# Effects of Exogenous Tryptophan on C/N Balance and Senescence Characteristics of Sorghum Seedlings Under Low Nitrogen Stress

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**Abstract:【Objective】** The purpose of this study was to investigate the effects of exogenous tryptophan on senescence of sorghum (*Sorghum bicolor* L.) seedling leaves under low nitrogen stress, and to explore the relationship between C/N balance and senescence of sorghum seedlings leaves, so as to provide effective regulation means for sorghum resistance to low nitrogen stress. **【Method】** In a hydroponic culture experiment, the low nitrogen tolerance sorghum line (398B) and the low nitrogen sensitive sorghum line (CS3541) were selected as the experimental materials. Two nitrogen levels were set at normal nitrogen (5 mmol·$L^{-1}$) and low nitrogen (0.5 mmol·$L^{-1}$), and 50 mg·$L^{-1}$ exogenous tryptophan was applicated by spraying. After 10 days application, leaf morphology, tissue structure, photosynthetic activity, chlorophyll fluorescence parameters, content of carbon and nitrogen metabolism-related substances and enzyme activities, C/N and senescence related gene expression levels were determined, and the correlation between C/N value and senescence genes in sorghum seedlings under low nitrogen stress was analyzed.**【Result】** (1) Compared with the normal nitrogen treatment, low nitrogen stress significantly reduced the leaf area of 398B and CS3541, while exogenous tryptophan significantly increased the leaf area of 398B and CS3541 by 36.72% and 52.06%. Meanwhile, leaf dry weight and leaf fresh weight of 398B and CS3541 were significantly increased by exogenous tryptophan under low nitrogen stress. (2) Compared with the normal nitrogen treatment, the rosette structure of 398B was relatively complete under low nitrogen stress, while exogenous tryptophan kept the leaf cells orderly and the rosette structure clear. In addition, exogenous tryptophan significantly increased the chlorophyll content of 398B leaves (36.85%), but did not significantly increase the pigment content of CS3541 leaves under low nitrogen stress. (3) Under low nitrogen stress, the exogenous tryptophan treatment resulted in higher PSII maximum photochemical efficiency (Fv/Fm) and non-photochemical quenching (NPQ) capacity, increased leaf photosynthetic rate, and maintained stronger photosynthetic capacity than that without tryptophan. (4) The treatment with exogenous tryptophan reduced the accumulation of sugar (soluble sugar, sucrose and starch) in leaves, but significantly increased the nitrogen content in leaves, correspondingly increased the carbon and nitrogen metabolism enzymes activities, and decreased the C/N in leaves. (5) Exogenous tryptophan positively regulated the expressions of senescence related genes *SbLHCB* and *SBSGR-2*, and negatively regulated the expressions of *SbNAC6*, *SbPaO3*, *SbPPDK-2* and *SbSAG12-2* under low nitrogen conditions. In addition, C/N was positively

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correlated with the expression of *SbLHCB* and *SbSGR-2*, and negatively correlated with the expression of *SbNAC6*, *SbPaO3*, *SbPPDK-2* and *SbSAG12-2*. 【**Conclusion** 】Under low nitrogen stress, exogenous tryptophan affected leaf morphology and photosynthetic characteristics by reducing C/N value and senescence gene expression, and delayed leaf senescence by regulating leaf carbon and nitrogen metabolism, thus enhancing the tolerance of sorghum seedlings under low nitrogen stress. Tryptophan application would be a strategy to weaken low nitrogen stress in the future sustainable agricultural production.