Planting dates and seedling age of red cabbage during the spring season in Uzbekistan

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Abstract. The importance of red cabbage for expanding the range of vegetable crops in Uzbekistan is highlighted in this paper. The results of three-year (2018-2020) studies on the comparative assessment of the effectiveness of three spring planting dates (March 5-9, 13-16 and 25-27) at three seedling ages (70, 60 and 50 days) at each planting date were presented. It was revealed that the later the seeds are sown to obtain seedlings for spring culture, the faster the seedlings appear and the more the seedlings form leaves. With the postponement of the timing of planting seedlings, the survival rate of seedlings increases. It has been established that the later the seedlings are planted, the higher the temperatures are the growth of plants and the formation of heads. The most unfavorable temperature conditions are formed when the seedlings are planted on March 25-27, which causes a delay at the beginning of the formation of heads of cabbage, an increase in the number of leaves of a root rosette, a decrease in the setting and average weight of heads of cabbage and their marketability. The best indicators of head set-up, their average weight and marketability, yield per unit area are provided when planting on March 14-16, 70 and 60-day old seedlings. Planting seedlings on March 25-27, seedlings of any age, due to the formation of heads of cabbage at excessively high temperatures, delays the flow of products, reduces the setting, average weight and marketability of heads of cabbage and significantly reduces the yield per unit area. It is recommended for a spring culture to plant on March 14-16 with 70 and 60-day old seedlings and not allow planting at the end of March.

1. Introduction
In recent years, in developed countries, much attention has been paid to the organization of healthy nutrition, in which great importance is attached to the consumption of fresh vegetables in a wide range and throughout the year [1, 2, 3, 4]. In many countries including in Uzbekistan, the concepts and programs of state policy in the field of healthy nutrition are being implemented [5, 6, 7]. It is generally accepted that vegetables are an irreplaceable source of many biologically active substances, many of which are antioxidants. Therefore, it is widely believed that vegetables are not only food, but also medicine [8, 9, 10, 11].
In Uzbekistan, the production of vegetables significantly exceeds the recommended consumption rates. However, the range of vegetable crops is still insufficient and needs to be expanded. Of great interest for expanding the range of vegetable crops is red cabbage, which is widespread in the USA and many European countries, but is unconventional in Uzbekistan. According to many researchers, it surpasses its relative white cabbage in nutritional value, therapeutic and prophylactic properties and a number of economic characteristics, which indicates the advisability of introducing it into culture [12, 13, 14].
Red cabbage in Uzbekistan can be cultivated in the spring-summer and summer-autumn periods, which differ significantly in temperature conditions. In the first season, plant growth occurs with an increase in temperatures, and the formation of heads of cabbage at high summer temperatures, and in the second, plant growth occurs with a decrease in temperature and the formation of heads of cabbage at favorable temperatures. In this regard, the successful introduction of red cabbage into the culture is possible only when the optimal planting dates and the age of seedlings are established when it is cultivated in different seasons [15].

The timing of sowing and planting red cabbage, like any agricultural crop, is determined by many factors: plant heat requirements, the length of the growing season, the purpose of the products, the climatic conditions of the zone, etc. Both excessively early and very late planting dates are dangerous for red cabbage: the former due to insufficient temperatures, the latter due to insufficient growing season [16, 17].

The main method of growing red cabbage is the seedling method. It is generally accepted that the older the seedlings are, the greater the run in the development of plants, and the more early the production begins to arrive. However, overgrown seedlings during transplantation lose more roots and take root worse. This indicates that the planting time and age of red cabbage seedlings should be applied in each specific case, taking into account the prevailing climatic conditions and varietal characteristics [11, 7, 18]. In the literature, there is a lot of information about the timing of planting and the age of red cabbage seedlings in various zones of vegetable growing. This information is quite diverse. In the USA, Germany and Bulgaria, white cabbage, red cabbage and savoy cabbage are combined together, called cabbage. The technology of their cultivation is adopted here the same [16, 17, 19].

In Poland, to provide products throughout the year, early ripening varieties are planted for summer consumption in April, and for autumn-winter consumption in the first half of July. For long-term storage, late varieties are used, planting them in late May - early June [5].

In Ireland, in order to get a harvest from August to November, red cabbage seeds are sown for seedlings with an early crop in February, a second crop in mid-April, an early crop in April, and a second crop in early June [19].

In Ukraine, red cabbage for use in summer is also grown as early cabbage and for use in winter - as late white cabbage. The approximate dates for sowing early cabbage seeds for seedlings are as follows: on the southern coast of the Crimea - January 5-15, in other regions of the Crimea - January 15-20, in the southern Steppe - January 20 - February 5, in the Forest-steppe - January 25 - February 10, in the western regions - January 20-30. Seedlings are planted at 55-60 days of age with 6-7 leaves at the following times: in the steppe regions of the Crimea and the Steppe - March 25-15, in the Forest-steppe - April 5-15, in Polesie - April 10-20 [9, 12, 15].

Seeds of mid-season varieties for 35-40 day old seedlings, planted from April 30 to May 10, are sown on March 20-30. In the Steppe, these dates come 5-15 days earlier, and in Polesie - 5 days later. Seedlings of late varieties are grown in open ground, sowing seeds 40-50 days before planting. Seedlings 35-40 days old are planted in Polesie - June 5-10, in the Forest-steppe - May 25 - June 10, Steppe - June 15-20, in Crimea - July 1-10 [5, 8].

In the literature, there are many reports on the timing of planting and the age of red cabbage seedlings in various zones of vegetable growing in Russia. There are especially many of them in the Non-Black Earth Zone [12, 13].

In Uzbekistan, no studies have been conducted to establish the optimal planting dates and age for red cabbage seedlings. Amateur vegetable growers grow this crop as white cabbage. The lack of research on the development and improvement of elements of the technology for growing red cabbage and the feasibility of expanding the acreage under this crop indicate that the establishment of the optimal planting dates and the age of the planted seedlings is an urgent scientific problem of great practical importance. This prompted us to conduct research to establish the optimal planting dates and the age of red cabbage seedlings when cultivating it in spring culture in the spring-summer period. The aim of the research was to compare and evaluate the effectiveness of overcoming three spring planting dates (5-9, 14-16 and 25-27 March) of red cabbage when using seedlings of three ages (70, 60 and 50 days) for each of them, and to issue reasonable recommendations for production on these important elements of the technology of growing this non-traditional vegetable crop, new for Uzbekistan.
2. Materials and Methods
The research was carried out in 2018-2020 at the Department of Vegetable, Melon and Potato Growing of the Tashkent State Agrarian University. Field experiments were laid on the experimental base of the Research Institute of Plant Genetic Resources, which has soil and climatic conditions typical of the flat regions of the Tashkent region.

The objects of research were seeds, seedlings, plants of the first year of life of the zoned hybrid Primero F1 at three spring planting dates and three seedling ages.

The research work program envisaged the comparison of three planting dates, March 1-5, March 11-15, and March 21-25, when using seedlings of three ages at each planting date: 70, 60 and 50 days. Due to unstable spring weather, the transplanting of seedlings was carried out on March 5-9 (2018 - March 9, 2019 - March 5 and 2020 - March 6), March 14-16 (2018 - 2019 - March 16, 2020 - March 14) and March 25-27 (March 27, 26 and 25, respectively). The age of the seedlings fluctuated downward to 3 days and upward to 5 days.

All the years of the study, the experiments were carried out in four replicates with a plant placement scheme of 70x30 cm. The plot area is 16.8 m². The length of the plot is 6 m, the number of plants on the plot is 80 pcs [18, 19].

The experiments were accompanied by phenological observations during the period of growing seedlings and plants in the field, determining the number of formed leaves of the root rosette and their size, the survival rate of seedlings during planting and thinning of plantings at the end of the growing season; observing the air temperature during the period of seedling survival and head formation, establishing the proportion of plants that formed the head of cabbage and the average weight of the head, taking into account the size and marketability of the crop. The main research results were statistically processed by the analysis of variance using the Microsoft Excel computer program.

3. Results and Discussion
Cultivation of seedlings for spring planting was carried out in a film greenhouse on biological heating. Seed germination and seedling growth took place under conditions of a gradual lengthening of daylight hours and an increase in outside temperature.

It was found that under these conditions, the postponement of the timing of sowing seeds contributed to the acceleration of the emergence of seedlings and increased field germination of seeds (Table 1). When sowing on December 11 and 21, as well as on January 2, seedlings began to appear 15-14 days after sowing, and when sowing on January 11 and 24, 12-11 days later. The emergence of full shoots, respectively, at the named sowing dates appeared after 23-22 days and after 17 days.

Field germination of seeds when grown in cassettes at all sowing dates was high. At later January sowing dates; it was 2-4% higher than at December.

Determination of the number of leaves and their size in seedlings before planting in the field showed that the calendar dates and duration of cultivation have a significant impact on the quality of the planted seedlings.

It was found that the later the sowing is carried out, the more leaves of the same age are formed, and the leaves are formed larger. At the same sowing time, older seedlings had a larger number and larger leaves. This is due to the fact that the later the sowing, the longer the seedling is grown, the more favorable temperatures it grows.

Determination of the survival rate of seedlings when planting in the field showed that it changes depending on the time of planting and the age of the seedlings. The later the seedlings were planted, the higher their survival rate was. Especially poor survival rate of seedlings was at the earliest possible date - March 5-9. Apparently, the temperature during the survival period during planting at this time was insufficient.

With the same planting time at the end of March, no difference in the survival rate of seedlings of different ages was observed. When planted in early and mid-March, younger seedlings were inferior in survival rate to older ones. We can confidently assume that 70-72 day old seedlings take root no worse than 59-66 and 52-55 days old.
Table 1. The rate of emergence of seedlings, field germination of seeds, quality and survival rate of seedlings at different dates of sowing seeds and duration of growing seedlings (2018-2020)

| Experience options | Planting date | Seedling age, days | Days from sowing to germination | Field germination of seeds, % | Number of leaves before planting seedlings | Leaf size, cm | Air temperature during the survival period of seedlings | Seedling survival, % |
|--------------------|---------------|--------------------|-------------------------------|-------------------------------|------------------------------------------|--------------|-----------------------------------------------|---------------------|
| 1                  | 9, 5, 6 March | 72, 69, 73         | 11.12                         | 15                            | 23                                      | 93.9         | 6.8                                           | 5.0x2.9             | 77.0                |
| 2                  | 63, 59, 63    | 21.12              | 14                            | 23                            | 93.8                                    | 6.1          | 4.3x2.4                                      | 13.8-4.9            | 75.2                |
| 3                  | 52, 48, 49    | 9.01               | 14                            | 22                            | 92.6                                    | 5.0          | 3.3x1.9                                      |                     | 69.4                |
| 4                  | 70, 70, 71    | 21.12              | 14                            | 23                            | 94.1                                    | 7.5          | 5.6x3.3                                      | 95.2                |
| 5                  | 59, 59, 57    | 2.01               | 14                            | 22                            | 91.5                                    | 6.5          | 4.8x2.8                                      | 22.0-12.3           | 93.9                |
| 6                  | 55, 49, 50    | 11.01              | 12                            | 17                            | 91.1                                    | 5.6          | 4.8x2.4                                      | 89.0                |
| 7                  | 71, 69, 67    | 2.01               | 14                            | 22                            | 92.6                                    | 8.3          | 6.1x3.7                                      | 96.8                |
| 8                  | 66, 59, 51    | 11.01              | 12                            | 17                            | 91.4                                    | 7.4          | 5.1x3.2                                      | 20.1-10.6           | 95.6                |
| 9                  | 55, 48, 50    | 24.01              | 11                            | 17                            | 96.2                                    | 6.6          | 4.3x2.9                                      | 96.5                |

In order to eliminate sparseness, a week after disembarkation, seedlings were transplanted into sparse places. Consequently, postponing the timing of sowing seeds to obtain seedlings for a spring culture, due to an increase in daylight hours and an increase in temperature, accelerates the emergence of seedlings, increases field germination of seeds, promotes the formation of more leaves and an increase in their size. An increase in the age of seedlings at the same planting time contributes to the formation of more leaves and an increase in their size.

At different spring planting dates, red cabbage plants develop under different temperature conditions, because there is an increase in temperatures from spring to summer (Table 2).

Temperature observations have shown that the later the planting is carried out, the higher the temperatures are the formation of leaves and the formation of heads. The average daily temperature of the period from planting to the first collection when disembarking seedlings on March 5-9 was about 17-18°C. The most favorable (17.5°C) it was formed when planting on March 14-16, seedlings of 70 days of age. This was due to the earlier onset of the time of the first harvest.

When planted on March 25-27, the average daily temperature of the period from planting to the first harvest was significantly higher (up to 20.4°C). This contributed to an increase in the duration of the setting of heads of cabbage and postponement of the process of formation of heads of cabbage to June, when there were high temperatures.

Differences in temperature conditions during the period of plant growth had a definite effect on the formation of leaves of the root rosette and their size (Table 3).

The number of leaves of the root rosette formed by one plant during planting on March 5-9 and 14-16 by seedlings of any age was practically the same, because the difference between the variants of the experiment was less than the least significant difference (HCP05), i.e. within the error of experience.
small leaves were formed at the last proven planting date of March 25-27, at any seedling age. It was also found that the earlier the planting was carried out, the larger the leaves formed. Particularly, them is greater.

explained by the fact that at later planting dates and at a lower age of seedlings, the formation of heads of Even more of them were formed when planting on March 25-27, seedlings of any age. This, apparently, is

When planting on March 14-16 with seedlings of 60 days of age, more leaves were significantly formed. The number and size of leaves in red cabbage at different spring planting dates and seedling ages

Table 2. Average daily temperature from planting to the first harvest and the duration of the growing season of red cabbage at different spring planting dates

| # | Experience options | Seeding age, days | 2018 | 2019 | 2020 | Average | 2018 | 2019 | 2020 | Average |
|---|------------------|------------------|------|------|------|---------|------|------|------|---------|
| 1 | 9, 5, 6 March    | 72, 69, 3        | 87   | 91   | 86   | 88      | 18.5 | 16.0 | 16.9 | 17.1    |
| 2 | March            | 63, 59, 63       | 89   | 93   | 89   | 90      | 18.5 | 16.3 | 17.3 | 17.4    |
| 3 | 16, 16, March   | 52, 48, 49       | 91   | 95   | 92   | 93      | 18.6 | 16.5 | 17.6 | 17.6    |
| 4 | March            | 59, 59, 57       | 84   | 84   | 87   | 85      | 18.1 | 17.5 | 18.5 | 18.0    |
| 5 | 14               | 55, 49, 50       | 89   | 91   | 90   | 90      | 18.1 | 17.7 | 18.9 | 18.2    |
| 6 | March            | 71, 69, 67       | 94   | 95   | 86   | 92      | 20.4 | 19.2 | 20.0 | 19.9    |
| 7 | 27, 26, March   | 66, 59, 61       | 95   | 96   | 90   | 94      | 20.5 | 19.6 | 20.3 | 20.1    |
| 8 | March            | 55, 48, 50       | 95   | 96   | 96   | 96      | 20.5 | 19.9 | 20.7 | 20.4    |

Average daily temperature from planting to the first harvest and the duration of the growing season of red cabbage at different spring planting dates

Table 3. The number and size of leaves in red cabbage at different spring planting dates and seedling ages

| # | Experience options | Seeding age, days | 2018 | 2019 | 2020 | Average | Leaf size, cm |
|---|------------------|------------------|------|------|------|---------|--------------|
| 1 | 9, 5, 6 March    | 72, 69, 73       | 12.5 | 13.3 | 14.0 | 13.3    | 4.2x2.4       |
| 2 | March            | 63, 59, 63       | 13.3 | 12.8 | 12.8 | 13.0    | 3.5x2.1       |
| 3 | 16, 16, March   | 52, 48, 49       | 12.5 | 12.5 | 11.9 | 12.3    | 2.7x1.7       |
| 4 | March            | 70, 70, 71       | 12.3 | 15.5 | 16.1 | 14.0    | 4.7x2.8       |
| 5 | 14               | 59, 59, 57       | 13.3 | 13.4 | 14.9 | 13.9    | 3.9x2.4       |
| 6 | March            | 55, 49, 50       | 16.5 | 12.5 | 13.6 | 14.2    | 3.4x2.1       |
| 7 | 27, 26, March   | 71, 69, 67       | 18.8 | 18.1 | 18.6 | 18.5    | 4.9x3.1       |
| 8 | March            | 66, 59, 61       | 18.3 | 17.5 | 18.0 | 17.9    | 4.4x2.7       |
| 9 |                 | 55, 48, 50       | 20.5 | 16.6 | 17.0 | 18.2    | 4.0x2.5       |

When planting on March 14-16 with seedlings of 60 days of age, more leaves were significantly formed. Even more of them were formed when planting on March 25-27, seedlings of any age. This, apparently, is explained by the fact that at later planting dates and at a lower age of seedlings, the formation of heads of cabbage due to an increase in temperature begins later and the number of leaves of the root rosette on them is greater.

It was also found that the earlier the planting was carried out, the larger the leaves formed. Particularly, small leaves were formed at the last proven planting date of March 25-27, at any seedling age.
Consequently, the later the planting is done, the higher the temperatures the plants grow. The most unfavorable temperature conditions for leaf formation and plant development are formed when planting on March 25-27 at any age of the sown seedlings. As a result, the formation of heads of cabbage is delayed, the plants form more leaves of the root rosette, but much smaller ones.

Table 4. Setting and average weight of red cabbage heads at different spring planting dates and the age of the planted seedlings

| Experience options | Binding cabbage heads, % | Average weight of cabbages, kg |
|--------------------|---------------------------|-----------------------------|
| # Planting date    | Seeding age, days | 2018 | 2019 | 2020 | Average | 2018 | 2019 | 2020 | Average |
| 1                  | 9, 5, 6 March       | 72, 69, 73 | 66.8 | 86.8 | 91.7 | 81.8 | 1.0 | 1.34 | 1.09 | 1.14 |
| 2                  | 9, 5, 6 March       | 63, 59, 63 | 61.8 | 80.2 | 90.6 | 77.5 | 0.98 | 1.32 | 1.20 | 1.17 |
| 3                  | 52, 49, 49         | 63.0 | 83.9 | 61.9 | 69.6 | 1.24 | 1.39 | 1.42 | 1.35 |
| 4                  | 16, 16, 14 March   | 70, 70, 71 | 86.8 | 93.2 | 90.9 | 90.6 | 1.08 | 1.49 | 1.58 | 1.32 |
| 5                  | 59, 59, 57         | 84.9 | 92.0 | 88.1 | 88.3 | 1.08 | 1.49 | 1.27 | 1.28 |
| 6                  | 55, 49, 50         | 70.6 | 85.8 | 87.0 | 81.1 | 0.98 | 1.27 | 1.07 | 1.11 |
| 7                  | 27, 26, 25 March   | 71, 69, 67 | 43.7 | 71.0 | 83.1 | 65.9 | 0.55 | 0.94 | 0.99 | 0.83 |
| 8                  | 66, 59, 61         | 43.8 | 71.5 | 63.1 | 59.5 | 0.58 | 0.95 | 0.96 | 0.83 |
| 9                  | 55, 48, 50         | 42.1 | 65.2 | 55.9 | 57.4 | 0.51 | 0.88 | 0.78 | 0.72 |

### Parameters

\[ S_{%} = 0.03, 0.01, 0.0 \]

\[ \text{HCP}_{\text{65}} = 0.2, 0.04, 0.02 \]

It was also found that the timing of planting seedlings and their age affect the setting and the average weight of the formed food organs. The best set of heads (81-91%) was distinguished by plants obtained when planting seedlings on March 14-16. When planting at this time, plants grown from seedlings of 70 and 60 days of age were distinguished by a higher set rate (Table 4). Plants grown from seedlings of 50 days of age were inferior to them in terms of head set (81%). Plants obtained from planting on March 5-9 were inferior to plants planted on March 14-16 in terms of head set. They set heads of cabbage on average 81-70% over three years. The superiority of plants planted on March 14-16 over plants planted on March 5-9, we are inclined to explain the fact that they grew at somewhat more favorable (less high) temperatures.

Plants planted on March 25-27 were distinguished by a very low set of heads (57-66%). This appears to have been due to the excessively high June temperatures. With all the planting times tested, there was a tendency to an increase in the setting of heads of cabbage with an increase in the age of the used seedlings.

When determining the average weight of a head of cabbage, it was revealed that the largest food organs were formed by planting on March 5-9 with 50 day old seedlings and planting on March 14-16 with 70 and 60 day seedlings. Planting seedlings on March 25-27 reduced the average weight of heads of cabbage. This was especially evident when using the youngest seedlings. The difference in the average weight of the head of cabbage between plants from the planting on March 25-27 and plants of earlier plantings was significant, it exceeded the NSR. A clear regular dependence of the average weight of the head of cabbage on the age of the seedlings was not observed at the same time of planting seedlings.
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Determination of the yield of marketable heads of cabbage from the total mass of the crop showed that the later the planting was carried out, the less was the output of marketable heads. It was especially low when planting seedlings on March 25-27. If, when planting on March 5-9, on average for three years, the marketability of the crop was 78-86% and when planting on March 14-16 - 78-80%, then when planting on March 25-27 - 45-49%, i.e. half of the harvest was non-marketable (Table 5).

It should be noted that the yield of marketable heads of cabbage to a certain extent depends on their average weight; the larger the heads of cabbage were formed, the higher was the marketability of the crop. The account of the sparseness of plantings carried out before harvesting made it possible to reveal that in the plantings on March 5-9 and 14-16, the preservation of plants during the growing season was practically the same. Plantings made on March 25-27 during the growing season had a greater loss of plants than earlier plantings. This, apparently, can be explained by the fact that the plants planted on March 25-27 grew for a longer time at high temperatures and were exposed to them for longer.

Consequently, when planting on March 5-9 and 14-16 using any tested seedling age, the set of heads, their average weight, the yield of marketable heads of cabbage from the total crop mass, the survival rate of plants during the growing season are practically the same. Planting on March 25-27 significantly reduces the setting and average weight of heads of cabbage, reduces the output of marketable heads of cabbage from the total crop mass and increases plant losses during the growing season. The influence of the seedling age at the same planting time on these indicators is not clearly manifested.

Comparison of the dates of the first and last harvests made it possible to reveal that the duration of the fruiting period in different years was different. There was no clear regular dependence of the duration of the fruiting period on the planting time and the age of seedlings. However, the timing of planting and the age of the seedlings have a certain effect on the calendar dates for the arrival of the crop. An analysis of the calendar dates for harvesting also showed that the earlier the planting is carried out and the more mature seedlings are used, the earlier the products begin to arrive and the sooner the last harvest ends. At the first harvest, up to 16% of the crop is harvested. The main part (66-80%) of products comes

| Table 5. Output of marketable heads of cabbage and sparse planting before harvesting red cabbage in spring culture |
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| # | Experience options | Output of marketable heads of cabbage, % | Sparseness of planting before harvesting, % |
| --- | --- | --- | --- |
| Plating date | Seedling age, days | 2018 | 2019 | 2020 | Average | 2018 | 2019 | 2020 | Average |
| 1 | 9, 5, 6 March | 72, 69, 73 | 91.8 | 74.9 | 66.2 | 77.6 | 10.6 | 10.3 | 2.2 | 7.7 |
| 2 | 16, 16, 14 March | 63, 59, 63 | 94.7 | 80.1 | 77.2 | 84.0 | 10.0 | 13.1 | 3.1 | 8.7 |
| 3 | 52, 48, 49 | 52, 48, 49 | 95.3 | 85.4 | 76.0 | 85.5 | 9.7 | 13.1 | 2.8 | 8.7 |
| 4 | 70, 70, 71 | 70, 70, 71 | 92.6 | 75.3 | 73.4 | 80.4 | 5.3 | 5.0 | 3.4 | 4.6 |
| 5 | 59, 59, 57 | 59, 59, 57 | 88.8 | 78.2 | 73.2 | 78.1 | 9.1 | 6.5 | 5.0 | 6.9 |
| 6 | 55, 49, 50 | 55, 49, 50 | 87.6 | 77.3 | 70.6 | 78.5 | 15.0 | 11.9 | 15.6 | 10.8 |
| 7 | 71, 69, 67 | 71, 69, 67 | 47.1 | 52.0 | 49.0 | 49.4 | 19.7 | 11.9 | 3.1 | 11.6 |
| 8 | 27, 26, 25 March | 66, 59, 61 | 48.4 | 51.2 | 46.6 | 48.7 | 24.3 | 12.2 | 4.7 | 13.7 |
| 9 | 55, 48, 50 | 55, 48, 50 | 46.2 | 47.3 | 42.6 | 45.4 | 19.1 | 15.1 | 5.3 | 13.2 |
| | $S_A$ | 0.84 | 0.4 |
| | HCP$_{65}$ | 4.9 | 2.3 |
from the second collection. Planting on March 25-27, due to high summer temperatures during the heading period, delays the arrival of early production.

The conducted counts of the total and marketable yield made it possible to establish that the spring planting dates and the age of seedlings have a significant impact on the yield of red cabbage when grown in the spring-summer period.

From research in the past, it is known that head formation in the Primero F1 hybrid takes 40 days. To determine the influence of temperature conditions on the formation of food organs at different planting dates and the age of the planted seedlings, we compared the average daily temperature for a 40-day period before the first harvest.

It was found that the least high temperatures (20.3-20.9°C) during the period of heading were formed when planting on March 5-9 using 70 and 60 day seedlings and when planting on March 14-16, 70 day seedlings, as well as when planting 5-March 9, 50 day old seedlings and March 14-16, 60 day old seedlings (21.2-21.7°C). The highest temperature (23.8-25.2°C) was noted at the landings on March 25-27. At all planting dates, plants grown from younger seedlings formed heads of cabbage at higher temperatures than plants grown from older seedlings. This was due to the later onset of head formation when using younger seedlings.

Taking into account the value of the total and marketable yield, it was found that the largest total and marketable yield during all three years of the study was formed by planting on March 14-16 with 70 and 60 day old seedlings (Table 6). During all three years of research, they reliably surpassed all other variants of experience in yield. The difference in yield of these two variants of the experiment with all other variants was higher than the NDS, that is, significant. The difference in yield between these two options (planting on March 14-16 with 70 and 60 day old seedlings) for two years out of three was less than NDS, i.e. unreliable. Therefore, the yield of these two variants of the experiment should be considered the same, despite the significant difference in the average three-year indicators.

According to the average data from three years of research, the yield of plantings on March 5-9 when using seedlings of any tested age, as well as plantings on March 14-16 using 50 day old seedlings was practically the same and lower than the plantings on March 14-16, 70 and 60 day seedlings. However, the yield of these four variants of the experiment was significantly higher than planting on March 25-27 with any seedling age tested.

Planting on March 25-27 by any seedling age tested gave an extremely low yield. Their total yield averaged over three years was 19.1-25.5 t / ha, and marketable - 8.6-12.8 t / ha, or the total yield compared to planting on March 5-9 was 70 days less in 1, 7-2.2 times, and marketable - 2.4-3.6 times. If the yield of plantings on March 25-27 is compared with the best option (planting on March 14-16 with 70 day old seedlings), then the decrease will be 2.3-3.1 times for the total crop and more than 3.0-5.2 times for the marketable yield.

The superiority of plantings on March 14-16, 70 and 60 day seedlings over all other variants of the experiment, in our opinion, is ensured by better temperature conditions, the formation of larger heads of cabbage, a greater proportion of plants forming a head of cabbage, better plant preservation during the growing season.

The extremely low yield of plantings on March 25-27 by all the tested seedling ages, in our opinion, is due to the growth of plants and the formation of heads of cabbage by them at unfavorable June temperatures, which cause a decrease in the number of plants forming a head of cabbage; the formation of an excessive amount of leaves of the root rosette; delay in tying heads; the formation of very small heads of cabbage and a decrease in plant survival during the growing season. Consequently, the highest yield is formed by plantings on March 14-16 at the seedling age of 70 and 60 days. Planting seedlings of any age tested on March 25-27 causes the growth of plants under unfavorable temperature conditions, which reduces the setting of heads of cabbage, reduces the average weight of heads of cabbage, contributes to the formation of an excessive number of leaves of the root rosette and a decrease in their size, delays the flow of crops, reduces the storage of plants during the growing season and as a result, it significantly reduces the yield and commercial quality of the crop.
4. Conclusions
When growing seedlings for spring planting dates, postponing the time for sowing seeds in a greenhouse, due to lengthening daylight hours and an increase in temperature, accelerates the emergence of seedlings, increases field germination of seeds, promotes the formation of more leaves in seedlings and an increase in their size. The postponement of the timing of planting seedlings helps to increase the survival rate of the planted seedlings.

The later the planting takes place, the higher the temperatures the plants grow and the heads form. At the same time, the most unfavorable conditions are formed when planting on March 25-27, which causes a delay in the formation of heads of cabbage, the formation of a larger number of leaves of the root rosette, with a decrease in their size, a decrease in the setting and average mass of heads of cabbage, a delay in the formation of heads and a decrease in their average weight.

The best indicators of head set-up, their average weight, the yield of marketable heads of cabbage from the total weight of the crop, the preservation of plants during the growing season are provided when planting on March 14-16, 70 and 60 day old seedlings. When landing on March 25-27, all these indicators deteriorate. The influence of the seedling age at the same planting time on these indicators is not clearly manifested.

In the spring planting, an earlier arrival of products is ensured with earlier planting and more mature seedlings. Planting on March 25-27, due to late planting and high temperatures, significantly delays the arrival of early products. The highest yield is formed by planting on March 14-16 with 70 and 60 day old seedlings. Planting seedlings of any age tested on March 25-27 causes the growth of plants and the formation of heads of cabbage at excessively high temperatures, which significantly reduces the yield and marketability of the crop. At the end of the experiment, it is highly recommend to the production of red cabbage in the spring culture to plant 70 and 60 day old seedlings in mid-March and not allow seedlings to be planted at the end of March.

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