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RESPONSE OF WHITE MUSTARD (*SINAPIS ALBA* L.) TO SOWING DATE AND CROP MANAGEMENT UNDER WATER STRESS CONDITIONS

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Abstract: *White mustard (Sinapis alba L.) is considered a suitable alternative crop for agricultural systems increasingly affected by climatic variability, due to its short growing season and efficient use of soil resources. This study evaluated the effects of sowing date, crop density and fertilization on crop establishment and yield under the pedoclimatic conditions of Dobrogea during the 2024–2025 agricultural year, characterized by severe water deficit. The experiment included 24 variants combining four sowing dates, two row spacings and three fertilization levels under minimum tillage. Results showed that the sowing date of 6 March 2025 provided the most favorable conditions for crop development and yield formation. Despite a high number of siliques per plant, severe drought during critical stages limited seed filling. The highest yield (2134 kg ha^{-1}) was obtained for the combination of 6 March sowing, 25 cm row spacing and N80P80 fertilization. These results support the optimization of white mustard cultivation under drought conditions in south-eastern Romania.*

• Introduction

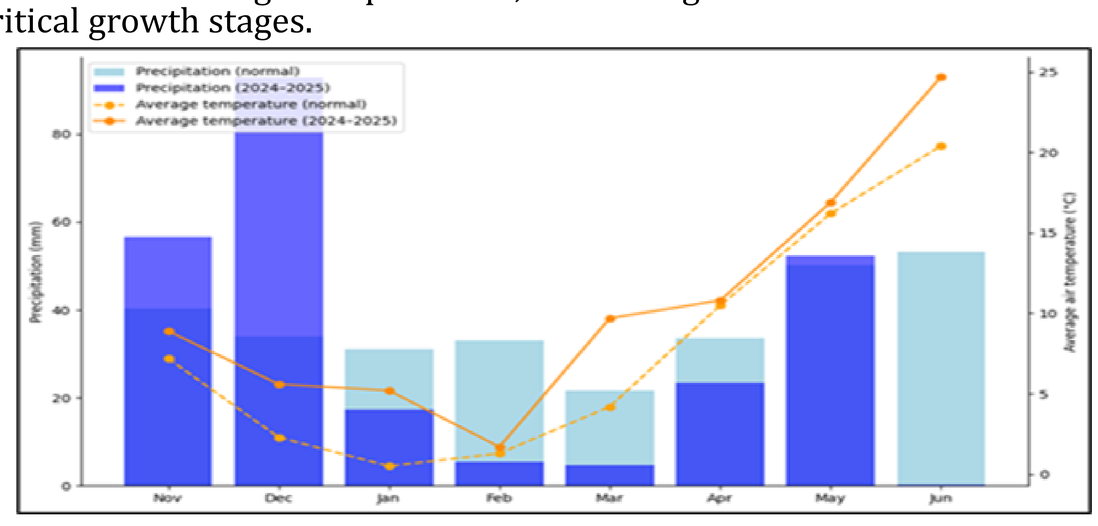
Climate change is increasingly affecting agricultural systems across Europe, particularly in regions with pronounced water deficit such as south-eastern Romania. More frequent droughts, high temperatures and irregular rainfall require adaptation of crop management to maintain yield stability. In this context, short-cycle crops with efficient water use, such as *Sinapis alba*, are gaining importance due to their adaptability to abiotic stress and suitability for sustainable systems. Under the pedoclimatic conditions of Dobrogea, early sowing and minimum tillage play a key role in optimizing water use and crop performance. However, the combined effects of sowing date, fertilization and crop density under these conditions remain insufficiently documented.

• Material and method

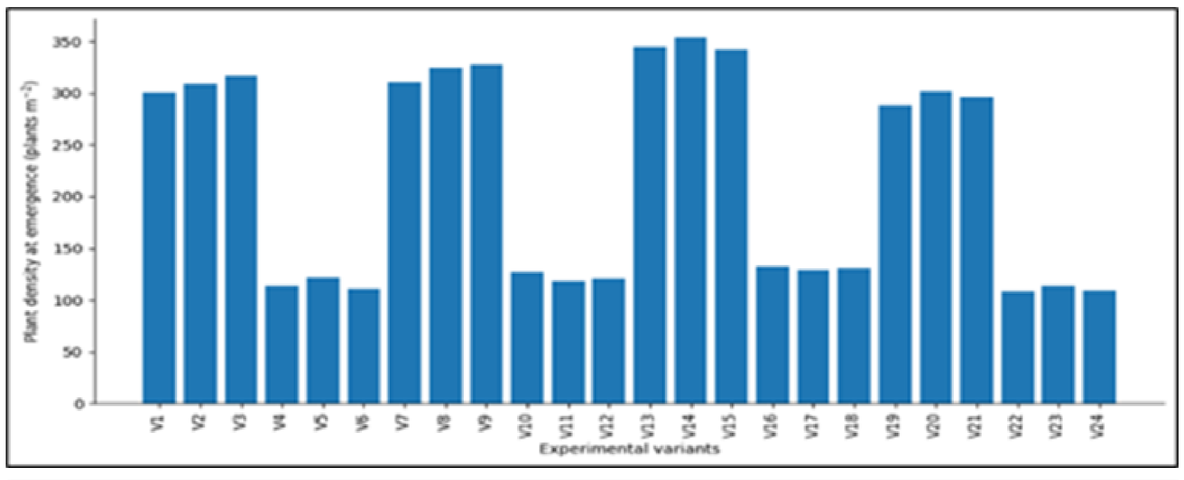
The study was conducted under field conditions in 2025 in the Mereni area (Constanța County, south-eastern Romania), on a vermic chernozem soil. The preceding crop was winter vetch, and a minimum tillage system was applied to conserve soil moisture. The biological material consisted of Sinapis alba cv. Cezara. The experiment followed a factorial design combining four sowing dates (24 February, 1 March, 6 March and 11 March), two row spacings (12.5 and 25 cm) and three fertilization levels (N40P40, N60P60 and N80P80), resulting in 24 experimental variants (1 ha each). Crop performance was assessed using field and laboratory measurements, including plant density, plant height, number of siliques per plant, seed weight and yield. Results were expressed as mean values and analyzed comparatively to evaluate the effects of technological factors under field conditions.

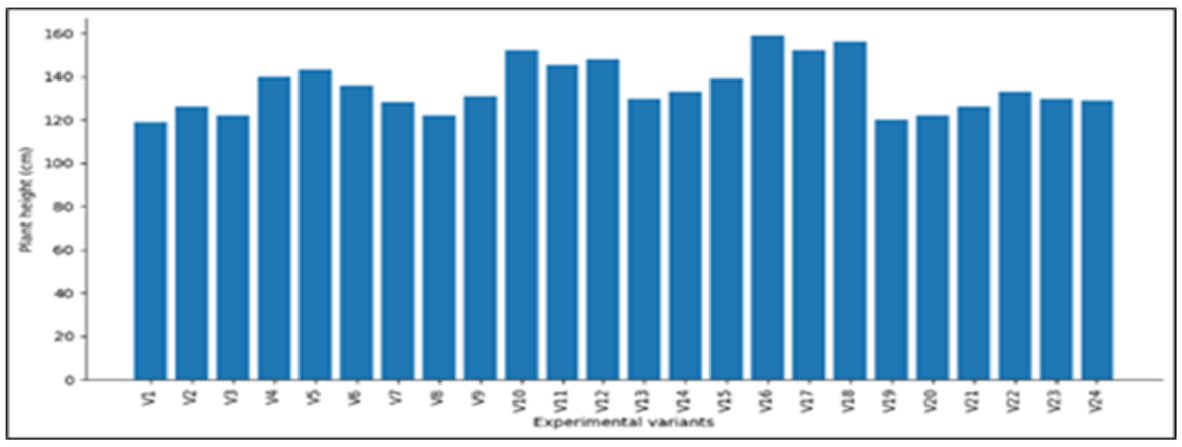
• Results and discussions

Climatic conditions during the 2024–2025 agricultural year had a strong influence on crop establishment and yield formation under minimum tillage (Figure 1). High precipitation during November–December ensured good soil water reserves, favoring early sowing. However, severe drought from February onward, especially in March (–79%) and June (–99.6%), combined with high temperatures, caused significant water stress during critical growth stages.

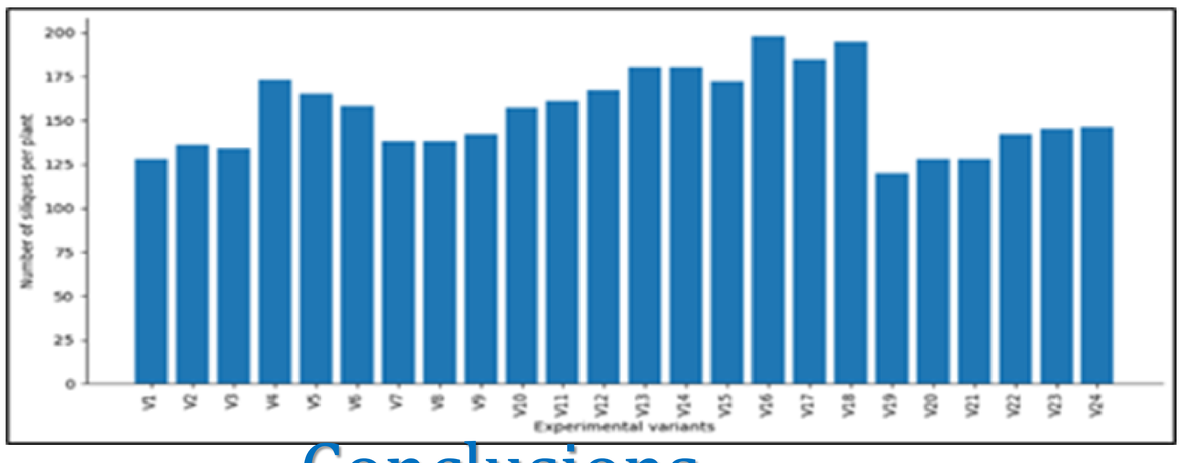


These conditions directly affected crop establishment (Figure 2). The highest plant density was recorded for the 6 March sowing date (up to 347 plants m^{-2}), while delayed sowing (11 March) reduced emergence by 15–20% due to lower soil moisture. Plant growth followed the same trend (Figure 3).





Maximum plant height (≈147 cm) was obtained for the 6 March sowing, while earlier or later sowing resulted in reduced vegetative development due to suboptimal temperature or water stress. The number of siliques per plant was also highest for 6 March (≈185 siliques plant^{-1}), indicating high yield potential (Figure 4). However, this potential was not fully converted into yield. Severe drought during March–April and especially in June negatively affected seed filling, leading to partially developed or sterile siliques. As a result, a clear discrepancy was observed between yield components and final productivity. Although siliques per plant were high, seed weight and yield were reduced under water stress. The best performance was recorded for the 6 March sowing date, with an average seed weight of 6.51 g plant^{-1} and a yield of 1992 kg ha^{-1}, reaching a maximum of 2134 kg ha^{-1}. The results show that under drought conditions, the number of siliques per plant is not a reliable indicator of yield. Instead, water availability during the reproductive stage is the key factor controlling productivity. The study confirms that sowing date is a major determinant of Sinapis alba performance in Dobrogea. While minimum tillage improved early crop stability, it could not fully mitigate severe drought during seed filling.



Conclusions

The results obtained under the pedoclimatic conditions of Mereni (Constanța County) confirm that sowing date is a key factor controlling crop establishment and yield potential in *Sinapis alba*, especially under pronounced spring water deficit. The sowing date of 6 March 2025 proved to be the most favorable, ensuring optimal plant density, improved vegetative growth and higher yield components. However, final seed yield was strongly dependent on water availability during critical stages, with severe drought in March–April and June significantly limiting seed filling. Minimum tillage improved soil moisture conservation and supported early crop development, but it could not fully mitigate drought stress during the reproductive stage. The highest productivity (2134 kg ha^{-1}) was obtained for the combination of: 6 March sowing, 25 cm row spacing, N80P80 fertilization (V16). This combination can be recommended as an optimal strategy for white mustard cultivation under similar climatic conditions in south-eastern Romania.