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INFLUENCE OF FOLIAR FERTILIZATION STRATEGIES ON THE GROWTH, MINERAL NUTRITION AND PRODUCTIVITY OF SUNFLOWER IN ARAD AND VARIAȘU MIC, ROMANIA

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Abstract:

Sunflower (Helianthus annuus L.) productivity depends on mineral nutrition, environmental conditions and crop management. This study compared five fertilization variants at two locations in Arad County, western Romania (Arad and Variaşu Mic). All variants received basal N60P80K80; V1 was the control, while foliar treatments comprised Folimax N Progress (V2), Lebosol Bor (V3), YaraVita BRASSITREL PRO (V4) and AMINOQUELANT Mg (V5), applied at specific vegetative stages.

Plant height, capitulum diameter, SPAD index, thousand-achene weight, seed yield and oil content were evaluated. V3 recorded the highest plant height (172 and 166 cm), capitulum diameter (20.1 and 19.6 cm), thousand-achene weight (60.8 and 59.4 g) and seed yield (3,340 and 3,180 kg ha^{-1}) in Arad and Variaşu Mic, respectively. These yields represented increases of 17.19% and 16.91% over the corresponding controls. V4 produced the highest SPAD readings (45.4 and 43.7) and ranked second for seed yield.

The highest oil contents were recorded under V3 (46.0% and 45.6%). Across all treatments, yields in Arad exceeded those in Variaşu Mic. The results identify the boron-based strategy as promising under the studied conditions; however, the reported differences remain descriptive until the complete experimental dataset, biological replication and appropriate statistical tests are verified.

• Introduction

- Sunflower (Helianthus annuus L.) productivity is shaped by the interaction between mineral nutrition, water availability, climatic conditions and crop management. Adequate nutrient supply supports vegetative growth, reproductive development and achene formation, whereas nutrient deficiencies and abiotic stress may restrict yield and seed quality. Foliar fertilization provides a complementary route for supplying selected nutrients directly through leaves; its effectiveness is influenced by formulation, nutrient mobility, application timing, weather conditions and the nutritional status of the crop.

- Boron is involved in cell-wall integrity and reproductive processes, including pollen function and seed formation. Amino-acid-based biostimulants may influence plant metabolism and nutrient-use efficiency, but their effects depend on the product and growing environment. For this reason, foliar treatments are considered supplements to balanced soil nutrition, not replacements for basal fertilization.

- Aim: to compare five fertilization strategies and evaluate sunflower growth, nutritional/physiological indicators, yield components and productivity at Arad and Variaşu Mic, in Arad County, western Romania, under the local pedoclimatic conditions.

• Material and method

- Experimental sites and design. The study was conducted at two locations in Arad County, western Romania: Arad and Variaşu Mic. Five fertilization variants were assessed at both sites. All variants received the same basal N60P80K80 fertilization, allowing the foliar products, application rates and timing to distinguish the treatments. V1 was used as the control reference for comparison.

- V1 – Control: basal N60P80K80 fertilization only; no foliar treatment.

- V2 – Folimax N Progress: 3 L ha^{-1}, applied once at the 6–8-leaf stage.

- V3 – Lebosol Bor: 2 L ha^{-1} at the 6–8-leaf stage, followed by 1 L ha^{-1} before floral bud appearance (total applied dose: 3 L ha^{-1}).

- V4 – YaraVita BRASSITREL PRO: 3 L ha^{-1}, applied at the 4–8-leaf stage.

- V5 – AMINOQUELANT Mg: 2 L ha^{-1}, applied at the stage of 5–6 pairs of leaves.

- Evaluated indicators. Vegetative development was characterized by plant height, capitulum diameter and leaf area; the SPAD index provided an indirect indication of leaf greenness/chlorophyll status. At maturity, yield components included the number of achenes per capitulum and thousand-achene weight. Final productivity was assessed as seed yield, while seed oil content was used as an additional quality indicator.

- Nutritional assessment and interpretation. Mineral nutrient concentrations in leaf tissue were considered where analytical data were available. SPAD readings describe leaf optical properties and are not a direct measurement of tissue nitrogen or other mineral concentrations; values can also vary with leaf age, sampling stage and measurement conditions. Statistical procedures and significance thresholds should be reported only if supported by the analyses performed on the final experimental dataset.



• Results and discussions

- Vegetative growth and SPAD. Plant height ranged from 161–172 cm in Arad and 155–166 cm in Variaşu Mic; V3 recorded the maxima (172 and 166 cm), versus 161 and 155 cm in the control. V4 had the highest SPAD readings (45.4 and 43.7), followed by V2 (45.0 and 43.1); V3 recorded 44.2 and 42.8. SPAD indicates leaf greenness, not tissue mineral concentration.

- Capitulum and achene traits. V3 recorded the largest capitula (20.1 and 19.6 cm) and thousand-achene weights (60.8 and 59.4 g) in Arad and Variaşu Mic. Control values were 18.2/17.8 cm and 56.2/54.9 g; V4 ranked second (19.7/19.2 cm; 59.7/58.5 g). Leaf-area and achene-number values are not tabulated in the manuscript.

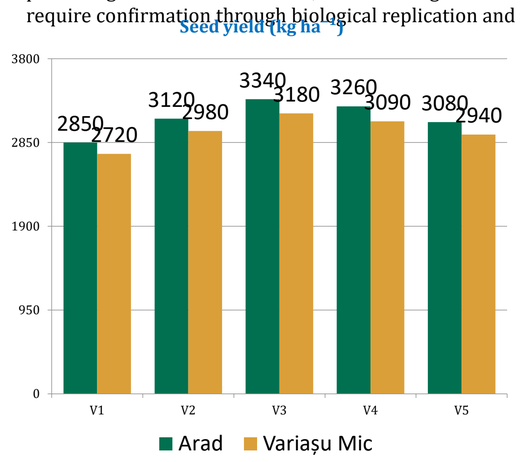
- Seed yield. V3 achieved 3,340 kg ha^{-1} in Arad (+17.19% vs. control) and 3,180 kg ha^{-1} in Variaşu Mic (+16.91%). V4 ranked second (3,260 and 3,090 kg ha^{-1}; +14.39% and +13.60%). V2 yielded 3,120 and 2,980 kg ha^{-1}; V5, 3,080 and 2,940 kg ha^{-1}. The controls recorded 2,850 and 2,720 kg ha^{-1}. Changes are calculated against each site's control.

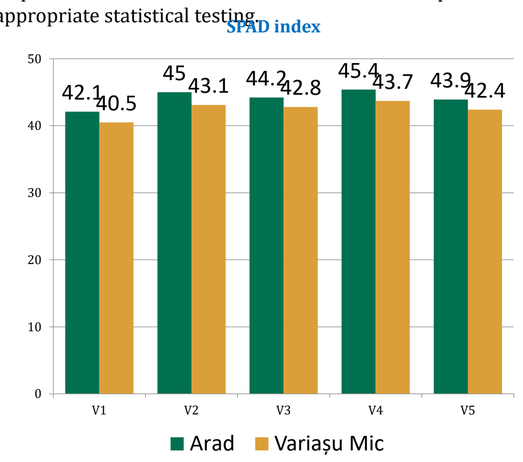
- Seed oil content ranged from 45.1–46.0% in Arad and 44.7–45.6% in Variaşu Mic. V3 recorded the highest values (46.0% and 45.6%), followed by V4 (45.7% and 45.4%).

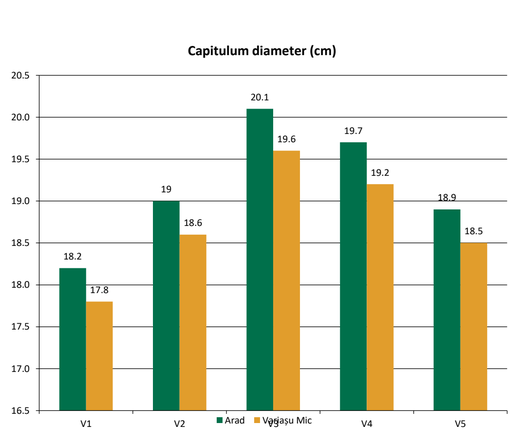
- Location comparison. Arad yields exceeded Variaşu Mic by 140–170 kg ha^{-1} across all treatments; the specific environmental causes are not identified in the available results.

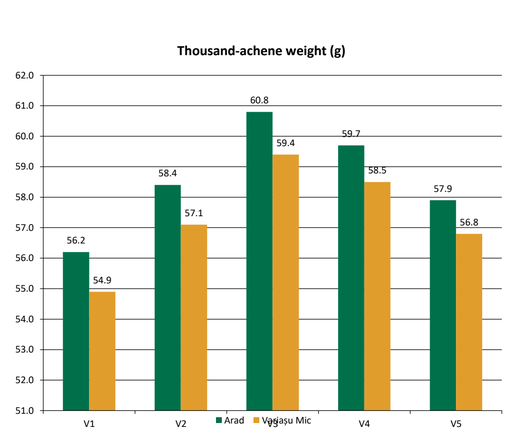
• Conclusions

- V3 (Lebosol Bor) led in plant height, capitulum diameter, thousand-achene weight and seed yield at both sites. V4 had the highest SPAD and second-highest yield. V3 also recorded the highest oil content. The boron-based treatment is promising for further evaluation; foliar feeding should complement balanced basal NPK. Results are descriptive and require confirmation through biological replication and appropriate statistical testing.









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