Water stress response on the enzymatic activity in cowpea nodules

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Abstract

A greenhouse experiment was carried out aiming to study the effect of water stress on metabolic activity of cowpea nodules at different plant development stages. Cowpea plants were grown in pots with yellow latosol soil under three different matric potentials treatments: -7.0 (control-S1), -70.0 (S2) and <-85.0 KPa (S3). The experimental design was randomized blocks with sub-divided plots, each plot containing a different degree of water stress, divided in sub-plots for the four different developmental stages: E1 (0-15), E2 (15-30), E3 (20-35) and E4 (30-45) days after emmergence. Water stress treatments were applied by monitoring soil water potential using a set of porous cups. The effect of water stress was most harmful to cowpea when it was applied at E2 than at other symbiotic process stages. Shoot/root ratio decreased from 2.61 to 2.14 when matric potential treatment was <-85.0 and -70.0 KPa respectively. There was a reduction in the glutamine synthetase activity and phosphoenolpyruvate carboxilase activity with increased stress, while glutamine synthase activity was the enzyme most sensitive to water stress. Glutamate dehydrogenase activity increased in more negative matric potential, indicating that this enzyme is sufficiently activitye under water stress.

Resumo

Experimento em casa de vegetação foi conduzido com objetivo de estudar os efeitos do estresse hídrico nas atividades metabólicas dos nódulos de caupi nos diferentes estádios de desenvolvimento da fixação de N2. As plantas de caupi foram crescidas em vasos com solo Latossolo amarelo sob diferentes potenciais matriciais: -7,0 (control-S1), -70,0 (S2) e <-85,0 KPa (S3). O desenho experimental foi em blocos ao acaso com parcela sub-dividida, na parcela principal contendo os diferentes níveis de potencial matricial e a sub-parcela contendo os diferentes estádios de desenvolvimento: E1 (0-15), E2 (15-30), E3 (20-35) e E4 (30-45) dias após a emergência. Os tratamentos de estresse foram aplicados gradualmente através do sistema de cápsula porosa. O efeito do estresse de água foi mais prejudicial ao caupi quando aplicado no estádio E2 do que nos demais estádios. A relação parte aérea/raiz decresceu de 2,61 para 2,14 no potencial matricial <-85,0 e -70,0 KPa respectivamente. Foi observado pequeno decréscimo nas atividades da glutamina sintetase e fosfoenolpiruvato carboxilase com o aumento do estresse, enquanto que a glutamina sintase foi a enzima mais sensível ao estresse. A atividade da glutamato desidrogenase aumentou no potencial matricial mais negativo indicando que esta enzima é suficientemente ativa sob estresse hídrico.