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Drought Tolerance Mechanisms of Pearl Millet

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Abstract

Two weeks old pearl millet plants (*Pennisetum glaucum* L.) were exposed for two weeks to drought in a climate chamber. Drought was induced by withholding water until the soil reached an pF value of 4.0 (medium drought stress) or 4.8 (severe drought stress), which was then maintained by watering the pots to a certain weight twice a day. The relative humidity was 40/60 % (day/night). In preliminary trials drought tolerant and drought sensitive genotypes were selected from genotypes, which have been received from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Then experiments were conducted with three drought tolerant and drought sensitive genotypes. At harvest, the living and dead parts of the leaves were separated and the living leaf area was determined. A source leaf (third leaf from the apex), a sink leaf (first leaf from the apex, which is still enclosed in the second leaf) and fine roots were immediately frozen in liquid nitrogen. The remaining plant parts were dried at 60 °C.

Drought reduced the CO_2-assimilating area markedly by decreasing the single leaf area and the number of photosynthetic active leaves with increasing drought stress. The osmotic potential and the turgor potential of the source leaves decreased with increasing drought stress. Leaf folding in response to severe drought stress, which reduces the transpiring leaf area, occured in all genotypes except in one drought sensitive line, which almost did not fold the leaves. Severe drought decreased the dry mass per unit leaf area decreased. The effect of drought on the glucose, fructose, sucrose and starch metabolism during the day and the night was different in sink leaves, source leaves and roots. The involvement of enzymes of the sugar and starch metabolism and sucrose transport in the effect of drought on the carbohydrate metabolism in source and sink tissues will be presented.

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