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Summary of the dissertation entitled:

“Response of selected legume species to different doses of superabsorbent”

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In the era of observed climatic changes contributing to the emergence of soil moisture deficiency, effective ways to retain and rationally manage water are being sought. One of the solutions to provide water for crops during periods without rain is the use of superabsorbent (hydrogel).

The aim of the study was to identify the response of selected species and legume cultivars: pea (*Pisum sativum* L.) cultivars Hubal and Batuta, faba bean (*Vicia faba* L. ssp. minor Beck) cultivars Granit and Bobas and soybean (*Glycine max* (L.) Merrill) cultivars Aldana and Merlin to different doses of superabsorbent. The effect of hydrogel on seed yield, selected elements of yield structure, morphological features of plants, gas exchange and chlorophyll fluorescence indices, leaf greenness index (SPAD) and chemical composition of seeds, were evaluated. An economic evaluation of the application of different doses of hydrogel in pea, faba bean and soybean crops was performed. The study was carried out during 2016-2018 based on 3 two-factor field experiments established in a split-block randomized design with 4 replications. The first research factor was the dose of superabsorbent (SAP) (0, 20, 30 kg·ha⁻¹), while the second – legume cultivar. A follow-up study was conducted in 2018 based on 3 strict, two-factor experiments in phytotron chambers. The test subjects were 3 legume species: faba bean (Granit), pea (Hubal) and soybean (Aldana). The first factor was the dose of SAP (0, 1, 2, 3, 4, 5, 6 g·kg⁻¹ of substrate), while the second factor was watering frequency (the treatments were watered every 1, 3, 6, 9 days). The experiment was conducted by complete randomization, in 4 replicates.

The results showed that the application of superabsorbent significantly increased the yield of faba bean, pea and soybean. The most effective dose was 20 kg·ha⁻¹, at which faba bean seed yield increased on average by 16.6%, pea by 15.2%, and soybean

by 17.7%. The genetic factor differentiated the yield of soybean; significantly higher yield was obtained for Merlin cultivar compared to Aldana (by 31.0% on average). The biometric parameters of the legume species did not vary with the dose of superabsorbent. Varietal differentiation was shown in the morphological structure of soybean. Merlin cultivar was taller, had its first pod set higher, and produced more pods, seeds per pod, and seeds per plant compared to Aldana. Biometric parameters of the legume species were significantly different according to watering frequency. Faba bean, pea and soybean plants watered daily were significantly higher and developed a greater number of nodes compared to plants watered every 3, 6 and 9 days. They also showed a significantly higher dry weight of the aboveground and underground parts. Only in soybean the dry weight of the underground part was significantly higher in the treatment watered the least frequently (every 9 days) compared to the treatments watered more frequently (every 1, 3 and 6 days).

Photosynthetic rate significantly increased after hydrogel application at a dose of $20 \text{ kg}\cdot\text{ha}^{-1}$, in faba bean in 2017 and 2018 and soybeans in 2016, while in peas the more effective dose was $30 \text{ kg}\cdot\text{ha}^{-1}$, whereas significant differences were recorded only in 2016. The dose of hydrogel applied did not affect transpiration rate and water use efficiency in the legume species. Chlorophyll fluorescence indices were generally significantly different between SAP doses. The mean value of the index describing the maximum quantum yield of PSII (Fv/Fm) significantly increased after application of the SAP dose of $30 \text{ kg}\cdot\text{ha}^{-1}$ in faba beans and peas in 2018, and SAP doses of $20 \text{ kg}\cdot\text{ha}^{-1}$ in pea in 2017. Higher values of the Fv/Fm ratio were found in faba bean and pea watered daily compared to the treatments watered every 3, 6 and 9 days, while in soybean the value of this ratio was highest in the treatment watered every 9 days. The mean value of functioning index of photosystem II (PI) was significantly higher after application of superabsorbent at a dose of $20 \text{ kg}\cdot\text{ha}^{-1}$ in faba beans and peas in 2017, and at a dose of $30 \text{ kg}\cdot\text{ha}^{-1}$ in faba bean in 2017 and 2018, and in pea in 2018. PI values for all legume species were highest on the treatment watered the least frequently (every 9 days) and its value decreased with increasing watering frequency.

The relative chlorophyll content in the leaves of the legume species (SPAD index) did not vary with the hydrogel dose, but a significant effect of cultivar on this trait was demonstrated. Higher mean value of SPAD index was characterized by faba bean cultivar Granit compared to Bobas and pea cultivar Hubal compared to Batuta, but significant differences were recorded only in 2017, and in the case of pea also in 2016.

In all years of the study, soybean variety Aldana showed a significantly higher mean SPAD index value compared to variety Merlin. The leaf greenness index of faba bean, pea, and soybean was significantly affected by watering frequency. In plants watered the least frequently (every 9 days), the value of SPAD index was significantly higher compared to plants watered every 1, 3, and 6 days. The chemical composition of seeds of the legume species varied only according to the genetic factor. Significantly more total protein was accumulated in faba bean seeds by the cultivar Bobas compared to Granit. Pea seeds of Batuta cultivar had a higher content of fat, phosphorus and potassium compared to Hubal. On the other hand, soybean cultivar Merlin accumulated more fat in seeds, but contained significantly less crude ash, phosphorus and potassium compared to Aldana.

The economic analysis showed that irrespective of the experimental factors, the highest production value was shown for soybean, followed by pea and faba bean. Application of superabsorbent at a dose of $20 \text{ kg} \cdot \text{ha}^{-1}$ increased the value of production by an average of 16.5% in the species tested, while at a dose of $30 \text{ kg} \cdot \text{ha}^{-1}$ – by 21,0% compared to the treatment where hydrogel was not applied.