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研究论文

干旱和复水对大豆光合生理生态特性的影响

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摘要 选用大豆作为实验材料，研究干旱和复水对大豆光合生理的影响，以期为大豆抗旱栽培和高效利用水分提供理论依据。通过研究发现，在土壤相对含水量高于47%时，处理组大豆凌晨叶片水势和对照组相比基本没有下降，但当土壤相对含水量低于47%时，处理组叶片水势急剧下降，表现为一定的阈值反应，存在明显的凌晨叶水势临界值。大豆开花前期叶片的凌晨叶水势阈值约为-1.02 MPa，低于此临界值，叶片水势急剧下降，叶片净光合速率也明显降低。研究发现，在实验的第3天，处理组土壤相对含水量为47%，叶片水势与对照组相比下降了7%，蒸腾速率为对照组的67%，净光合速率为对照组的90%，水分利用效率比对照组高35%，这说明大豆的蒸腾比光合对干旱更敏感。因此，可利用这一结果采取适度干旱等措施达到节水增产的目的。复水后大豆叶片水分状况得到改善，大豆叶片的净光合速率和蒸腾速率都表现为接近于直线的上升，气孔导度的恢复也很快，这表明大豆存在着胁迫解除后快速生长的特征。但是，干旱对大豆的生长等生理过程是否存在滞后效应，滞后效应的大小等问题还需要进一步的研究。

关键词 大豆；干旱和复水；水势；光合作用；节水增产；快速生长

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Effect of drought and rewatering on photosynthetic physioecological characteristics of soybean

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Abstract Water is the most essential condition to plant life, but the water resource is becoming more and more shorter in the 21st century. Soybean, as one of the five major crops in the world, is mankind's important sources of high-quality protein and edible oil. However, soybean is sensitive to water deficit and the water requirement of soybean is relatively high. Soybean in Chinese all three main soybean planting regions often suffer from drought to some degree during its growth season. So, the drought-resistant breeding and drought-resistant culturing of soybeans has been paid high attention since 1980's. Photosynthesis is an important factor that determines soybean's yield. At present, the research on soybean's photosynthetic characteristic mainly concentrates on its relationship with the yield. But it is lacking in studies on soybean's photosynthetic physioecological responses to drought and rewatering, which is helpful for constructing a theoretic basis for drought-tolerance planting and high-efficiency water use of soybean.
Field experiments were conducted with soybean (*Glycine max*，*yudou* 29), a mainly planted soybean variety in Henan Province to study the relationship between the leaves photosynthetic characters and other physioecological parameters under soil drying and rewatering treatments. Soil moisture was controlled by weighing method, and leave water potential was determined by HR-33T dew point microvolt thermometer. The diurnal course of leaf photosynthetic ratio and transpiration ratio of top fully spread leaves were determined by LI-6400 portable photosynthesis measure system in situ (begun at 8:00 a.m). Each treatment had 5 replicates.
It was showed that the dawn water potential of soybean leaves under drying treatment decrease

s little in comparison with well-watered treatments (CK), when soil moisture was higher than 47% of FWC (field water capacity). But when soil moisture was below 47% of FWC, the leave water potential decreased rapidly, which appeared a significant threshold value reaction. The threshold value of soybean dawn leaves water potential was nearly -1.02 MPa. Below this threshold value, the leave water potential and net photosynthesis ratio dropped rapidly. On the third day, the soil moisture under drought treatment was 47%, leaf water potential of the treatment was 7% lower than that of the CK, transpiration ratio and net photosynthesis ratio were respectively 67% and 90% that of the CK, the WUE was 35% higher than that of the CK. Above results indicated that the transpiration of soybean is more sensitive to drought than photosynthesis. This proved that it was possible to save water and increase yield simultaneously for soybean by cultivating measure. After rewatering, the leave water status of soybean was improved, the net photosynthesis ratio and transpiration ratio increased linearly, and Gs also recovered quickly. The results showed that soybean have a fast-growing characteristic after removing stress. However, whether there is a lagging effect of rewatering on soybean physiological traits and how important it is need further research.

Key words soybean；drought and rewatering；water potential；photosynthesis；water-saving and production-increasing；fast-growing

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