Projektförderung
PF10/2003

The effects of genotype and nitrogen supply on drought tolerance mechanisms of pearl millet

Report of Zakia Ali Ibrahim and Sabine Golombek

Project supported by the Eiselen foundation

(Project-Nr.: 10/2003) and DAAD

CONCLUSIONS

The investigations of this study revealed interesting mechanisms of the adaptation of the osmotic potential to drought in interaction with nitrogen availability in pearl millet. But the analyses of the mechanism of osmotic adaptation showed no differences between the investigated sudanese pearl millet genotypes and could therefore not explain the differences in drought tolerance between the genotypes. Therefore for future studies on the reasons of differences in drought tolerance of sudanese pearl millet genotypes it seems not recommendable to conduct further investigations about the osmotic adaptation.

The turgescence of the plants decreased markedly under drought from low to high nitrogen availability. Therefore a high nitrogen fertilization is not recommendable for cultivation of pearl millet under drought. The pearl millet genotypes showed differences in their turgescence at each combination of drought and nitrogen availability. For future studies on the reasons of differences in drought tolerance of sudanese pearl millet genotypes in interaction with nitrogen availability investigations of the turgor potential and its effects on growth and gas exchange seems to be useful.

Pearl millet leaves grown under drought and high nitrogen availability are not recommendable for the use as animal fodder because of their high nitrate concentrations.

Drought had no major effect on the total nitrogen uptake and did not hamper the nitrogen translocation from the root into the top of the plant in the investigated pearl millet genotypes.

The net CO_2-assimilation per plant was reduced in response to drought by a decline of the CO_2-assimilating leaf area and the net CO_2-assimilation rate per unit leaf area. The reduction of the net photosynthetic rate was mainly due to nonstomatal factors like e.g. a disturbed metabolism for CO_2 uptake. The drought induced decrease of the photosynthesis was accompanied by a decline in transpiration.

The reduction the net photosynthetic rate under the drought imposed in these experiments was reversible within short time and therefore caused by factors, which were reversible within short time.

To understand genotypic differences of drought tolerance, it is useful also for future investigations to analyse the effect of drought and subsequent dehydration on the gas exchange parameter of different genotypes in response at different nitrogen availabilities. In this experiments interesting differences between genotypes in their photosynthetic rate in response to drought and nitrogen were observed. E.g. the landrace 'Dembi' showed the phenomen, that it was able to compensate for the limited CO_2 assimilation under drought by increasing the net photosynthesis after rehydration in the morning to values much higher than the control, when the nitrogen supply was medium or high.

Drought reduced the net photoynthetic rate strongly in the fourth leaves, but not in the second leaves, which have due to their low source activity already low photosynthetic rates.