

# Changes of potato root system size under drought and heat stress



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## Introduction

Potato is a typical temperate climate plant, characterized by a specific temperature and water regime. Too high temperature causes changes in the development of both above and underground parts of plant. Similarly, drought stress affects the development of the entire plant. 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 change of root system size.

## Material and Methods

In vitro plants of 6 varieties: Ametyst, Etiuda, Laskara, Lawenda, Lech, Jurata (6 plants per variant) were placed in plastic pipes with a diameter of 12 cm and a length of 50 cm divided into 10 cm of layer. The pipes were filled with soil mixed with sand. Plants grown in controled conditions. The following combinations were used: control - optimal irrigation, drought – limitation of irrigation for 2 weeks, high temperature stress – maintenance of elevated temperature (38/ 25°C) for 2 weeks, drought + high temperature – limitation of irrigation for 2 weeks and maintenance of elevated temperature (38/25°C). In the phase of full plant development, the size of the root system was assessed: depth range, fresh and dry mass of the entire root system, distribution in individual layers (every 10 cm) and root share in the total biomass of plant.



## Results

Figure 1. Changes of root dry mass (g) upon drought and heat stress

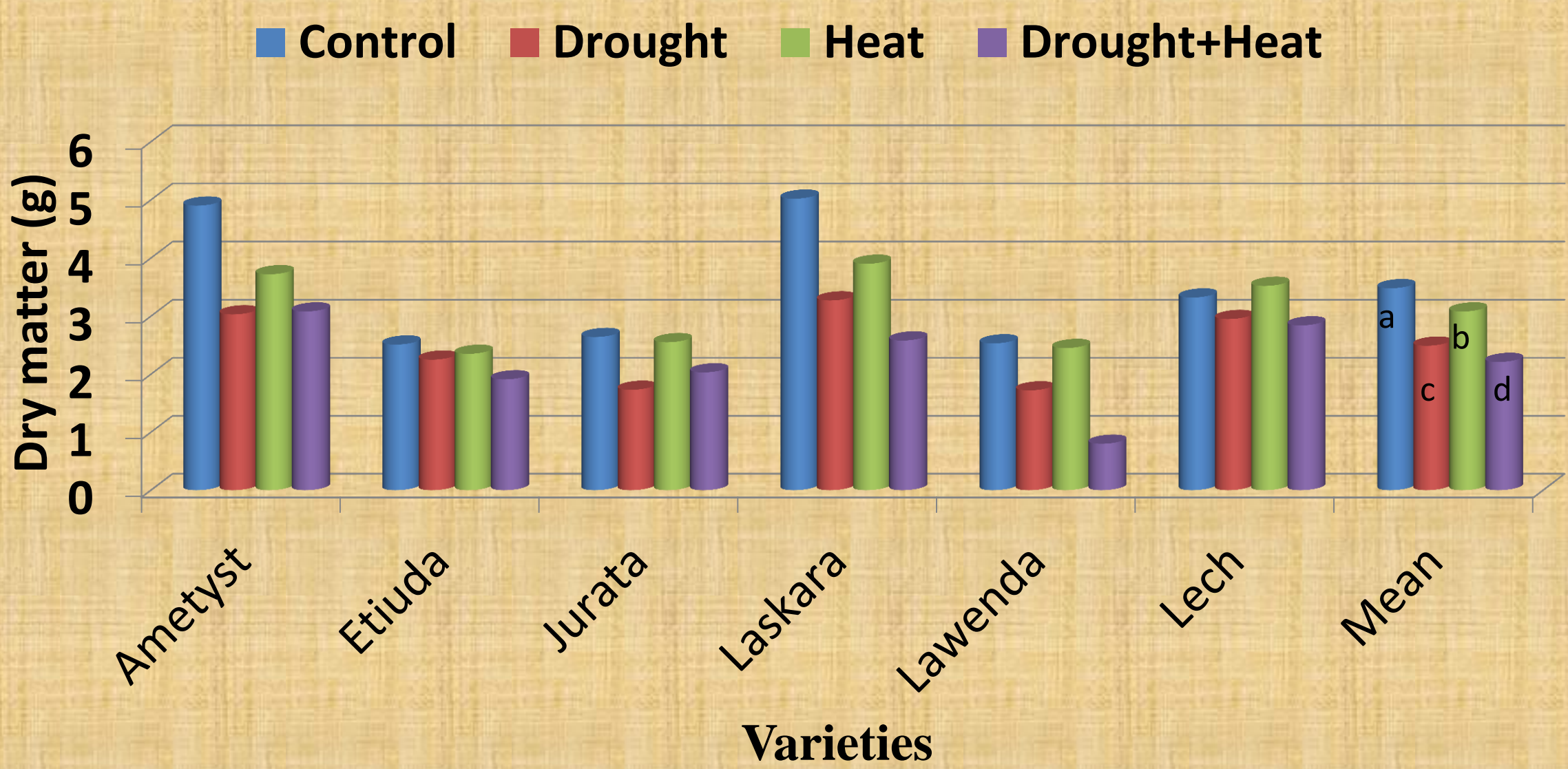


Figure 2. Share of roots in total plant biomass

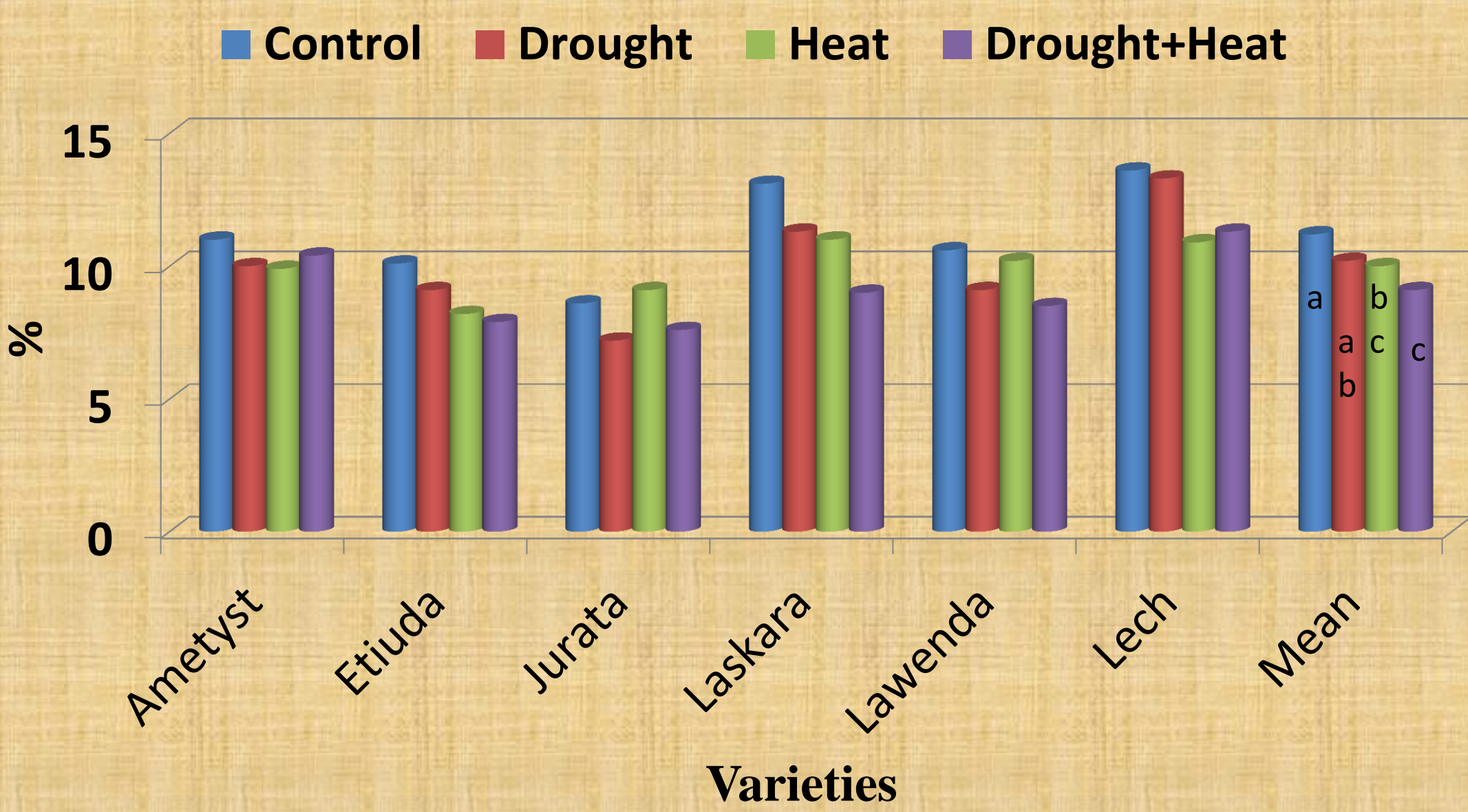


Table 1. Distribution of the roots dry mass in the soil profile

Tested parameter	Layer (cm)/ Combination	0-10	10-20	20-30	30-40	40-50
Root dry mass (g)	Control	0,16	0,63	0,64	0,85	1,20
	Drought	0,0	0,43	0,49	0,52	1,05
	Heat	0,1	0,33	0,57	0,70	1,38
	Drought + Heat	0,0	0,24	0,41	0,53	1,03



Both the stress of drought and high temperature caused a decrease of the root system size. The greatest decrease in root mass was noted in the case of applying both stresses simultaneously (33.6%), smaller after applying only drought stress (26.5%) and the smallest after applying high temperature stress (9.8%). The reaction of varieties was varied. The largest decreases in root mass were noted in the Ametyst and Lawenda varieties, the smallest in the varieties of Lech and Etiuda. Upon the both stresses, the share of roots in the total biomass of the plant decreased. The lowest share of roots was found after applying both stresses simultaneously.