Curr. Agric. Vol. 36, No. 1-2, 2012, 115-117.

EFFECT OF SALTS ON NET PHOTOSYNTHETIC RATE, TRANSPIRATION RATE AND STOMATAL RESISTANCE IN GRASS SPS *Cenchrus Setigerus -76*

Reena Bora
Head, Department of Botany, Mahila P.G.Mahavidyalaya,Jodhpur.

ABSTRACT

Experiments were conducted for assessing the effect of various concentrations of salts on net photosynthetic rate, transpiration rate and stomatal resistance at pre and post flowering stages of *Cenchrus setigerus.* Measurements of net photosynthetic rate, transpiration rate and stomatal resistance on intact leaves were analysed using CI-301 CO_2 Gas Analyzer (CID, Inc. Vancouver Washington U.S.A.). NaCl decreased the net photosynthetic rate at low and high concentration in this plant, while NaF and Na_2SO_4 treatments recorded increased rates. $CaCl_2$ increased net photosynthetic rate with the increasing concentration in post flowering stage of *C.setigerus* plants.
Key Words : Pn, Tr, Sr.

INTRODUCTION

Salinity is one of the important constraints in crop productivity. Salt in medium generally alter a wide array of metabolic processes culminating in stunted growth. (Reddy and Vora,1985) Salinity reduced net photosynthetic rate. Drake *et al.* (1997) have shown that decreases in stomatal conductance can explain reductions in leaf transpiration rate. A heavy environmental concentration of salts unleashes various types of physical and chemical stress in plants, provoking complex responses that involve changes in morphology, physiology and metabolism (Hasegawa *et al.*, 2000; Musyimi, 2005). Growth inhibition by salt stress is associated with alterations in the water relationships within the plant, due to osmotic effects with, specific ion toxicity and mineral deficiencies (Bar *et al.*, 1996; Netondo *et al.*, 2004a; Musyimi, 2005). Na+ in the roots and exclusion of ions from entering the roots from the exterior (Munns and Termaat, 1986; Munns, 2002). On the other hand, inclusive plants take up salt in great quantities and store it in the stems and leaves. The interactive nature affecting nutrient availability, uptake and distribution are real and complex mechanisms in the presence of numerous environmental factors such as aeration, temperature and other stresses such as salinity and flooding (Marchner, 1995; Bar *et al.*, 1996). Photosynthesis is the enzymatic conversion of light energy into chemical energy. It is one of the most fundamental biological functions. Photosynthetic process indicates that increasing CO_2 provides an opportunity to increase plant productivity (Kramer,1981). Stomata respond to changes in light intensity and temperature, as well as showing both blue-light and phytochrome-type responses.These changes control both the rates of photosynthetic gas exchanges and rates of water use (loss) through transpiration. Stiborova et al. (1987) suggested that a reduction in photosynthesis associated with effects of salts could be due to a decrease in activity of CO_2 fixation enzymes as assayed in leaf homogenates.

METERIAL AND METHODS

For *in vivo* studies seeds were sown in earthenware pots. After two weeks of seedlings growth thinning was done and five to six plants of uniform size were selected in each pot. Different concentrations of salts were given to three week old plants. For pre flowering stage subsequent three treatments were given at an interval of four days. Pots treated with water served as controls. After the emergence of inflorescences the spikes, plants were given fourth treatment for post flowering stage in the same manner as that of the pre flowering stage. Top terminal leaves served as plant materials.

Measurements of net photosynthetic rate, transpiration rate and stomatal resistance on intact leaves were analysed using CI-301 CO_2 Gas Analyzer (CID, Inc. Vancouver Washington U.S.A.). In pre flowering stage two measurements were taken after subsequent three treatments and in post flowering stage measurements were taken after fourth treatment. Time was fixed for each measurement.

Photosynthetic rate is determined by the CO_2 analyzer by measuring the photosynthetic rate at which a CO_2 concentration is assimilated by a known leaf area in a given time. The net photosynthetic rate thus obtained is expressed in $\mu M/m^2/s$. Transpiration rate is measured by the water vapour flux per one sided leaf area and is expressed as $mM/m^2/s$. stomatal resistance is obtained by measuring transpiration and leaf surface tempreture (°C) and is measured as $m^2/s/M$. All these measurements were taken in open system measurement mode of the analyzer. In the present investigation The net photosynthetic rate, transpiration rate and stomatal resistance were recorded in various concentrations of salts.

RESULTS AND DISCUSSION

Plants treated with NaCl, Na_2SO_4 10^{-1}M, NaF and $CaCl_2$ 10^{-1} M at pre and NaF and $CaCl_2$ 10^{-2}M at post flowering stages showed increased net photosynthetic rates with respect to their control plants of *Cenchrus setigerus* plant grown *in vivo* (Table-1). On the contrary Lloyds et al. (1987) reported that NaCl Stalinization reduced CO_2 assimilation rate in *Citrus sinensis* leaves even though the leaves maintained turgor. Highest and lowest Sr. value at 10^{-1} M concentration of Na_2SO_4 (pre flowering stage) and 10^{-2} M of Na_2SO_4 (Post flowering stage) respectively.

Table 1. Effect of Salts on Net Photosynthetic rate, Transpiration rate and Stomatal resistance in *Cenchrus setigerus* -76.

Treatments	Net Photosynthetic rate (μ mol / m^2 / s) Pn Pre Flow	Post Flow.	Transpiration rate (m mol / m^2 / s) Tr Pre Flow	Post Flow.	Stomatal resistance (m^2 / s / mol) Sr Pre Flow	Post Flow.
Control	4.95	8.15	0.2	0.50	151.75	108.85
NaCl						
10^{-3} M	6.20	6.95	0.2	0.30	137.2	122.15
10^{-2} M	6.80	4.70	0.2	0.30	130.55	111.50
10^{-1} M	6.35	6.05	0.25	0.35	124.20	94.05
Na_2SO_4						
10^{-3} M	4.95	5.85	0.15	0.35	120.55	109.05
10^{-2} M	4.55	7.30	0.20	0.25	108.10	158.35
10^{-1} M	5.15	4.45	0.15	0.30	287.70	107.50
NaF						
10^{-3} M	5.90	8.85	0.20	0.40	73.61	75.10
10^{-2} M	7.0	8.8	0.20	0.50	115.50	87.40
10^{-1} M	6.45	10.05	0.20	0.40	96.15	89.10
$CaCl_2$						
10^{-3} M	4.50	5.90	0.20	0.40	83.30	76.65
10^{-2} M	4.35	10.40	0.15	0.50	106.95	72.50
10^{-1} M	9.25	6.25	0.20	0.40	90.15	98.05

Kingsbury et al.,1984 reported that salinity affects general metabolism causing reduced photosynthesis and a parallel reduction in stomatal and mesophyll conductance, resulting in lower growth rates in the stressed plants. Transpiration rate and stomatal resistance offered by guard cells showed definite trend of increase or decrease with the rates of net photosynthesis. As expected salt stress decreased the amount of water lost by the plant. Transpiration rate (E) decreased significantly ($p \leq 0.05$) in response to increasing salt concentration of the growth medium Inhibitory rates of net photosynthesis were coupled with high stomatal resistance and low transpiration rates and vice-versa conditions was prevalent in high rates of net photosynthesis.

CONCLUSIONS

This study showed that high growth inhibition of *Cenchrus setigerus* seedlings at high salinity may be related to high leaf chloride content. The results showed that salinity reduces growth and reduced photosynthetic rate.

REFERENCES

Bar, Y., A. Apelbaum, U. Kafkafi and R. Goren, 1996. Polyamines in chloride-stressed citrus plants: Alleviation of stress by nitrate supplementation via irrigation water. J. Am. Soc. Hortic.Sci.,121:507-513.

Drake, B.G., M.A. Gonzalez-Meler and S.P. Long, 1997. More efficient plants: A consequence of a rising atmospheric CO2. Annu. Rev. Plant Physiol. Plant Mol. Biol., 48: 609-639.

Hasegawa, P.M., R.A. Bressan, J.K. Zhu and H.J. Bohnert, 2000. Plant cellular and molecular responses to high salinity. Ann. Rev. Plant Physiol. Plant Mol. Biol., 51: 463-499.

kingsburyR.W., Epstein, E. and Pearcy, R.W. 1984. Physiological responses to salinity in selected lines of Wheat *Plant Physiol*., 74:417-423.

Kramer, P.J.1981. *Bioscience*.31:29.

LLoyds, J., Syvertsen, J.P. and Kriedmann, P.E.1987. Salinity effects on leaf water relaions, gas exchanges of Valacia orange, *Citrus sinensis* L.Osbeck,on root stock with different salt exclusion characteristics'. *Aust.J.Plant Physiol*., 14:605-617.

Munns, R. and A. Termaat, 1986. Whole plant responses to salinity. Aust. J. Plant Physiol., 13: 143-160.

Munns, R., 2002. Comparative physiology of salt and water stress. Plant Cell Environ., 25: 239-250.

Musyimi, D.M., 2005. Evaluation of young avocado plants (*Persea americana* Mill.) for tolerance to soil salinity by physiological parameters. M.Sc. Thesis. Maseno University, Kisumu, Kenya.

Netondo, G.W., J.C. Onyango and E. Beck, 2004. Sorghum and salinity: I. Response of growth, water relations and ion accumulation to NaCl salinity. Crop Sci., 44: 797-805.

Netondo, G.W., J.C. Onyango and E. Beck, 2004. Sorghum and salinity: II. Gas exchange and chlorophyll fluorescence of sorghum under salt stress. Crop Sci., 44: 806-811.

Reddy,M.P. and Vora, A.B.1985. Effect of salinity on protein metabolism in Bajra *(Pennisetum typhoides* S and H) leaves. *Ind.J.Plant Physiol*., 28:190-195.

Stiborva,M., Ksinska, S. and Brezinova, A.1987. Effect of NaCl on the growth and biochemical characteristics of photosynthesis of Barley and Maize. *Photosynthetica*. 21:320-328.