Seed productivity of different Festulolium varieties

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Abstract. Festulolium is the first artificially created Poaceae forage culture. The advantages of this crop are good regrowth capacity, high content of sugars and good winter hardiness. The authors investigated biological features and seed productivity of new varieties of Festulolium of different morphotypes in the conditions of the forest-steppe of the Central Chernozem Region of Russia. The material for research included 6 Festulolium varieties (the Aelita, VIK-90, Viknel, Debut, Izumrudnyi, and Sinta) bred in the Russian plant breeding centers, included in the State Register of the Russian Federation and admitted for cultivation in the territory of the Central Chernozem Region by the State Commission for Cultivation. Field experiments were carried out according to conventional procedures adopted in seed production of perennial grasses. Due to phenological observations the authors define that the duration of the vegetation period of Festulolium depends on the variety and weather conditions during the vegetation season. According to the results of observations it can be noted that in order to form the yield of seeds, the grass stands of different years of vegetation require an average sum of temperatures of 1283-1816°C and 128-181 mm of total precipitation. The most early-ripening variety was the Sinta followed closely by the Izumrudnyi variety. In the second and subsequent years of vegetation the plants of these varieties began to grow earlier than the plants of other varieties in the spring and were the first to reach the stage of full seed maturation in 83-88 days. Such varieties as the Debut, Viknel, VIK-90 were defined as late-maturing; their seeds ripened in 96-102 days. The most intensive linear growth, the greatest plant leafiness, leaf area, net photosynthetic productivity, photosynthetic potential and subsequent seed yield of 735.5 kg was demonstrated by the Izumrudnyi variety. Seed yield of the Sinta variety was slightly less (695.9 kg) followed by the VIK-90, Viknel and Aelita varieties.

1. Introduction

The problem of increasing the production of high-quality fodder and creation of a reliable fodder base is particularly relevant for advanced development of agriculture of the Central Chernozem Region. This is due to the fact that each year in this region about one quarter (2.5-3.5 million hectares) of the total area of arable lands used for the production of succulent and green fodder is allocated to ensure a full supply of the livestock industry with feed.

An important reserve for improving the efficiency of fodder production industry is the introduction and field adaptation of new species and varieties of non-conventional forage grasses and their well-conducted seed breeding. The use of new varieties in agricultural production is one of the most profitable agricultural practices that quickly pay out.

Festulolium (× Festulolium F. Aschers. Et Graebn.) is the first artificially derived fodder crop that was obtained by intergeneric hybridization in the Lolium sp. (ryegrass) and Festuca sp. (fescue) genera.
system. The advantages of *Festulolium* are good recovery ability, high content of sugars and high winter hardiness [1, 2]. At present 19 varieties of *Festulolium* are registered in the State Register [3].

The main objective of creation of *Festulolium* hybrids was to combine several economically valuable features of its parental forms in one plant. From ryegrasses *Festulolium* inherited the ability of the plant to intensively form a large number of folious vegetative shoots after repeated mowing or overgrazing, as well as excellent feeding qualities (high content of sugar and exchange energy) that increase the palatability and digestibility of *Festulolium* herbage used for fodder. From fescues the hybrids of *Festulolium* borrowed good winter hardness, drought resistance, resistance to long-term grazing and trampling [4, 5, 6].

Depending on the selection of parental forms and their morphotypes the herbage of the obtained hybrids is used for the preparation and conservation of various types of feeds, both in pure form and in grass mixtures grown on cultural haylands and pastures [7, 8, 9, 10, 11].

However, despite its high yields and excellent feeding qualities *Festulolium* is not yet widespread in the fodder production industry of the Central Chernozem Region due to the insufficient knowledge of biology, ecology and seed productivity of modern varieties. In this regard, the objective of the presented research was to study the growth, development and seed productivity of *Festulolium* varieties of various morphotypes in the conditions of the forest-steppe of the Central Chernozem Region.

### 2. Materials and methods

The experimental part of the study was performed in 2007-2012 in field trials of the Department of Soil Management, Crop Science and Plant Protection, Voronezh State Agrarian University on the plots of ‘Agrotechnology’ Training, Research and Technological Center (N51.7140416 E39.21545371).

The soil in the experimental plot was leached medium loamy chernozem containing 4.56-5.50% of humus, 78-129 g kg\(^{-1}\) of labile phosphorus (P\(_2\)O\(_5\)), 109-118 mg kg\(^{-1}\) of exchangeable potassium (according to Chirikov), pH\(_{\text{salt}}\) was from 4.9 to 5.1, the total absorbed bases was from 21.3 to 22.2 mg-eq. per 100 g of soil, and the degree of base saturation was of 74-86%.

The preceding crop for *Festulolium* was the vetch-oat mixture harvested for green fodder.

The preparation of soil for sowing was conventional for creating seed herbage of perennial grasses in the Central Chernozem Region.

The object of research included six *Festulolium* varieties of different morphotypes: the Aelita, VIK-90, Viknel, Debut, Izumrudnyi, and Sinta. These varieties were created in the Russian plant breeding centers, included into the State Register of the Russian Federation, and admitted for cultivation in the Central Chernozem Region.

Plants of the studied varieties of *Festulolium* belong to different morphotypes: ryegrass or fescue. According to its biological features the tetraploid VIK-90 variety (meadow fescue × Italian ryegrass) belongs to the ryegrass morphotype. The hexaploid Izumrudnyi variety (tall fescue × annual ryegrass) is of the fescue morphotype. The Debut, Sinta, and Aelita tetraploid varieties were created in the Ural Breeding Center using the parent material obtained from the Laboratory of Cytology and Genetics of V.R. Williams All-Russian Fodder Research Institute [12]. Their morphotype is closer to perennial ryegrass. The Viknel variety (Italian ryegrass × meadow fescue) was bred at Stavropol Research Institute of Agriculture.

The seeding rate was 8.0 kg per hectare with the skip-row planting system (at 30 cm). *Festulolium* seed plantings were harvested by the Sampo-130 harvester at the seed moisture of 40-45% with yield accounting of each registration plot and its subsequent recalculation on the basis of 12% moisture and 100% seed purity.

The experiment was laid in 4 replicates with the randomized location of the plots. The area of the registration plot was 20 m\(^2\). The experiments, relevant records and observations were carried out according to standard Methodological Instructive Regulations (1986) for perennial grasses seed production.
3. Results and discussion

When *Festulolium* is cultivated for seeds, its requirements on the provision of life factors are slightly different than in case of cultivation for fodder purposes. By the type of its development *Festulolium* belongs to winter crops. In the year of sowing it develops only up to the tillering stage forming shortened vegetative shoots. A necessary condition for the transition of plants from the vegetative to the generative stage is the vernalization stage. Therefore, fruiting of *Festulolium* occurs after wintering, i.e. the next year after sowing. The generative shoots are formed in the second and subsequent years both from the overwintered shoots and shoots that appear in spring.

In the conditions of coverless early spring sowing (the third decade of April – the first decade of May) the shoots of *Festulolium* appears on Day 12-15. On Day 4-6 after germination the first true leaf appears, and the second leaf appears after 9-12 days. In the stage of 4-5 true leaves the first side shoot appears.

The parameters of field germination of the studied *Festulolium* varieties differed only slightly, but there were significant changes depending on the weather conditions of the year when the herbage was established (Table 1).

| Variety   | Field germination, % | Density of seedlings, pcs per m² | Plant death over vegetation, % | Number of plants, pcs per m² before wintering | Plant survival rate, % before wintering | Number of plants, pcs per m² after wintering | Plant survival rate, % after wintering |
|-----------|----------------------|---------------------------------|-------------------------------|---------------------------------------------|----------------------------------------|---------------------------------------------|-----------------------------------------|
| VIK-90    | 65.0                 | 134.5                           | 11.2                          | 120.9                                       | 89.4                                   | 108.1                                       | 84.0                                    |
| Izumrudnyi| 72.9                 | 141.0                           | 9.4                           | 129.0                                       | 74.0                                   | 117.4                                       | 84.0                                    |
| Sinta     | 67.8                 | 127.1                           | 12.6                          | 112.9                                       | 84.0                                   | 94.9                                        | 84.0                                    |
| Debut     | 62.9                 | 134.7                           | 10.9                          | 121.4                                       | 91.4                                   | 110.9                                       | 87.6                                    |
| Viknel    | 69.7                 | 139.4                           | 20.4                          | 115.8                                       | 87.6                                   | 101.5                                       | 87.6                                    |
| Aelita    | 72.3                 | 140.0                           | 15.9                          | 120.7                                       | 88.2                                   | 106.5                                       | 88.2                                    |
| LSD₀.₅    | -                   | 3.0-5.7                         | -                             | 3.8-6.5                                      | -                                     | 2.8-7.6                                     | -                                       |

Over the period of studies the greatest field germination was observed in the Izumrudnyi and Aelita varieties (72.9% and 72.3%, respectively). For the other studied varieties their field germination varied from 62.9 to 69.7%. The average density of seedlings depending on the variety was 127.1-141.0 pcs per m². The rate of plant death over the vegetation period was the lowest in the Izumrudnyi (9.4%) and Debut (10.9%) varieties, and the highest in the Viknel variety (20.4%).

The grass in the first year of vegetation vigorously bushes over the entire summer cycle. The number of well-developed shoots present since autumn directly influences the successful wintering and crop yield. Before wintering the plants had from 5 to 8 shortened vegetative shoots. Intensive plant growth ceased when the air temperature decreased to 5-7°C.

In the development of the Izumrudnyi hexaploid variety and the VIK-90, Sinta, Debut, Viknel, and Aelita tetraploid varieties the following phenological stages can be distinguished: seedling emergence and tillering in the first year of vegetation; in the second and subsequent years of vegetation – spring regrowth, tillering, stem elongation, earing (paniculation for the Izumrudnyi variety), flowering, and seed maturation.

Phenological observations allowed establishing the characteristics of growth and development of different *Festulolium* varieties. The mass renewal of vegetation of *Festulolium* in the Central Chernozem Region in the year of seed harvesting is observed within the terms close to the date of transition of the average daily air temperature above +5°C. Favorable conditions for tillering were observed at the temperature of +10 ... +15°C. A characteristic feature of the Izumrudnyi variety is the slow emergence
and growth of plants in the first year of vegetation, and early regrowth, intensive formation of large and foliages plantings in the second and subsequent years of vegetation.

Earing (in the ryegrass type) or paniculation (in the fescue type) occurs 9-13 days after the stage of stem elongation. The earing (paniculation) stage is considered to begin when the top of the inflorescence emerges from the upper leaf sheath. The duration of the period of vegetation renewal to earing (paniculation) of *Festulolium* in our experiments was 39-48 days.

*Festulolium* is a cross-pollinated plant (pollinated mainly by the wind). The duration of flowering within one plant is from 2 to 4 days; flowering of plant population is time-expanded and lasts from 8 to 11 days. The observations have shown that in the conditions of the Central Chernozem Region flowering of *Festulolium* occurred when the following amounts of effective temperatures were accumulated (on average): 779-883°C for the Izumrudnyi variety; 928-973°C for the VIK-90 variety; 833-919°C for the Sinta variety; 940-1064°C for the Debut variety; 927-949°C for the Viknel variety; and 876-967°C for the Aelita variety.

The fruiting period of *Festulolium* lasts from 16 to 21 days, and the period from the beginning of flowering to full ripeness of seeds lasts from 24 to 39 days.

The duration of vegetation period of *Festulolium* depended on the variety and weather conditions during the growing season. The Sinta and Izumrudnyi varieties appeared to be the most early-ripening. In the second and subsequent years of vegetation they began to grow earlier than other varieties in the spring and were the first to reach the stage of full seed maturation in 83-88 days. The Aelita variety ripened on Day 92-93 from spring regrowth. The Debut, Viknel and VIK-90 were the most late-ripening varieties; their seeds ripened in 96-102 days. In order to form the yield of seeds, the grass stands of different years of vegetation require an average sum of temperatures of 1283-1816°C.

After seed ripening *Festulolium* begins to regrow and then enters the stage of autumn tillering, during which it begins wintering. For successful wintering plants need to form an adequate supply of nutrients. The viability and durability of *Festulolium* herbage is directly related to the nature of development of its aboveground mass. Seed productivity depends on how favorable the conditions were for plant growth during the period of vegetation.

The studies have shown that the height of *Festulolium* plants, which is determined by the length of generative shoots, is an indirect indicator of productivity of *Festulolium* varieties. According to this indicator, the variation of the studied crop varieties during the years of research was quite strong (V = 31-33%). In the flowering stage the Izumrudnyi variety had the greatest length of generative shoots (105.4-108.9 cm), while in other varieties it did not exceed 47.9-63.2 cm. Despite its height, the Izumrudnyi variety had the lowest degree of lodging of grass stand (7.3-7.7%). The relationship between the length of generative shoots and the degree of lodging was close and negative (r = -0.92).

The leafiness of plants in the period of spring regrowth to tillering varied only slightly by *Festulolium* varieties, since the plantings grew in the same conditions. The Izumrudnyi and Sinta varieties had the greatest leafiness (47-49%), which was 3-9% higher than in other varieties. The leafiness of plants continued increasing until the flowering stage. Its greatest values (56-71%) were noted in the second year of vegetation of *Festulolium*. In the ripening stage there was a slowdown in growth processes: the leafiness of plants did not exceed 26-33%. This was typical for all varieties of all years of vegetation of *Festulolium*. The leafiness of plants and seed productivity of *Festulolium* had an average correlation (r = 0.635-0.772).

During the transition of *Festulolium* to intensive growth (the tillering stage) the varietal specificity of plants for the development of leaf surface was manifested. The largest leaf area was in the Izumrudnyi variety (45.4 thousand m$^2$·ha$^{-1}$); the Sinta variety had a slightly less leaf area (43.2 thousand m$^2$·ha$^{-1}$), and the smallest leaf area among the studied varieties was in the VIK-90 variety (34.4 thousand m$^2$·ha$^{-1}$). This pattern was preserved in further stages of development of all years of vegetation (Table 2).
Table 2. Indicators of photosynthetic activity of different *Festulolium* varieties in the second year of vegetation (averaged for the 2008-2011 period)

| Variety   | Leafiness of plants, %<sup>a</sup> | Leaf area, thousand m<sup>2</sup>ha<sup>-1</sup><sup>1a</sup> | Net photosynthetic productivity, g per m<sup>2</sup> × day<sup>a</sup> | Photosynthetic potential, thousand m<sup>2</sup> × day·ha<sup>-1</sup><sup>b</sup> |
|-----------|----------------------------------|------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| VIK-90    | 57.8                             | 34.4                                          | 2.69                                            | 972                                             |
| Izumrudnyi| 65.1                             | 45.4                                          | 3.68                                            | 1.336                                           |
| Sinta     | 71.2                             | 43.2                                          | 3.14                                            | 1.221                                           |
| Debut     | 67.1                             | 38.9                                          | 2.76                                            | 1.102                                           |
| Viknel    | 55.7                             | 36.5                                          | 2.69                                            | 1.025                                           |
| Aelita    | 64.0                             | 39.3                                          | 2.84                                            | 1.113                                           |
| НСР<sub>05</sub> | 1.1-2.3 | 2.8-3.7 | 0.19-0.52 | - |

<sup>a</sup> – in the flowering stage; <sup>b</sup> – total over the period of vegetation.

Table 3. Structure of *Festulolium* seed grass stand depending on its variety

| Variety   | Length of inflorescence, cm | Number of generative shoots, pcs per m<sup>2</sup> | Number of spikelets per inflorescence, pcs | Number of seeds per inflorescence, pcs |
|-----------|-----------------------------|---------------------------------------------------|------------------------------------------|----------------------------------------|
| 2008-2011, the second year of vegetation | | | |
| VIK-90    | 16.6                         | 679.7                                             | 18.9                                     | 64.9                                   |
| Izumrudnyi| 23.8                         | 813.9                                             | 37.0                                     | 79.9                                   |
| Sinta     | 17.3                         | 725.9                                             | 18.4                                     | 71.6                                   |
| Debut     | 16.5                         | 707.0                                             | 17.5                                     | 62.6                                   |
| Viknel    | 16.7                         | 698.9                                             | 18.5                                     | 66.2                                   |
| Aelita    | 16.4                         | 718.3                                             | 18.7                                     | 67.0                                   |
| LSD<sub>05</sub> | 0.7-0.9 | 6.1-8.7 | 0.8-1.0 | 1.0-2.4 |
| 2009-2012, the third year of vegetation | | | |
| VIK-90    | 16.9                         | 520.2                                             | 17.5                                     | 61.6                                   |
| Izumrudnyi| 23.7                         | 741.6                                             | 35.0                                     | 73.8                                   |
| Sinta     | 16.7                         | 563.3                                             | 17.8                                     | 64.6                                   |
| Debut     | 16.4                         | 539.5                                             | 17.3                                     | 58.2                                   |
| Viknel    | 15.9                         | 537.2                                             | 17.4                                     | 63.3                                   |
| Aelita    | 16.1                         | 552.6                                             | 18.3                                     | 62.3                                   |
| LSD<sub>05</sub> | 0.5-0.9 | 5.1-8.9 | 0.8-1.1 | 1.8-2.4 |
| 2010-2012, the fourth year of vegetation | | | |
| VIK-90    | 15.8                         | 409.7                                             | 16.0                                     | 60.0                                   |
| Izumrudnyi| 23.2                         | 499.0                                             | 32.5                                     | 72.6                                   |
| Sinta     | 16.2                         | 437.3                                             | 16.1                                     | 63.5                                   |
| Debut     | 16.9                         | 430.9                                             | 16.8                                     | 56.2                                   |
| Viknel    | 16.4                         | 427.3                                             | 15.6                                     | 58.7                                   |
| Aelita    | 16.5                         | 444.9                                             | 16.5                                     | 61.1                                   |
| LSD<sub>05</sub> | 0.8-1.1 | 7.7-13.2 | 0.6-0.9 | 2.6-3.4 |

In the second year of vegetation in all stages of development the leaf area of all the studied varieties
of *Festulolium* had a very strong correlation with the seed yield \((r = 0.966-0.986)\). The Izumrudnyi variety stood out among the other varieties with its high photosynthetic potential \((1,336 \text{ thousand m}^2 \times \text{day-ha}^{-1})\). The Sinta \((1,221 \text{ thousand m}^2 \times \text{day-ha}^{-1})\), Aelita \((1,113 \text{ thousand m}^2 \times \text{day-ha}^{-1})\) and Debut \((1,102 \text{ thousand m}^2 \times \text{day-ha}^{-1})\) were slightly inferior. The VIK-90 and Viknel varieties had almost equal, but the lowest photosynthetic potential in all the years of vegetation of seed grass stand \((972-1,025 \text{ thousand m}^2 \times \text{day-ha}^{-1})\).

The net photosynthetic productivity of the studied varieties reached its maximum values in the flowering stage, and then started to decrease with the onset of fruit formation and ripening due to the death of leaves and other parts of the plant. Among the studied varieties of *Festulolium* the highest values of net photosynthetic productivity were observed for the Izumrudnyi variety \((3.68 \text{ g per m}^2 \times \text{day})\). At the same time, the net photosynthetic productivity was very closely correlated with the seed yield \((r = 0.925-0.992)\) in all stages of development of *Festulolium*.

The formation of *Festulolium* productivity elements largely depends on variety (Table 3).

Compared to other varieties, the Izumrudnyi variety formed 11.2-31.8% more generative shoots \((814 \text{ pcs in the second year of vegetation; 742 pcs in the third year of vegetation; and 499 pcs in the fourth year of vegetation})\) and 94% more spikelets in the inflorescence \((37, 35, \text{ and } 33 \text{ pcs, respectively})\). The results of observations established that the number of generative shoots per unit area decreased with the age of plants, and the number of spikelets per plant changed insignificantly.

**Table 4. *Festulolium* seed productivity depending on the variety**

| Variety  | Yield of seeds, kg-ha\(^{-1}\) |
|----------|---------------------------------|
|          | 2008   | 2009   | 2010   | 2011   | 2012   | Average |
| In the second year of vegetation |
| VIK-90   | 634.9  | 578.6  | 218.2  | 499.4  | -     | 482.8   |
| Izumrudnyi | 735.5  | 681.6  | 306.8  | 645.9  | -     | 592.5   |
| Sinta    | 695.9  | 649.3  | 282.9  | 608.9  | -     | 559.3   |
| Debut    | 642.0  | 618.8  | 260.1  | 544.7  | -     | 516.4   |
| Viknel   | 615.9  | 612.1  | 238.6  | 522.9  | -     | 497.4   |
| Aelita   | 659.7  | 649.3  | 255.1  | 575.9  | -     | 535.0   |
| LSD\(05\) | 14.4   | 12.1   | 14.9   | 11.8   | -     |         |
| In the third year of vegetation |
| VIK-90   | -      | 373.3  | 148.4  | 295.4  | 298.4  | 278.9   |
| Izumrudnyi | -      | 592.6  | 247.4  | 628.6  | 526.5  | 498.8   |
| Sinta    | -      | 415.2  | 201.1  | 379.5  | 379.9  | 343.9   |
| Debut    | -      | 407.7  | 160.1  | 334.4  | 317.0  | 304.8   |
| Viknel   | -      | 375.8  | 164.8  | 320.1  | 314.6  | 293.8   |
| Aelita   | -      | 414.8  | 190.6  | 345.6  | 331.1  | 320.5   |
| LSD\(05\) | -      | 12.2   | 14.4   | 12.6   | 15.8   |         |
| In the fourth year of vegetation |
| VIK-90   | -      | -      | 118.1  | 183.6  | 213.6  | 171.8   |
| Izumrudnyi | -      | -      | 217.4  | 278.2  | 307.8  | 267.8   |
| Sinta    | -      | -      | 132.9  | 224.3  | 275.9  | 211.0   |
| Debut    | -      | -      | 117.1  | 187.7  | 232.5  | 179.1   |
| Viknel   | -      | -      | 98.6   | 187.8  | 206.8  | 164.4   |
| Aelita   | -      | -      | 121.4  | 224.2  | 231.3  | 192.3   |
| LSD\(05\) | -      | -      | 11.3   | 14.5   | 17.6   |         |

The size of harvest of *Festulolium* seeds was largely influenced by the cultivated variety and
meteorological conditions during the vegetation period (Table 4). It was noted that all varieties gave the maximum yield in 2008 (from 615.9 to 735.5 kg∙ha⁻¹) and in 2009 (from 578.6 to 681.6 kg∙ha⁻¹).

It was revealed that the lack of moisture had a significant impact on seed yield parameters. In the arid conditions of 2010 the lowest yield of Festulolium seeds was noted being 2.1-2.9 times less compared to the years with more favorable weather conditions. Depending on the variety, the seed yield was 218-306.8 kg∙ha⁻¹ in the second year of vegetation (in 2010), 148.4-247.4 kg∙ha⁻¹ in the third year of vegetation, and 98.6-217.4 kg∙ha⁻¹ in the fourth year of vegetation.

A characteristic biological feature of Festulolium is a decrease in seed yield in the third and especially the fourth year of vegetation. For instance, the seed productivity of the studied varieties decreased by 93-215 kg∙ha⁻¹ (19-42%) in the third year of vegetation, and by 311.0-367.3 kg∙ha⁻¹ (152-276%) in the fourth year of vegetation. The yield of the Izumrudnyi variety decreased over the years to a lesser extent compared to other varieties.

The most productive in all years of vegetation was the Izumrudnyi variety. It gave 592.5 kg∙ha⁻¹ of seeds in the second year of vegetation, 498.8 kg∙ha⁻¹ in the third year of vegetation and 267.8 kg∙ha⁻¹ in the fourth year of vegetation. The yield of the Sinta variety by the years of vegetation was 559.3; 343.9; 98.6; 217.4 kg∙ha⁻¹ and 211.0 kg∙ha⁻¹, respectively. The VIK-90, Viknel and Aelita varieties were less productive.

4. Conclusion
The studies conducted in 2007-2012 showed that the agro-climatic conditions of the forest-steppe of the Central Chernozem Region were favorable for the cultivation of Festulolium for the seeds for all the studied varieties. The overwinter survival of plants was 84-91%. The duration of the vegetation period of Festulolium depended on its variety and weather conditions during the vegetation period. The Sinta and Izumrudnyi appeared to be the most early-ripening varieties. In the second and subsequent years of vegetation their plants began to grow earlier than other varieties in the spring and were the first to reach the stage of full seed maturation in 83-88 days. The Aelita variety was the next in terms of seed maturation: its seeds ripened on Day 92-93 from spring regrowth. The most late-ripening varieties were the Debut, Viknel and VIK-90; their seeds ripened in 96-102 days. In order to form the yield of seeds, the grass stands of different years of vegetation required an average sum of temperatures of 1283-1816°C and 128-181 mm of total precipitation. In the conditions of the Central Chernozem Region the studied varieties of Festulolium were capable of producing rather high yields of seeds. The highest yield (482.8-592.5 kg∙ha⁻¹) was obtained in the second year of vegetation. The most productive in all years of vegetation was the Izumrudnyi variety. It gave 592.5 kg∙ha⁻¹ of seeds in the second year of vegetation, 498.8 kg∙ha⁻¹ in the third year of vegetation and 267.8 kg∙ha⁻¹ in the fourth year of vegetation. In the fourth year of vegetation the yield of seeds of all varieties decreases dramatically (by 152-276%).

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