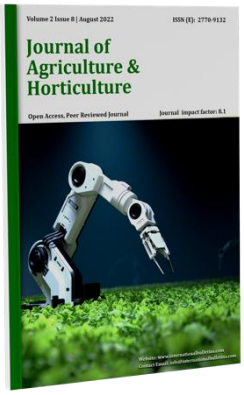

SEED PRODUCTIVITY AND SOWING QUALITIES OF MONARDA (MONARDA L.) VARIETY SAMPLES IN SOUTHERN UZBEKISTAN

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Abstract. The article presents the results of studies on the morphobiological characteristics, seed productivity, and sowing qualities of seeds of Monarda (Monarda L.) variety samples under the southern conditions of Uzbekistan. During the research, the developmental phases of the variety samples, plant height, number of branches, green and dry biomass yield, as well as seed productivity and sowing qualities were evaluated. According to the obtained results, seed germination in all variety s exceeded standard requirements, with the highest values recorded for the *Limonniy aromat* variety . This variety was identified as promising in terms of both seed productivity and seed quality. The research findings demonstrate the feasibility of introducing Monarda under the southern conditions of Uzbekistan and cultivating it for seed production.

Keywords: monarda (Monarda L.), Lamiaceae family, introduction, vegetable crop assortment, medicinal and essential oil plants, morphobiological traits, variety samples, seed productivity, seed yield, seed germination, sowing qualities, 1000-seed weight, seed production technology.

Introduction. At present, the development of vegetable production, the supply of the population with products rich in biologically active substances, and the expansion of crop assortments are among the priority tasks of agriculture. From this perspective, adapting new and promising plant species to local soil and climatic conditions through the method of introduction has significant scientific and practical importance.

Monarda (Monarda L.) is widely used worldwide as a multifunctional plant with food, medicinal, and essential oil properties. Its green biomass and flowers contain high levels of essential oils, biologically active compounds, and antioxidants, which makes it a valuable raw material for vegetable production, pharmaceuticals, and the food industry. In addition, Monarda is characterized by high adaptability, intensive growth rates, and resistance to stress factors.

Introducing Monarda under the conditions of the southern regions of Uzbekistan provides opportunities to enrich the assortment of vegetable crops and to implement the production of products with high added value. However, this process requires comprehensive investigation of the morphological characteristics of variety samples, economically valuable traits, green and dry biomass yield, essential oil content and composition, as well as seed productivity and seed production properties.

The present study is aimed at evaluating Monarda variety samples under the southern regions of Uzbekistan based on morphological and economically valuable traits, identifying promising variety s distinguished by high green and dry biomass yield and essential oil content,

and developing a scientifically grounded seed production technology for Monarda. The research results have scientific and practical significance for the introduction of Monarda into vegetable production, as well as for the development of locally adapted variety s and the improvement of the seed production system.

Monarda (Monarda L.), belonging to the Lamiaceae family, is classified as an essential oil plant. Its native range includes Mexico and the eastern coasts of North America, where it grows in the wild. According to researchers, the essential oil of Monarda is characterized by the presence of unique aromatic components typical of citrus fruits, in addition to a mint-like fragrance. These properties are reported to expand the possibilities for the use of Monarda in the food, pharmaceutical, and perfumery industries [1].

Currently, monarda is widely used in many countries around the world as a valuable food and medicinal plant. It serves as an aromatic flavoring additive, a natural preservative for vegetables and fruits, and an important raw material in the production of non-alcoholic beverages [2].

Germination is the ability of seeds to sprout and grow, and it is characterized by the number of seeds that produce normal seedlings under optimal conditions within a certain period of time [3].

After harvesting, monarda seeds quickly demonstrate their germination capacity. To determine germination, the seeds are placed on a moistened paper napkin, which is then set on the lid of a glass jar and kept in warm conditions. After approximately 5–6 days, the level of seed germination can be assessed. For long-term preservation of seed quality, the most suitable method is storage in tightly sealed glass containers or hermetically closed aluminum packages. In addition, seeds can maintain good germination for 2–3 years when stored in ordinary paper packets in a refrigerator at a temperature of 5–6 °C [4].

During the research, the seed productivity and sowing qualities of the studied monarda variety samples were investigated. In an unheated greenhouse, seeds sown on December 5 showed initial emergence between December 16 and 28, while mass emergence occurred from December 16 to January 15 (Table 1).

Table 1

Timing of Developmental Stages of Monarda Variety Samples, 2024

Variety name	Sowing date	Emergence		Technical maturity		Flowering		Biological maturity	
		10%	75%	10%	75%	10%	75%	10%	75%
Mona Liza	05.12.23	16.12.23	20.12.23	15.04.24	18.04.24	20.04.24	24.04.24	28.06.24	06.07.24
Vkus bergamota	05.12.23	16.12.23	19.12.23	14.04.24	18.04.24	21.04.24	25.04.24	28.06.24	06.07.24
Limonniy aromat	05.12.23	19.12.23	19.12.23	14.04.24	18.04.24	21.04.24	24.04.24	27.06.24	06.07.24

The initial technical maturity of the plants was observed between April 14 and May 20, while mass technical maturity occurred from April 18 to May 26.

The first flowering of the plants took place between April 20 and June 2, and full flowering was recorded from April 23 to June 7.

One of the most important traits was the initial seed maturity. This stage was identified by the appearance of a brown coloration in the seeds of the lowest flowers that bloomed first within the inflorescence, which occurred between June 27 and July 12. Mass seed maturation was observed from July 5 to July 18 (Figure 1).

Figure 1. Seed-producing monarda plants and their seeds

The morphobiological characteristics of monarda variety samples grown for seed production are presented in Table 2.

Table 2. Expression of morphobiological traits of monarda variety samples, 2024

Variety name	Plant height, cm	Number of branches, pcs	Leaf size, cm (length)	Leaf size, cm (width)	Inflorescence length, cm	Number of inflorescences per plant, pcs
Limonniy aromat	75.1	14	5.0	1.4	63.5	9
Vkus bergamota	65.6	18	5.0	1.4	57.7	10
Mona Liza	67.5	14	4.9	1.3	51.0	10

The height of seed-producing monarda plants reached 75.6 cm in the *Limonniy aromat* variety and 65.6 cm in the *Vkus bergamota* variety . The number of lateral branches varied by variety , ranging from 14 to 18 branches per plant. No significant differences were observed among the variety s with respect to leaf size. However, a noticeable difference was recorded in the length of the inflorescence. In the *Limonniy aromat* variety , the inflorescence length was

63.5 cm, whereas in the *Mona Liza* variety it was 51.0 cm, which is 12.5 cm shorter compared with *Limonniy aromat*.

Data on the most important indicators—seed productivity and yield of the plants, as well as the sowing qualities of the seeds—are presented in Table 3.

Table 3. Seed productivity of monarda and sowing qualities of the seeds, 2024

Crop name	Seed productivity per plant, g/plant	Seed yield, g/m^2	1000-seed weight, g	Germination* (%) – Standard	Germination* (%) – Actual
Limonniy aromat	6.60	46.2	0.4–0.6	55	92
Vkus bergamota	4.30	30.1	0.3–0.4	55	91
Mona Liza	3.64	25.48	0.4–0.5	55	88

According to the data presented in the table, seed productivity per plant was **6.60 g** in the *Limonniy aromat* variety , **4.30 g** in the *Vkus bergamota* variety , and **3.64 g** in the *Mona Liza* variety . Seed yield amounted to **46.2 g/m^2** in *Limonniy aromat*, **30.1 g/m^2** in *Vkus bergamota*, and **25.48 g/m^2** in *Mona Liza*. The weight of 1000 seeds in the *Limonniy aromat* variety ranged from **0.4 to 0.5 g**.

According to the accepted standards, the germination capacity of first-class seeds of monarda variety s must not be lower than **55%**. In our study, seed germination reached **92.0%** in *Limonniy aromat*, **91.0%** in *Vkus bergamota*, and **88.0%** in *Mona Liza*, which can be considered very high values.

Based on the obtained results, the introduction of monarda under the conditions of southern Uzbekistan, its cultivation for seed production, and its practical implementation are scientifically justified. In particular, the *Limonniy aromat* and *Vkus bergamota* variety s are recommended as promising varieties due to their high seed productivity and superior seed quality.

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