Pah. J. Agri. Sci. Vol. 36 (1-2), 1999

INFI4UENCE OF FERTILIZER AND WATER STRESS ON LEAF AREA OF SUNFLOWER *(HELIANTHUS ANNUUS* L.)

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The influence of nitrogen fertilizer and water stress on leaf area of sunflower *(Helianthus annuus* L.) was studied in pots. Urea as a nitrogen fertilizer was applied at the time of sowing and sporadic stress was induced by a cycle of ten-day watering and ten-day stress period after 20, 30, 40 and 50 days of sowing. Data revealed that the sporadic stress and urea fertilizer had highly significant response. When either the stress period was increased or urea fertilizer decreased, the leaf area signIficantly decreased. The highest leaf area values were recorded with full dose of urea, intermediate with 1/3rd dose and the lowest with 1/8th dose of urea at all sporadic stress levels.

Key words: leaf area, nitrogen fertilizer, sunflower, water stress

INTRODUCTION

Water stress is one of the severe conditions that affect crop productivity. Water stress probably limits the plant production more than any other environmental parameter. Water being an integral part of plant, plays a vital role in the maintenance of plant life. The deficiency of water modifies soil-plant-water relationship by lowering tissue water potential and impairing metabolic processes (Akhtar *et al.,* 1993). The effects of water stress on water status and growth of different plant speeies have been shown to depend on the stage of growth when stress occurs. Several researches have indicated that moisture stress at any growth stage reduces crops yield (Monayeri *et al.,* 1984; Sarwar *et al.,* 1991). Similarly, Jamro and Larik (1991) pointed out that water stress during vegetative growth reduces leaf area and dry matter due to decrease in leaf water potential from less water uptake or more atmospheric demand which in turn decreases leaf expansion. Palmer *et al.* (1996) studied the impact of nitrogen on leaf expansion of sunflower and reported that the availability of nitrate had a strong effect on leaf area expansion. A general response to drought is accelerated senescence of leaves in lower parts of the shoot. Water stress also causes metabolic and compositional changes such as decline in photosynthetic rate, increase in abscisic acid and ethylene concentrations, decrease in cytokinin levels and reduced protein synthesis :Wolfe *et al.,* 1988). The present investigation was undertaken to determine the influence of nitrogen fertilizer and sporadic water stress on leaf area of sunflower *(Helianthus annuus* L.).

MATERIALS AND METHODS

The experiment was carried out in the net house of botanical garden, University of Agriculture, Faisalabad. Sunflower variety Shams was used and the seeds were obtained from the Ayub Agricultural Research Institute, Faisalabad. The seeds were sown in 120 pots and urea as nitrogen fertilizer was added to each pot having 23 cm diameter and 9.5 kg soil in it . The soil analysis before experiment showed that it was deficient in nitrogen (0.036%) and organic matter (0.73%) with pH 8.0 and saturation percentage of 36%. One plant per pot was maintained. Urea as a nitrogen fertilizer was applied in solution form in three doses. No phosphatic or potash fertilizer was added to the pots.

1. Full dose(normal) : 75 kg/acre
2. 1/3rd dose (normal) : 25 kg/acre
3. 1/8th dose (normal) : 9.37 kg/acre

Four water stress levels and three urea treatments (as above) were used. The experiment was laid out in completely randomized design with eight replications. The number of pots per stress treatment was 24 whereas the number of pots per urea treatment was 8. Before application of urea to all the 120 pots, these were divided into five groups of 24 pots each. Group 1 pots having all three nitrogen levels were kept as control to which water was applied continuously. In rest of the four groups each having respective nitrogen level, sporadic drought was induced using a cycle of ten-day watering and a ten-day stress period at the following stages:

ControL.....(SO)
Drought started 20 days after sowing (Si)
Drought started 30 days after sowing (S2)

Drought started 40 days after sowing (S3)
Drought started 50 days after sowingid«)

Leaf area was measured just before flower initiation and mean of three plants was calculated for statistical analysis. The leaf area was measured as reported by Carleton and Foote (1965).

Leaf area = Length x breadth x 0.75 (a constant).

The data were analyzed and significance was determined by Duncan's multiple range test (Steel and Torrie,1980).

RESULTS AND DISCUSSIONS

Table I showed a highly significant difference among fertilizer means with regard to leaf area just before flower initiation. Among the urea levels applied the maximum significant leaf area (36.50 cm^2) was observed in full urea concentration, while the minimum (24.38 cm^n) in 1/8th concentration, indicating a highly significant ($p<O.Ol$) decrease in leaf area with decrease in urea concentration.

The difference in leaf area was highly significant among all the stress treatments. Maximum significant value (47.27cm^2)for leaf area was observed in So- (zero stress) and maximum significant decrease (18.68cm^2) was observed in SI (stress 20 days after sowing). Intermediate values were observed with other stress treatments (stressed after 30,40 and 50 days of sowing). These results indicate that with each successive increase in sporadic stress, the leaf area decreases significantly. The interaction between water stress and fertilizer levels, varied significantly. With full dose, 1/3"'!and 1/8th urea levels, leaf area decreased gradually with the increase of sporadic stress period. When full dose of urea was applied, the maximum leaf area (51.15 cm^2) was observed in So, while the minimum (21.43cm^2) in SI (stress 20 days after sowing). Similarly, with 1/8th urea dose, the highest value (41.00 cm^2) of leaf area was noted in So and lowest (16.59 ems) in Si. These results indicated that at all the sporadic stress levels including control (zero stress), the highest values for leaf area were obtained when full dose of urea was applied.

It is, therefore, evident that both the sporadic water stress and varying urea doses have highly significant effect on leaf area. When either the sporadic stress period is increased or urea dose is decreased, the leaf area will significantly decrease. The adverse effect of water stress on leaf area in different crop plants has also been reported by different workers. Karamanos *et al.* (1982) recorded reduction in leaf size by reducing both the area at unfolding and the mean growth rate under water stress conditions in field bean *(Vicia faba* L.). Menzel *et al.* (1986) had record reduction in leaf area of passion fruit hybrids by soil moisture stress along with variation in other morphological characteristics.

Conclusions: Leaf area decreased significantly with increase in sporadic stress period and progressive decrease in urea doses.

Table 1. Leaf area (cm^2) just before flower initiation

	Dose of urea fertilizer used			
Stress level	Full	1/3rd	1/8th	Stress means
So	51,15	49.65	41,00	47.27a
SI	21,43	18.01	16.59	18.68e
S2	25.61	20.15	17,48	21,08d
S3	38.77	22.81	17.87	26.48c
S4	45.55	34.17	28.95	36.22b
Fertilizer means	36.50A	34.99B	24.38C	

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