1000 seeds of onion ranged from 3.1 to 3.6 grams, depending on the sowing dates.

Seeds with high varietal purity fully express all the characteristics and traits of the variety. High-quality seeds should possess both high varietal purity and high sowing quality. For example, the varietal purity of elite seeds must be 100% (the admixture of other varieties or forms should not exceed 0.2%), with a high weight of 1000 seeds, not infected with diseases or pests, and a viability of not less than 85-95%.

The importance of high-quality seeds in achieving high crop yields and product quality is on par with the importance of fertilizers and land management practices. The standards that define seed quality are established in state regulations. In this case, seeds are divided into various quality groups, namely classes based on viability and categories based on varietal qualities.

Onion seeds should meet at least the following indicators for sowing quality: Class 1 - purity 99%, viability 95%; Class 2 - 96% and 90%; Class 3 - 95% and 90%. In our research, the seeds of the Prospect variety achieved 1st class purity of 99%, 2nd class purity of 96%, and 3rd class purity of 90%, with viability at 98% for the August 30 sowing date and 95% for the September 9 sowing date (Table 7).

Table 7

Quality Characteristics of the Onion "Istiqlol" Variety (2017-2024)

Crop Type	Class Purity (not less than) %			General mixture of other varieties (not more than) %
	1	2	3	
Onion	99	96	90	4

Practical experience shows that over long-term production, the quality of varieties decreases and yield decreases when seed standards are violated. This situation is determined by biological changes that occur due to the mechanical contamination of the seed and the influence of the external environment, leading to separation and mutational changes.

One of the main reasons for the weakening of varieties is the mixing of other varieties (species) and other crops during sowing, harvesting, transportation, and storage. In our studies, the mixture of other varieties in the general composition of Class 3 did not exceed 4 percent.

Conclusions

1. Between 2017 and 2024, a resource-saving new method of growing seed onions was developed while replacing the "Istiqlol" variety seedling at various times.
2. When the "Istiqlol" variety seedlings were replaced in the soil, the number of seedlings that sprouted in October and November was 7.8–12.1% higher compared to replanting the onion bulbs. The number of leaves per plant increased by 10.0–43.3%, and the leaf length was 15–25% higher compared to the control variant.
3. When the "Istiqlol" variety seedlings were replaced in the soil, the number of plants emerging from winter was 9.6–14.8% higher compared to replanting the onion bulbs.
4. Due to the uninterrupted physiological processes in the onion bulbs and the developed root system, the appearance of flowering stalks, flowering days, and seed ripening period were extended by 20-34 days compared to the control. As a result, the yield on August 30 was 532 kg, on September 9 was 515 kg, and on September 19 was 491 kg, which was 14.2-23.7% higher than the control variety.
5. In the variants where the "Istiqlol" variety seedlings were replaced in the soil, the prolonged flowering and seed ripening period resulted in a weight of 1000 seeds ranging from 3.4 grams to 3.6 grams, which was 9.6-16.1% higher than the control variant, as determined by laboratory analyses.
6. When analyzing the germination of the produced seeds, the germination capacity was 2-6% (84-88%) higher compared to the control variety, and the viability was 3-10% (88-98%) higher, as revealed in laboratory experiments.

In the variants where the "Istiqlol" variety seedlings were replaced in the soil, the profitability level of the produced seeds was examined, and it increased to 138.3% on August 30, 130.7% on September 9, and 120.0% on September 19, demonstrating that the profitability level was 44.5-62.8% higher compared to the control variant under the current technology on September 26.

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