INFLUENCE OF SOIL DROUGHT ON POTATO PLANT ROOT ARCHITECTURE

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Introduction

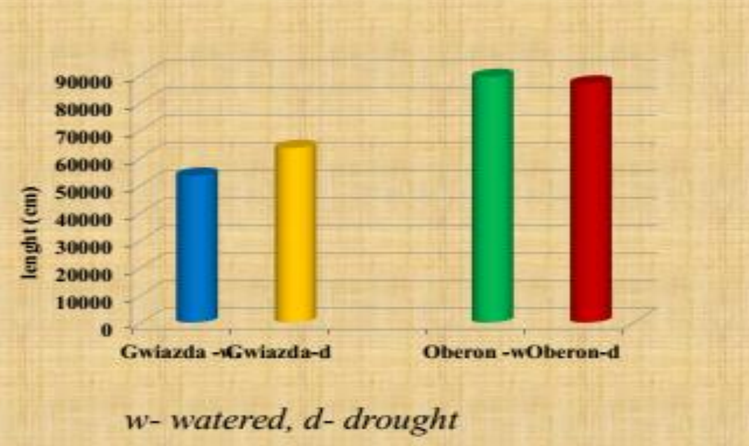
Under global climate change, drought tolerance is supposed to become more important for gaining stable yields in all crop in the future. Since potato plants are not tolerant to drought at present, the enhancement of drought tolerance is an urgent task for potato researchers in the 21st century. The potato is a species with a relatively shallow root system, causing its high dependence on the regularity of rainfall and sensitivity to their periodic shortages. Reaction of cultivars to drought stress is different. The aim of the study was to assess the reaction of two potato cultivars of different sensitivity to soil drought to root size and its architecture.

Material and Methods

The study of the root system was carried out in a specially designed pots with a height of 1 m and a diameter of 40 cm to allow the normal development of the root system. Pots were opened along, what created the technical feasibility the extraction without damaging the entire root system. The pot structure also provided the possibility to extract the roots of the respective layers - every 20 cm (the substrate was separated by a grid at the given depth). The experiment was conducted on two cultivars of different sensitivity to drought: Gwiazda – tolerant and Oberon – sensitive. In the stage of tuberization plants were subjected to 2-weeks drought. After the drought (in the middle of July) the following measurements of the root system was done: depth, total length, total area, an average diameter, fresh and dry weight and the distribution of roots in particular layers. The final element was to determine the relationship between the size of the root system, and aboveground plant mass and reaction of two cultivars expressed of root system changes under drought.

Results

The depth of the root system in both cultivars was 100 cm but the basic root mass enveloped to 60 cm. In other layers the root mass was much smaller. There was large variations in the root mass and length and its distribution in the different layers of the soil. Changes in the root system under drought were as follows: cultivar Gwiazda reacted increase the length root system during the drought while in the cultivar Oberon, the root length remained at the same level. In the more sensitive cultivar Oberon, a significant reduction in the diameter of the roots was observed.



w- watered, d- drought

Fig 1. Changes of roots lenght under soil drought

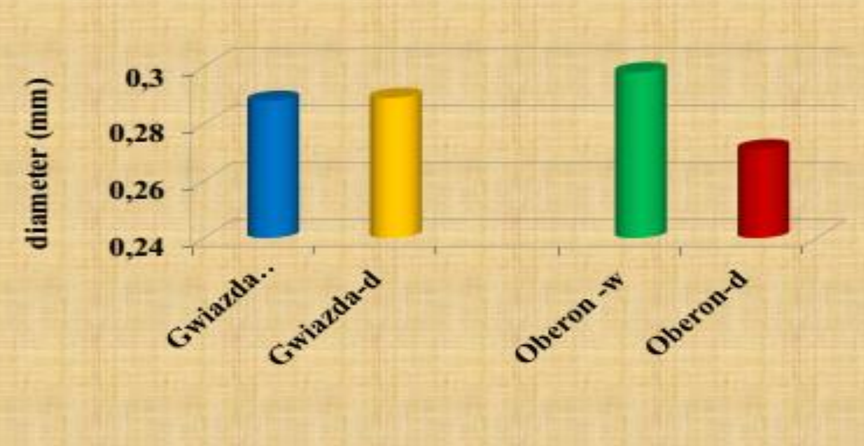


Fig.2. Changes of roots diameter under soil drought

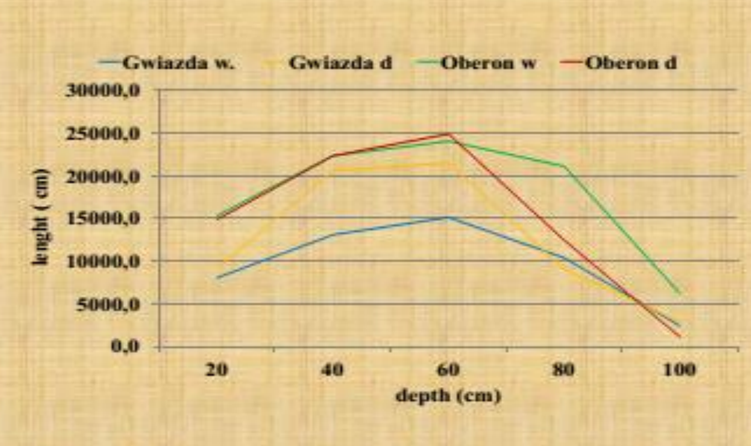


Fig. 3. Changes of roots lenght in soil profile under soil drought

There was also a change in the dry matter of roots under the drought. In cultivar Gwiazda the dry weight did not change significantly, whereas in the variety Oberon the decline was greater. The ratio of aboveground part to the root system was varied in both varieties. The higher value of this indicator was recorded in variety Gwiazda. Under the drought, the ratio of aboveground part to the roots slightly increased in both cultivars. The participation of roots in the total plant biomass was much lower under drought. No differences were observed regarding the cultivar characteristics.

Fig4 . Changes of root dry matter under soil drought

Fig.5. Changes of above-ground dry mass to root ratio under soil drought

Fig. Changes of root share in total biomass

Summary

Changes in the size of root system under the soil drought in cultivars with different drought sensitivity were different. In the resistant variety, the increase of root system was observed in sensitive, reminded on similar level