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# MUSTARD (SINAPIS ALBA L.) IN RAINFED FOOTHILLS EVALUATION OF THE GROWING PERIOD AND VALUABLE ECONOMIC TRAITS OF VARIETIES AND SPECIMENS

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**Abstract:** This article examines the growth, developmental phases, and duration of the vegetation period of mustard (Sinapis alba L.) varieties and specimens in rainfed foothill conditions. The study evaluated the germination and full maturation periods of 20 varieties and samples. Based on the results, promising early-maturing varieties and samples suitable for rainfed conditions were selected.

**Key words:** mustard, Sinapis alba L., rainfed conditions, variety sample, growing season, development phases, early maturity, breeding, starting material, Bakhmal-70.

**INTRODUCTION:** Mustard (Sinapis alba L.) is an oil-bearing and non-traditional crop capable of producing high-quality oil from its seeds, as well as being used as green fertilizer and for other purposes. White mustard belongs to the cabbage family and differs from other oilseed crops in its biological characteristics and cultivation capabilities. The literature notes that mustard seeds contain up to 35-40% high-quality oil and its importance as a honey-producing crop [1].

The growth and development of mustard depends not only on the genetic characteristics of the variety but also on air temperature, soil and air humidity, nutrition levels, disease and pest susceptibility, sowing dates, and sowing rates. Therefore, studying various varieties and samples under specific soil and climatic conditions is important for determining their biological characteristics and selecting promising forms for breeding [2].

Naumkin and Velkova studied the cultivation technology of white mustard and evaluated its biological properties, cultivation conditions, and yield indicators. These studies indicate the need to cultivate mustard in accordance with specific agro-ecological conditions and to account for varietal characteristics [3].

The relatively short growing season of mustard allows for its cultivation at different times. According to Novikov, mustard can be grown from early spring to late autumn due to its short growing season. Mustard planted at early stages forms a well-developed root system and leaf mass in the surface layer of the soil, increasing its ability to compete with weeds [4].

Trubina et al. studied the prospects of white mustard varieties and the possibilities of their use. The authors also emphasize the importance of mustard as a green fertilizer, noting its rapid development in the short term and relatively rapid decomposition in the soil [5].

The duration of the mustard vegetation period is considered one of the important biological characteristics of the variety. According to the data presented in the report, the growing season of white mustard can vary by 8-10 days over the years depending on weather conditions. It has been noted that the level of mineral nutrition also affects plant growth and development, altering the duration of the growing season.

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Studying the duration of the growing season in rainfed conditions is of particular importance. This is because under conditions of limited precipitation and soil moisture, early-maturing varieties and samples can more effectively utilize available moisture and form a harvest in a relatively short period. From this perspective, determining the timing of germination, branching, budding, flowering, and full ripening of mustard varieties and samples is one of the important indicators for breeding.

Therefore, the purpose of this study was to study the duration of the development phases of various varieties and specimens of mustard in the conditions of rainfed foothills and to identify early-maturing and promising starting materials for breeding.

**Research materials and methodology:** Research was conducted in 2026 under rainfed foothill conditions at the Bakhmal Scientific Experimental Station of the Research Institute of Rainfed Agriculture. A total of 20 varieties and samples of mustard (Sinapis alba L.) were studied in the experiment.

Mustard varieties and samples were planted on March 28, 2026. During the study, the growth and development of the varieties and samples were regularly monitored. Phenological observations identified the periods from sowing to germination, from germination to branching, budding, flowering, and full maturity.

When evaluating varieties and samples, primary attention was paid to the duration of their development phases and the growing season. The germination period of each variety and sample was calculated based on the number of days from the date of planting until the appearance of the first seedlings. The duration of subsequent developmental phases was also determined by the number of days between the start and end of the corresponding phase.

In the study, the following development phases of mustard varieties and samples were observed: sowing-emergence, emergence-branching, emergence-budding, emergence-flowering, and emergence-full maturity. The obtained data were subjected to a comparative analysis by variety and sample.

Based on phenological observations, varieties and specimens with a short growing season, early germination, and relatively short maturation periods were identified. These indicators were used as the main criteria for assessing the adaptability of mustard in rainfed mountain conditions and for selecting promising starting materials for breeding.

**Research results and their discussion:Significant** differences were identified in the duration of growth and development phases of mustard varieties and samples (Sinapis alba L.) studied in 2026 under rainfed mountain conditions. The study observed the periods of varieties and samples from sowing to germination, from germination to branching, budding, flowering, and full ripening.

According to the experimental results, the period from planting to germination for the varieties and samples of mustard was 4-9 days. The earliest germinated specimen was the Bakhmal-70 variety, where this period was 4 days. For sample L2019/8 it was 5 days, and for samples L.2019/1 and L2019/19 it was 6 days. For the Nika and Kristal varieties, the germination period was 8 days, and for the Belle variety, it was 9 days.

The period from germination to branching ranged from 23 to 27 days for the varieties and samples. The shortest period was observed in the Bakhmal-70 and L2019/8 samples—23 days. In samples L.2019/5, L.2019/1, and L2019/19, this period was 24 days. In the Nika and Belle varieties, the pre-branching period was 26 and 27 days, respectively, which is slightly longer than in other samples.

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| No. | Names of samples | Sowing germination | Germination | Germination ' | Germination-flowering | Germination ripening |
|---|---|---|---|---|---|---|
| 1 | Nika | 8 | 26 | 39 | 54 | 85 |
| 2 | Belle | 9 | 27 | 40 | 53 | 82 |
| 3 | Crystal | 8 | 25 | 42 | 54 | 81 |
| 4 | Bakhmal 70 | 4 | 23 | 41 | 52 | 80 |
| 5 | L2019/1 | 6 | 24 | 40 | 54 | 78 |
| 6 | L2019/2 | 7 | 25 | 42 | 54 | 83 |
| 7 | L2019/3 | 7 | 25 | 41 | 53 | 82 |
| 8 | L2019/5 | 7 | 24 | 42 | 53 | 81 |
| 9 | L2019/8 | 5 | 23 | 40 | 53 | 80 |
| 10 | L2019/19 | 6 | 24 | 41 | 55 | 82 |

**Table 1.**

**Duration of the development phases of mustard variety sampl**

The period from germination to budding was 39-42 days. The earliest budding specimen was the Nika variety, where this indicator was 39 days. In the Belle and L2019/8 samples, budding was observed after 40 days. In the Crystal, L.2019/2, and L.2019/5 samples, this period was 42 days.

The period from germination to flowering ranged from 52 to 55 days, depending on the variety and sample. It was established that the difference between the varieties during this developmental phase was insignificant compared to the germination and branching phases. The shortest flowering period was 52 days for the Bakhmal-70 variety, and 54 days for the Nika and Kristal varieties. In the L2019/19 sample, this indicator was 55 days, and the longest period was recorded.

The vegetation period until full maturity was 78-85 days. The shortest vegetation period was 78 days for sample L.2019/1, and 80 days for samples Bakhmal-70 and L2019/8. In the variety samples Kristal and L.2019/5, it was 81 days, in the samples Belle, L.2019/3, and L.2019/19, it was 82 days, and in the sample L.2019/2, it was 83 days. The longest growing season was observed in the Nika variety-85 days.

Overall, the research results showed that the development rates of mustard varieties and samples in rainfed foothill conditions differ depending on genotypic characteristics. In particular, the short duration of the full ripening period is an important trait for breeding. This is because under rainfed conditions, it is important for the plant to develop in a short time, effectively use moisture, and form a harvest within a favorable timeframe.

Among the studied varieties and samples, L.2019/1, Bakhmal-70, and L2019/8 were distinguished by their shorter growing season. It was found that the L.2019/1 specimen fully ripened in 78 days and was 2-5 days earlier than other varieties and samples. In Bakhmal-70 and L2019/8 samples, full maturation was observed after 80 days. These samples were evaluated as suitable for rainfed foothill conditions, early-maturing, and promising starting materials for use in breeding work.

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**CONCLUSION:** In 2026, 20 varieties and specimens of mustard (Sinapis alba L.) were studied in the rainfed foothill conditions of the Bakhmal Scientific Experimental Station of the Research Institute of Rainfed Agriculture. Phenological observations revealed certain differences in the duration of the developmental phases of the varieties and samples.

The period from sowing to germination for mustard varieties and samples was 4-9 days, from germination to branching was 23-27 days, from budding to 39-42 days, from flowering to 52-55 days, and from full ripening to 78-85 days.

Among the studied varieties and specimens, L.2019/1, Bakhmal-70, and L2019/8 stood out for their early maturity. Sample L.2019/1 reached full maturity in 78 days, and samples Bakhmal-70 and L2019/8 in 80 days.

In Bakhmal-70 and L2019/8 samples, the germination rate was also high, amounting to 4 and 5 days, respectively. The L.2019/1 specimen germinated in 6 days and reached full maturity in 78 days.

Thus, among the mustard varieties and specimens studied in the conditions of rainfed foothills, it is advisable to use samples L.2019/1, Bakhmal-70, and L2019/8 as promising starting material for breeding work based on early maturity and rapid development.

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