Changes of above-ground part of potato plants under drought and heat stress

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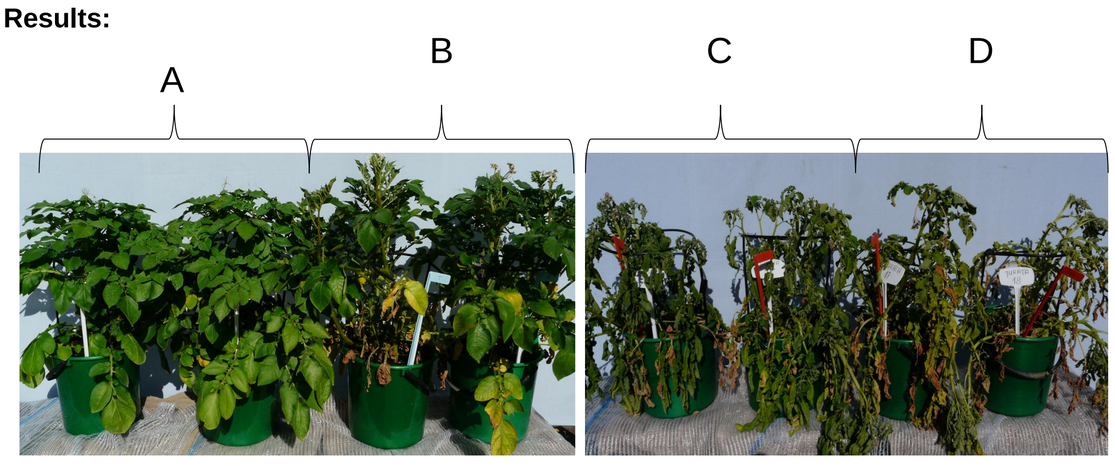
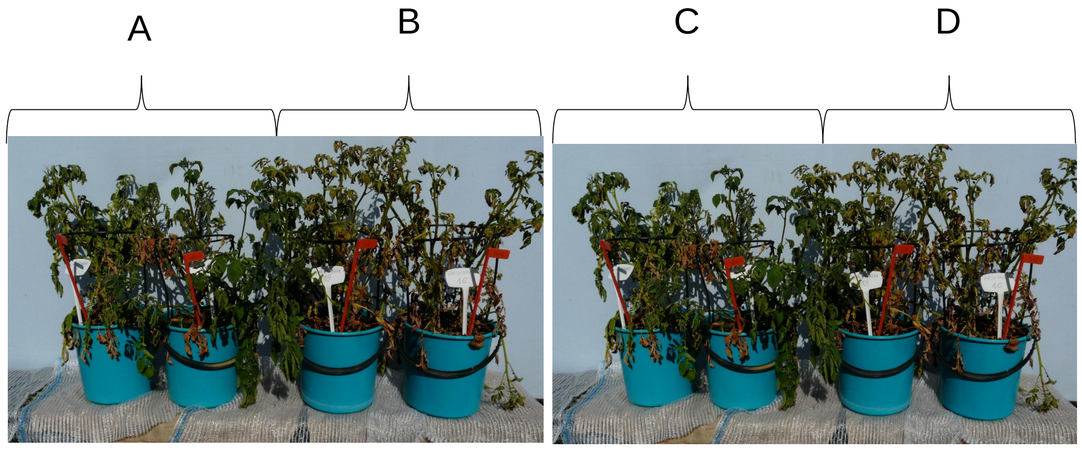
Introduction: Drought is one of the major abiotic stresses affecting plant growth, development and productivity. Potato (Solanum tuberosum L.) have relatively shallow root systems and is moderately drought sensitive crop (Schafleitner et al., 2007) whose yield is drastically restricted by dehydration. Potato is a typical moderate climate plant. Higher than optimal temperature limits or completely inhibits tuberisation. In natural conditions, high temperature and drought generally occur simultaneously. The negative effects of thermal and water stress can be mitigated by the introduction of varieties with improved thermoregulation and better water management in plant cultivation.

Material and methods: The aim of the study was to evaluate the response of several potato varieties to the stress of drought and high temperature, expressed as a changes of above-ground part of plants. The pot experiment was carried out in the vegetation hall on six potato genotypes: Ametyst, Etiuda, Laskara, Lawenada, Lech, Jurata. The following combinations were used: 1 control - optimal irrigation, drought - limitation of irrigation for 2 weeks, high temperature stress - maintenance of elevated temperature (38/ 25^{o}C in vegetation chambers), drought + high temperature - limitation of irrigation for 2 weeks and maintenance of elevated temperature (38/25^{o}C). Plants were stressed 3 weeks after the start of the tuberisation process. During the growing season the following plant measurements were made: number and stem length and mass, leaves mass, the aboveground plant mass, assimilation area size, RWC (Relative Water Content), photosynthesis efficiency by means of chlorophyll fluorescence indicators: PI_{ABS} and Fv/Fm using the Pocket PEA device.

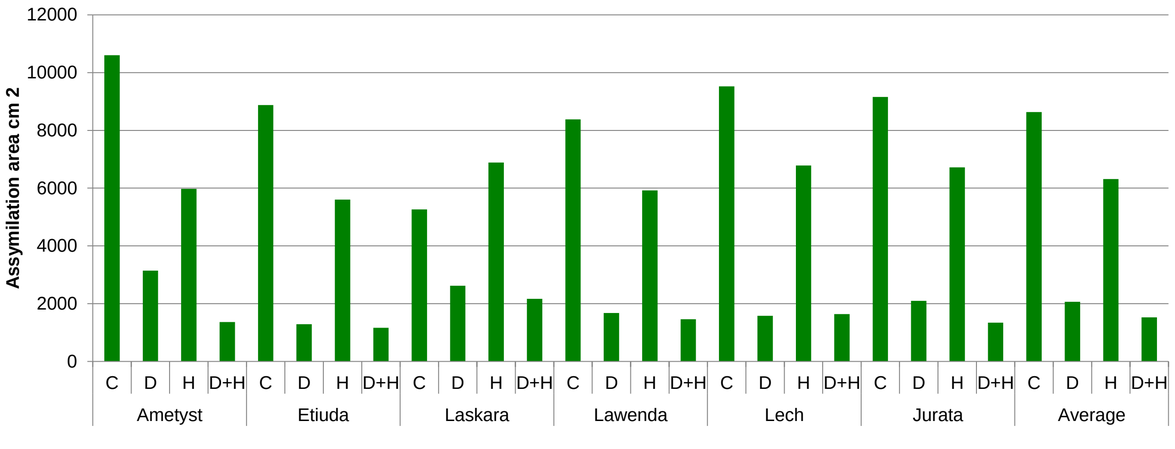
Results:



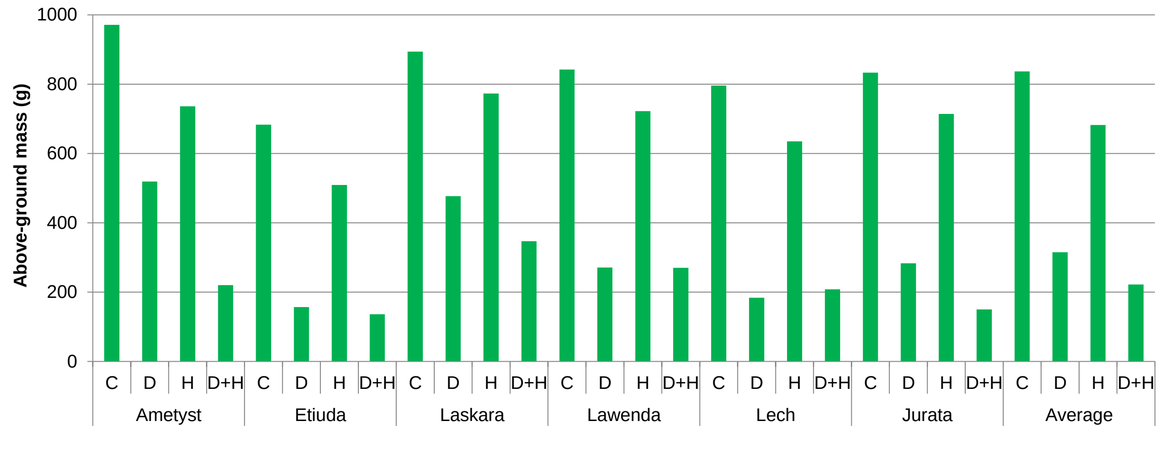
Ryc.1. Potato plants (Jurata) growing under optimal conditions (A), high temperature (B), soil drought (C) and combine soil drought and high temperature conditions (D).



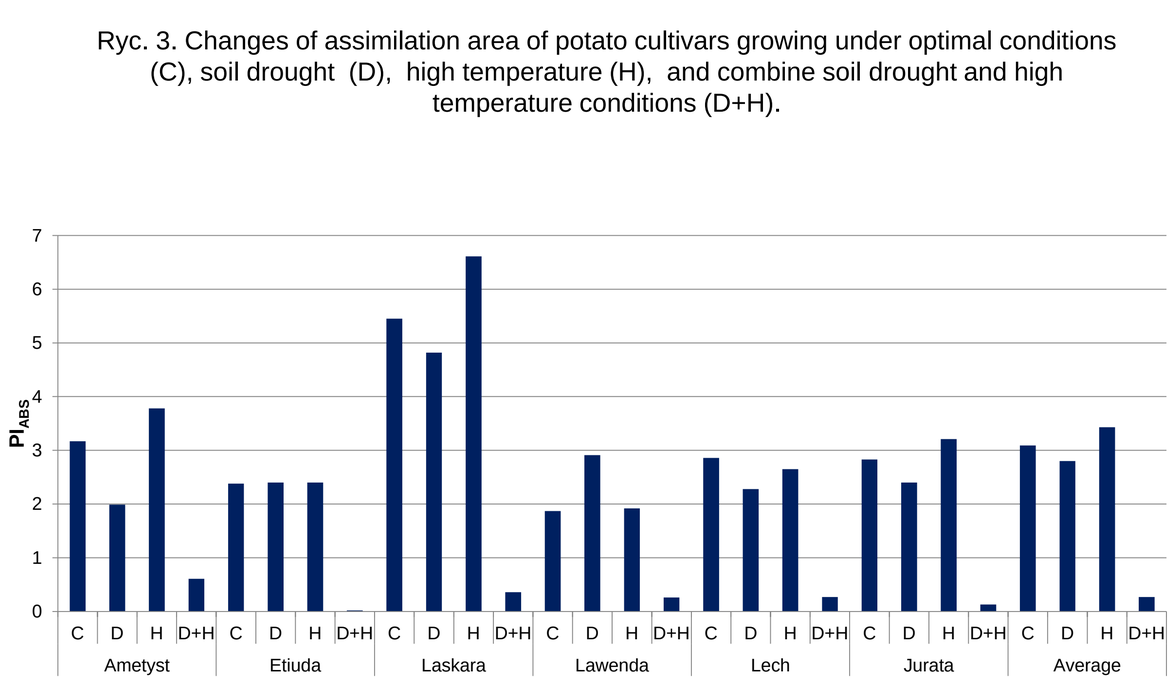
Ryc.1. Potato plants (Laskara) growing under optimal conditions (A), high temperature (B), soil drought (C) and combine soil drought and high temperature conditions (D).



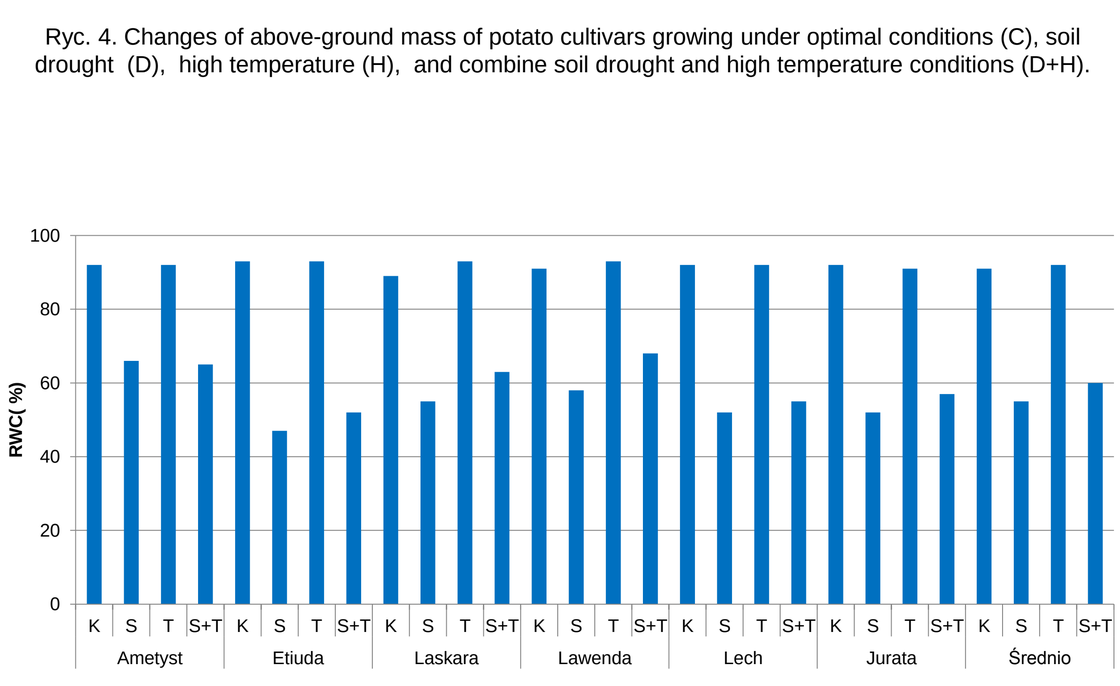
Ryc. 3. Changes of assimilation area of potato cultivars growing under optimal conditions (C), soil drought (D), high temperature (H), and combine soil drought and high temperature conditions (D+H).



Ryc. 4. Changes of above-ground mass of potato cultivars growing under optimal conditions (C), soil drought (D), high temperature (H), and combine soil drought and high temperature conditions (D+H).



Ryc. 5. Changes of PI_{ABS} of potato cultivars growing under optimal conditions (C), soil drought (D), high temperature (H), and combine soil drought and high temperature conditions (D+H).



Ryc. 6. Changes of Relative Water Content cultivars growing under optimal conditions (C), soil drought (D), high temperature (H), and combine soil drought and high temperature conditions (D+H).

References:

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