# Effect of planting time and seedling feeding area on the yield and biochemical composition of leek *(Allium porrum* L.*)*

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**Abstract.** In the article, the results of the research carried out in order to study the effect of planting time and feeding area on the biochemical composition of leek (*Allium porrum* L.) are presented with an in-depth scientific analysis. Planting was done by hand in 4x1 cm rows in 7x40x60 cm boxes in the greenhouse on February 20, March 10, and April 1. Seedlings appeared after 10-12 days, on May 1 they were transplanted to open ground. This ensured that the seedlings were 70, 50, and 30 days old. Planting in open ground was carried out in a scheme of 50x10 cm. Harvesting took place on September 1-5. At the end of the research, the data analysis shows that by evaluating the nature of growth of false stem diameter in leek onion plants at different planting periods during the growing season, it can be noted that the feeding area for seedlings is larger and the seedlings when planted early, standard products had earlier maturity and higher product quality.

## 1 Introduction

The effect of seedling quality on the formation of leek yield includes two aspects: firstly, from a biological point of view, that is, the more developed the seedlings, the faster the salable part (false stem) is formed and the probability of obtaining standard products the higher it will be. Second, underripe or overgrown seedlings may break during planting and damage the root system, leading to death and reduced yield. In this regard, the quality of seedlings is closely related to the quality and level of the harvest [1].

Some scientists set the following requirements for the quality of leek seedlings grown in greenhouses: seedling age 50-60 days, number of leaves 3-4 pieces, plant height 15-20 cm, false stem diameter 0.6-0, 8 cm [2-3].

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The nutritional value of leek depends on the amount of energy, mineral and biologically active substances in the plant [4-6].

Among leafy vegetables, this is the only crop that has the ability to accumulate ascorbic acid during storage, the amount of ascorbic acid increases 1.5 times [2, 5].

Leeks are slightly different in chemical composition from onions and perennial onions and are close to garlic in terms of dry matter content. Leek leaves have the following chemical composition (% of dry matter): water - 90.82, total sugar - 0.81; fat - 0.44; nitrogenous substances - 2.10, non-nitrogenous extractives - 3.74; crude fiber - 1.27; ash - 0.82. Water content in onions is 87.62%, total sugar is 0.44; fat - 0.29, nitrogenous substances - 2.83; nitrogen-free extractives - 6.09; raw fiber - 1.49, ash - 1.24 [6].

The false stem of leek also contains thiamin, riboflavin, pantothenic acid, sulfur-preserving essential oils - up to 37 mg/100 g, B1 vitamins accumulate in onions up to 9 mg/100 g [4].

Leeks also contain mineral salts: potassium, calcium, magnesium, phosphorus, iron, sodium, sulfur. It contains especially many potassium salts - up to 254 mg/100 g [6-9].

According to V.A. Kokoreva, O.A. Kostyrkina, the mineral content of leek has not been fully studied, but it has been found that nickel, cobalt, chromium, molybdenum, titanium are present in addition to the main macro and microelements. They determined that nitrates accumulate in the fresh weight of plants from 30 to 50 mg/100 g [7].

As a result of the above work, it became known that the chemical composition varies depending on the variety, growth conditions and weather conditions.

Leek is a universal vegetable crop. It is characterized by high productivity, resistance to adverse environmental factors and valuable nutritional properties [10-16].

## 2 Materials and Methods

Experiments were conducted in 2020-2022 at the "Center for Innovative Developments and Consultation in Agriculture" at the Tashkent State Agrarian University, as well as at the experimental farm site of the Research Institute of Plant Genetic Resources. Experiments were conducted in 4 rows and 4 replications.

Planting was done by hand in 7x40x60 cm boxes in 4x1 cm rows. Planting was carried out in a greenhouse on February 20, March 10, and April 1. Seedlings appeared after 10-12 days. On May 1, they were transplanted to open ground.

In our studies, leek seedlings were 70, 50 and 30 days old when planted in open ground (May 1), and the feeding area of plants of each age was 4, 8, 12, 16 $cm^2$.

During harvesting, according to GOST 522-89 (standard) and the standards adopted in Germany, the weight of the plant, the diameter of the false stem, the height of the plant and the total yield of the product yield, number of leaves, leaf area were taken into account. Chemical analyzes of the plant were carried out in the laboratory [8].

## 3 Results and Discussion

### 3.1 Yield of "Lincoln F1" hybrid

The relationship between the intensity of photosynthesis and productivity is very complex. Productivity is determined more by the size of the photosynthetic apparatus (extensive characteristic) than by work activity (intensive parameter).

This may be partly due to the fact that photosynthetic rate is inherited as a polygenic trait. At the same time, if the active consumers of assimilations (attraction of centers) do not correspond to the flow of increase of assimilations, it is not desirable to improve photosynthesis.

**Table 1.** Effect of planting time and seedling feeding area on yield of "Lincoln F1" hybrid

| Years | Planting dates | Feeding area, $cm^2$ | Yield, t/ha | | The share of the marketable part, % |
|---|---|---|---|---|---|
| | | | total | marketable | |
| 2022 | February 20 | 4 | 79 | 61 | 77 |
| | | 8 | 84 | 63 | 75 |
| | | 12 | 86 | 65 | 76 |
| | | 16 | 88 | 68 | 77 |
| | March 10 (control) | 4 | 64 | 49 | 76 |
| | | 8 | 68 | 50 | 74 |
| | | 12 | 71 | 54 | 76 |
| | | 16 | 73 | 56 | 77 |
| | April 1 | 4 | 56 | 43 | 77 |
| | | 8 | 56 | 43 | 77 |
| | | 12 | 59 | 45 | 76 |
| | | 16 | 61 | 47 | 77 |
| 2023 | February 20 | 4 | 73 | 38 | 52 |
| | | 8 | 79 | 40 | 51 |
| | | 12 | 84 | 43 | 51 |
| | | 16 | 86 | 45 | 52 |
| | March 10 | 4 | 63 | 32 | 51 |
| | | 8 | 64 | 34 | 53 |
| | | 12 | 66 | 35 | 53 |
| | | 16 | 66 | 36 | 55 |
| | April 1 | 4 | 51 | 24 | 47 |
| | | 8 | 52 | 26 | 50 |
| | | 12 | 55 | 29 | 53 |
| | | 16 | 56 | 31 | 55 |

The time of planting and feeding leek seedlings had a significant impact not only on the growth and development of plants, but also on productivity.

The earlier the seedlings in the study were planted, the higher the total and market yield (Table 1). Expressed as a percentage, the difference in the total yield during February and March planting days was 20-25 percent, commodity yield was 26-28 percent, and compared to the April planting time, this difference reached 43-49, 49-52 percent, respectively.

The yield data also showed a preference for seedlings with a larger feeding area at early planting days.

At the time of planting in February, the difference in total yield between the 4 cm and 16 cm feed area was 10.6 t/ha, and the commodity portion was 7.7 t/ha. When planting in March, this difference is 6 and 5.4 t/ha, respectively; it was 5.1 and 5.7 t/ha with April planting period.

But leeks are grown to produce "false stem" that are sold as onions. Plants planted late and with a seedling feeding area of 16 $cm^2$ will have a smaller diameter. During this planting period, the share of the commodity part was on average 62%. Comparing the largest and smallest areas for feeding seedlings in the April planting period, it can be noted that with thickened planting of seedlings, we lost 5.8 t/ha of additional goods.

The highest commodity yield (58.3 t/ha) and percentage of commodity fraction (67%) were obtained during early planting and seedling nutrition from larger area. In this variant, the average weight of the plant was 636 g.

When planted in February, the plants reached marketable size by early July. With planting in March, the beginning of this stage changed by two weeks, with planting in April - by one month, which corresponded to the difference in the age of the planted seedlings.

Seedlings grown with a larger feeding area accelerate the development of plants at the time of early planting by 5-10 days, which allows to obtain standard products earlier. The difference between the diameter of the false stem of the plants grown with the largest and smallest feeding area was 1.3 cm. The influence of seedling cultivation conditions on this indicator decreased in the following planting days, the difference was 0.7 cm during planting in March, and 0.3 cm during planting in April.

Periodic descriptions of plants during the vegetation period made it possible to determine some features of the increase in plant mass.

In the first month after planting, the intensity of growth processes was not so great - the weight of plants in all options increased by 8-10 g in the option with February planting, by 4-5 g in March, and by 2 g in April. It can be noted that the growth of the leaf surface during this period is not very important.

Intensive growth in the mass of leek plants begins in early July in all variants. For July, plant weight increased by 118 g at planting in February and at 4 $cm^2$ feeding area, 119 g at 8 $cm^2$, 121 g at 12 $cm^2$, and 116 g at 16 $cm^2$; with the planting period in March and with a feeding area of 4 $cm^2$ - 117 g, with 8 $cm^2$ - 119 g, with 12 $cm^2$ - 121 g, with 16 $cm^2$ - 123 g; during April planting – 125 g, 131 g, 130 g and 128 g, respectively.

From the beginning of August, the growth of the plant mass decreased significantly, which is related to the decrease in light intensity and temperature and heavy precipitation during this period.

### 3.2 Biochemical composition of "Lincoln F1" hybrid

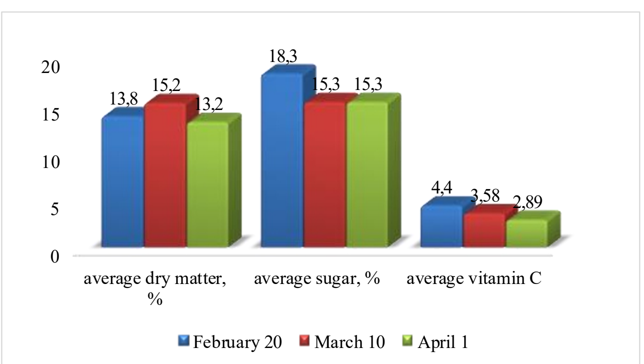


**Fig 1.** Biochemical composition of "Lincoln F1" hybrid

Analyzing the biochemical composition of leeks, it can be noted that there are some differences between planting dates. In terms of dry matter, the March plantings produced even more dry matter than the February plantings, and even more dry matter than the April plantings.

**Table 2.** Biochemical composition of leeks at different planting dates (average for 2022-2023)

| Planting time | Dry matter, % | | | Sugar, % | | | Vitamin C | | |
|---|---|---|---|---|---|---|---|---|---|
| | recurrence | | average | recurrence | | average | recurrence | | average |
| | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| February 20 | 13,4 | 14,2 | 13,8 | 19,5 | 17,1 | 18,3 | 3,99 | 4,84 | 4,4 |
| March 10 | 15,8 | 14,6 | 15,2 | 13,6 | 17,1 | 15,3 | 3,7 | 3,47 | 3,58 |
| April 1 | 13,4 | 13,1 | 13,2 | 16,5 | 14,1 | 15,3 | 2,58 | 3,2 | 2,89 |

However, the content of sugar and ascorbic acid in plants during the first planting period was much higher than in plants planted in March and April.

According to the literature, leek plants contain 13% dry matter, 6.5% sugar and 35 mg/100 g of ascorbic acid. According to our data, leek contains 13-15% dry matter, 2.5-4.5% sugar; 15.3-18.3 mg/100 g of ascorbic acid was found.

## 4 Conclusion

From year to year, the total yield did not differ much, but the differences in the yield of the commodity part became more pronounced.

In 2022 and 2023, the share of the commodity part in the total mass of the plant was 61-77% according to the experimental options, which is related to the relatively uneven rainfall during the period of intensive plant growth. The reason for such a low yield of the commodity part was the cracking of the base of the false stem, which is also associated with uneven rainfall.

Increasing the feeding area of seedlings from 4 $cm^2$ to 16 $cm^2$ made it possible to increase the total yield by 9-14%, and the product yield by 15-17%.

According to the literature, leek plants contain 13% dry matter, 6.5% sugar and 35 mg/100 g of ascorbic acid. According to our data, leek contains 13-15% dry matter, 2.5-4.5% sugar; 15.3-18.3 mg/100 g of ascorbic acid was found.

By evaluating the characteristics of the growth of false stem diameter in leek plants at different planting periods during the growing season, it can be noted that the feeding area for seedlings is larger, and when seedlings are planted early, the maturity date of standard products is earlier and the product quality is higher.

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