

# Results of oilseed poppy breeding and production potential of new varieties

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**Abstract:** Breeding of poppy (*Papaver somniferum* L.) for food use of poppy seeds has a long tradition in Slovakia. Conventional breeding methods have brought several successes in the form of registration of new varieties with better yield parameters. In breeding process, the methods of crossing and selection of offspring were used. In the years 2016 – 2018, the testing of selected poppy seeds was performed at the Central Control and Testing Institute in Agriculture with the aim to register new varieties. Testing was carried out according to the valid methodology in 5 localities of the Slovak Republic. The experiments were based on the block method on plots with an area of 10 m<sup>2</sup> in four replications. The obtained poppy seed yield and empty dry capsules were compared to the parameters of standard - control varieties ('Opal' and 'Major'). In the year 2019, 4 new food poppy varieties - 'Azurit', 'MS Diamant', 'MS Topas' and 'MS Zafir' were registered. On average, the reached poppy seed yield during 3 years from 5 experimental localities ranged from 1.77 t.ha<sup>-1</sup> ± 0.16 ('Azurit') to 1.90 t.ha<sup>-1</sup> ± 0.17 ('MS Diamant'). For comparison, the average yield of control varieties was 1.76 t.ha<sup>-1</sup> ± 0.12. An important additional indication in evaluation of the variety economic value is the yield of empty dry capsules. It ranged from 0.98 t.ha<sup>-1</sup> ± 0.12 and 0.98 t.ha<sup>-1</sup> ± 0.09 ('Azurit' and 'MS Diamant', respectively) to 1.09 t.ha<sup>-1</sup> ± 0.21 and 1.09 t.ha<sup>-1</sup> ± 0.16 ('MS Topas' and 'MS Zafir', respectively). The average dry capsule yield of control varieties was 0.93 t.ha<sup>-1</sup> ± 0.13. Statistical evaluation by analysis of variance didn't reveal significant differences in seed yield between tested and control varieties (p = 0.661). The difference was significant in the yield of dry capsules (p = 0.048). The locality had a statistically significant effect on the yield of seeds and capsules (p < 0.001). A statistically significant difference on the yield of seeds (p = 0.050) and capsules (p < 0.001) was also found in the experimental year. New poppy varieties showed generally a higher seed yield potential compared to standard varieties. Based on the knowledge on soil and climatic conditions of individual experimental localities and test years, it is possible to choose a suitable variety for specific growing conditions in order to be able to maximize its genetic potential.

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## INTRODUCTION

Poppy (*Papaver somniferum* L.) is a traditional crop of Slavic people. The consumption of poppy seed is deeply rooted in the culture of the people of Central Europe, including Slovakia. Poppy breeding in Slovakia has undergone a long-term development. Since the beginning of this creative activity (dating from 1948), the main goal in the creation of new varieties has been focused on varieties of the universal type, i.e., varieties with a high yield of high-quality poppy seeds for food use and poppy straw with a high morphine content for the pharmaceutical industry. With regard to the negative correlations between seed yield and morphine content, as well as the preference for seed yield as the main product over the by-product – poppy straw, such this type of variety was not registered

in Slovakia until 2019. With regard to the interest in varieties producing quality poppy seeds and the interest in the quality of poppy straw by the pharmaceutical industry, breeding is currently divided into two directions - food-type varieties and industrial-type varieties.

This study provides an overview of the results in the breeding of poppy food varieties over the last ten years, whereas this activity has been ongoing since 1961 in Slovakia (Research and Breeding Station Malý Šariš, RIPP, NAFC) and the results of cooperation between this institution and the Prešov University in Prešov.

## MATERIAL AND METHODS

### *Breeding methods*

Methods of collecting landraces poppy populations, crossing domestic and foreign varieties and genotypes were used in breeding of new varieties (Voškeruša et al., 1965; Boháč, 1986; Fejér, 2014, Vašák eds., 2010). Subsequently, selection and evaluation of lines was performed in accordance with breeding objectives (Fejér, 2015; Fejér et al., 2018).

### *Establishment, conduct and evaluation of field experiments*

Field experiments with poppy were carried out on plots with an area of 10 m<sup>2</sup> in four repetitions, at five localities in Slovakia during the years 2016 - 2018. The establishment and evaluation were carried out according to the methodology of CCTIA. Four new varieties were evaluated and compared to the standard varieties Major and Opal.

## Results

On average, the reached poppy seed yield during 3 years from 5 experimental localities ranged from 1.77±0.16 t.ha<sup>-1</sup> (Azurit) to 1.90±0.17 t.ha<sup>-1</sup> (MS Diamant). For comparison, the average yield of control varieties was 1.76±0.12 t.ha<sup>-1</sup>. The statistically significant differences in seed yield ( $p = 0.661$ ) between tested and control varieties were not found. The yield of dry empty capsules is additional information Table 2. It ranged from 0.98±0.12 t.ha<sup>-1</sup> and 0.98±0.09 t.ha<sup>-1</sup> ('Azurit' and 'MS Diamant', respectively) to 1.09±0.21 t.ha<sup>-1</sup> and 1.09±0.16 t.ha<sup>-1</sup> ('MS Topas' and 'MS Zafir', respectively). The average dry capsule yield of control varieties was 0.93±0.13 t.ha<sup>-1</sup>. Statistically significant differences in capsule yield were found ( $p = 0.048$ ). In the past, poppy straw from such varieties has been used to extract alkaloids. Nowadays, the poppy straw from such type of varieties is unsuitable for pharmaceutical processing due to its low alkaloid content.

A statistically significant influence of the experimental localities on the yield of seeds and capsules was found ( $p < 0.001$ ). Furthermore, the statistical evidence of the experimental year on these parameters was found (yield of seeds  $p = 0.050$ ; yield of dry capsules  $p < 0.001$ ).

**Table 1.** Seed yield (t.ha<sup>-1</sup>), average values of the five experimental localities.

Variety	Year			Average	S.D.
	2016	2017	2018		
Azurit	1,85	1,58	1,88	1,77	± 0,68
MS Topas	2,01	1,71	*	1,86	± 0,71
MS Zafir	1,99	1,72	*	1,85	± 0,75
MS Diamant	*	1,78	2,02	1,90	± 0,61
Major Control 1	1,84	1,68	1,91	1,81	± 0,71
Opal Control 2	1,82	1,61	1,70	1,71	± 0,56
Average C1 and C2	1,83	1,65	1,81	1,76	± 0,10

\* = not evaluated; S.D. = Standard Deviation

**Table 1.** Dry empty capsules yield (t.ha<sup>-1</sup>), average values of the five experimental localities.

Variety	Year			Average	S.D.
	2016	2017	2018		
Azurit	1.11	0.87	0.95	0.98	± 0.33
MS Topas	1.23	0.94	*	1.09	± 0.29
MS Zafir	1.21	0.98	*	1.09	± 0.35
MS Diamant	*	0.92	1.04	0.98	± 0.26
Major Control 1	1.14	0.93	1.00	1.02	± 0.29
Opal Control 2	0.95	0.77	0.81	0.84	± 0.18
Average C1 and C2	1.05	0.85	0.91	0.93	± 0.10

\* = not evaluated; S.D. = Standard Deviation

### CONCLUSION

Newly registered food-type varieties showed a higher poppy seed yield compared to standard control varieties. The significant influence of the experimental locality and the experimental year on the evaluated parameters was observed. Based on the known climatic and soil conditions of the experimental localities, it is possible to elaborate a recommendation for the zoning of suitable varieties to specific growing conditions.

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