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# Investigating the response of Camelina oilseed plant (*Camelina sativa* L.) to different doses of metribuzin and trifloralin herbicides primed with BABA

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## Introduction

Oilseeds are critical in agriculture for providing calories and energy, constituting the second-largest global food reserves after grains. Plants like Camelina, which thrive with minimal inputs compared to other oilseeds, could help meet edible oil demand. In agricultural ecosystems, weeds compete with crops, impacting their growth, yield, and quality (Da Silva, 2022). Herbicides are crucial for weed control, significantly affecting crop yields. Among these, metribuzin (a pre-sowing herbicide) and trifluralin (a selective herbicide branded as Treflan) are commonly used. Improving seed quality to increase germination percentage, speed, and uniformity, as well as enhancing seedling establishment under different conditions, is essential for boosting crop competitiveness against weeds. Seed priming with agents like BABA (β-aminobutyric acid) can improve tolerance to environmental stresses (Noriani, 2019). This study aims to evaluate the effect of different doses of pre-emergence and pre-planting herbicides on the germination and seedling establishment of BABA-primed Camelina seeds.

## Materials and methods

This experiment was conducted in 2023-2024 at the research laboratory of Aburaihan Faculty of Agricultural Technology, University of Tehran, Pakdasht. It was designed as a factorial experiment based on a completely randomized design with 3 replications. To determine herbicide tolerance in Camelina, a dose-response test for metribuzin and trifluralin was first performed. Camelina seeds (25 per Petri dish) were exposed to 5 cc of herbicide solution. A base solution of 1000 ml/L was prepared by adding 1 cc of trifluralin and 1 gram of metribuzin to 1 liter of water. An experiment was then conducted to determine the optimal concentration of BABA and duration of seed pretreatment to induce herbicide tolerance. Test factors included BABA concentrations of 250, 500, 1000, and 2000 µM for 0, 2, and 4 hours, and three herbicide treatments: distilled water (control), metribuzin at 10 ml/g/L, and trifluralin at 100 ml/L. Seed germination was recorded every 6 hours for 14 days, and 50% germination rate (R50) was calculated using Germin v3 software, while radicle length was measured. Data were analyzed with SAS software, and graphs were created in Excel.

## Results and Discussion

The dose-response test showed that the lowest harmful doses were 10 ppm for metribuzin and 100 ppm for trifluralin, both inhibiting Camelina radicle length by 62%. These doses were used in subsequent experiments to assess the effect of BABA on herbicide tolerance. Analysis of variance revealed that the interaction between time, herbicide, and BABA significantly affected radicle length ($p < 0.01$). In the control (without herbicide), the maximum radicle lengths were observed in the 4-hour × 500 µM BABA treatment (50.5 mm) and the 2-hour × 1000 µM BABA treatment (51.5 mm), while the non-primed treatment had the shortest radicle lengths. For metribuzin, the longest radicles were seen in the 4-hour × 1000 µM BABA (41.3 mm) and 2-hour × 2000 µM BABA treatments (38.1 mm). In the trifluralin treatments, the 4-hour × 2000 µM BABA and 2-hour × 2000 µM BABA treatments produced the longest radicles (37.9 mm and 36.7 mm, respectively) (Figure 1). Similar findings were reported by Karimmojeni et al. (2022), who noted that increased doses of metribuzin significantly reduced root length and volume in Purpurea Shiraz plants. For R50, treatments and their interactions significantly affected germination ($p < 0.01$). In the control, priming seeds for 2 or 4 hours with 2000 µM BABA increased R50 by 33% compared to unprimed seeds. In the metribuzin treatment, R50 increased by 25% in the 2-hour × 2000 µM BABA treatment compared to the non-primed metribuzin group. Similarly, in the trifluralin treatment, the highest R50 was seen in the 2-hour × 500 µM BABA group, which showed a 23% increase compared to the non-primed trifluralin group.

**Table 1. Analysis of variance of the effect of BABA priming on growth trait and germination of camelina seeds**

| S.O.V | df | Radicle length | Germination rate of 50% of seeds (R50) |
|---|---|---|---|
| Time | 2 | 199.56** | 0.00078545** |
| BABA | 3 | 68.97** | 0.0000008** |
| Herbicide | 2 | 1101.55** | 0.00000126** |
| Time × BABA | 6 | 30.24** | 0.000001** |
| Time× Herbicide | 4 | 135.70** | 0.00000043** |
| Herbicide × BABA | 6 | 12.44** | 0.00000022** |
| Herbicide × Time× BABA | 12 | 29.28** | 0.00000028** |
| Error | 70 | 1.48 | 0.0000001 |
| CV% | - | 3.27 | 0.032 |

* and ** respectively significant at the 5 and 1 percent probability level

## Conclusion

Metribuzin and trifluralin reduced Camelina growth parameters such as radicle length and germination speed. However, BABA priming significantly improved growth and tolerance to these herbicides. Although BABA is costly, it acts as a resistance-inducing agent by activating plant defense mechanisms. Future research should explore BABA's interaction with other herbicide groups and evaluate plant responses under field conditions.

## Keywords

BABA, Germination, Metribuzin, Radicle length, Trifluralin

## References

1. Da Silva, E. M. G., de Aguiar, A. C. M., Mendes, K. F., & da Silva, A. A. (2022). Weed Competition and Interference in Crops. *In Applied Weed and Herbicide Science* (pp. 55-96). Cham: Springer International Publishing.
2. Nouriyani H. (2019). Effect of Seed Priming on Germination Characteristics, Biochemical Changes and Early Seedling Growth of Sesame (Sesamum indicum). *Iranian J. Seed Res.* 5(2), 43-58.
3. Karimmojeni, H., Rezaei, M., Tseng, T. M., & Mastinu, A. (2022). Effects of metribuzin herbicide on some morpho-physiological characteristics of two Echinacea species. *Horticulturae*, 8(2), 169.