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0BRIEF COMMUNICATION

Growth, biomass production, and assimilatory characters in *Cenchrus ciliaris* L. under elevated CO_2 condition

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Abstract

The effect of elevated carbon dioxide (600±50 cm^3 m^{-3}; C_{600}) on growth performance, biomass production, and photosynthesis of *Cenchrus ciliaris* L. cv. 3108 was studied. This crop responded significantly by plant height, leaf length and width, and biomass production under C_{600}. Leaf area index increased triple fold in the crops grown in the open top chamber with C_{600}. The biomass production in term of fresh and dry biomass accumulation increased by 134.35 (fresh) and 193.34 (dry) % over the control (C_{360}) condition where the crops were grown for 120 d. The rate of photosynthesis and stomatal conductance increased by 24.51 and 46.33 %, respectively, in C_{600} over C_{360} plants. In comparison with C_{360}, the rate of transpiration decreased by 6.8 % under C_{600}. Long-term exposure (120 d) to C_{600} enhanced photosynthetic water use efficiency by 34 %. Also the contents of chlorophylls *a* and *b* significantly increased in C_{600}. Thus *C. ciliaris* grown in C_{600} throughout the crop season may produce more fodder in terms of green biomass.

Additional key words: area leaf mass; leaf area index; net photosynthetic rate; specific leaf area; stomatal conductance; tiller; transpiration.

Since the mid 1800's, the human activities have contributed to an increase in atmospheric CO_2 concentration from roughly 250 to present day 350 cm^3 m^{-3} projecting a further doubling of the global CO_2 within the next century (Watson *et al.* 1990). Plant species are specific in physiological response to high CO_2 concentration (Zhang and Nobel 1996). The increased net photosynthetic rate (P_N) affects the growth of plants as indicated by increased growth and yield in many crop species grown under elevated CO_2 (Sasek and Strain 1991, Das *et al.* 2000). Pal *et al.* (2004) also reported the increase in plant growth and biomass production under elevated CO_2 concentration (EC).

Cenchrus ciliaris is the most important fodder grass species, grown in arid and semi-arid tropics (cf. Baig *et al.* 2005). This is perennial multi-cut, highly palatable, and nutritious grass species that can be utilized under cut and carry as well as under grazing system of production. The objective of the present study was to determine long term effect of high CO_2 concentration (600±50 cm^3 m^{-3}; C_{600}) on growth, biomass production, and photosynthesis of *C. ciliaris* L. cv. 3108.

30-d-old seedlings were transplanted inside the open top chambers (OTCs) and in open field as control at 50 cm row to row and plant to plant spacing. Nitrogen and phosphorus were applied as basal at the rate of 60 kg N and 40 kg P_2O_5 per hectar before transplanting seedlings at the onset of monsoon, *i.e.* in July. The plants were maintained using recommended agronomical practices. Pure CO_2 gas was used for enrichment of CO_2 inside the OTCs. The flow of CO_2 was adjusted with the help of a flow meter to get the target concentration of CO_2 inside the OTCs. The period of enrichment was from 08:00 to 17:00 h every day from transplantation of seedlings. Irrigation was given as and when required.

The morphological characters [plant height, tiller production, leaf area, fresh (FM) and dry (DM) biomass production] were recorded at stage of 50 % flowering. Leaf area of fresh leaves was measured before weighing by using leaf area meter (*LICOR-3000*, USA). The fresh

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