productive tillers. It is concluded that selection based on plant height, ear length, ear girth and total number of tillers either individually or in combination results in high yielding lines.

Path values based on genotypic correlation coefficients showing direct and indirect effects on grain yield is given in Table 2. Results revealed that the direct contribution of number of productive tillers was positive and the highest on grain yield per plant. Ear girth, ear length and plant height which had significant association with grain yield found to have direct contribution to the grain yield. Reddy and Sharma (1982) observed, plant height had high positive direct effect on grain yield, whereas, direct effects were either low or negative for tillers per plant and ear length. Rao *et al.* (1987) showed, plant height and number of tillers had positive direct effects on grain yield.

A very high negative contribution was exhibited by total number of tillers but its indirect contribution was exerted through number of productive tillers on grain yield per plant. A very low negative contribution was given by 1000 grain weight but its contribution was indirectly via ear girth. The direct effect of days to maturity on grain yield per plant is negligible . Khairwal *et al.* (1990) observed that days to 50 per cent heading had very poor or negative effect on grain yield. On seeing themaximun contribution of characters to the grain yield, the prime importance should be given to the number of productive tillers followed by ear girth, ear length and plant height. Mukherji *et al.* (1982) also suggested the improvement in yield through selection can be achieved by concentrating on higher number of effective tillers and plant height might improve the yield potential.

REFERENCES

DEWEY D.R. and LU, K.H. (1959). A correlation and path analysis of components of crested wheat grass seed production **Agron.J., 51**:515- 518.

JOHNSON, H.W., ROBINSON, H.F. and COMSTOCK, R.E. (1955) Estimates of genetic and environmental variability in soyabean. **Agron J., 47**: 314-318.

KHAIRWAL, I.S., SINGH, S. and OM PARKASH (1990) Path analysis in pearl millet. **Haryana Agric. Univ.J. Res., 20**: 76-77.

MUKHERJI P., AGARWAL, R.K. and SINGH, R.M. (1982) Variability, correlation and path coefficeicnts in inbreds of pearl millet *(Pennisetum typhoides)*. **Madras Agric. J., 69**: 45-50.

RAO, P.V., SINGH, N.B. and GILL, K.S. (1987) Correlation studies in pearl millet *(Pennisetum typhoides*(Durm) S.& G.)**Andhra Agric.J., 34**: 5-7.

REDDY N.S.and SHARMA, R.K. (1982) Variability and interrelationships for yield character and protein content in inbred lines of bajra.**Crop Improv., 9**: 124-128.

Madras Agric. J., 82(2): 100-103 February, 1995
https://doi.org/10.29321/MAJ.10.A01136

INFLUENCE OF IRRIGATION AND NITROGEN ON PLANT WATER STATUS AND THERMAL RESPONSES OF MAIZE, *Zea mays*

R.SELVARAJU and M.R. IRUTHAYARAJ

Department of Agronomy , Agricultural College and Research Institute
Tamil Nadu Agricultural University, Coimbatore 641 003

ABSTRACT

Stomatal conductance, transpiration rate and canopy temperature served as indicators of stress and were measured using a steady state porometer and infrared thermometer, respectively , in different treatments of maize *(Zea mays* L.) grown on moderately well drained sandy clay loam soil of Coimbatore. In general, stomatal conductance and transpiration rates were increased from 25 to 50 days after sowing thereafter declined upto maturity. Higher stomatal conductance and transpiration rates were associated with irrigation scheduling based on 0.75 IW/CPE ratio due to more frequent and adequate water availability. Among the methods of irrigation, every furrow method recorded highest stomatal conductance and transpiration rate irrespective of the stages of the plant growth, Nitrogen application increased the transpiration rate and stomatal conductance. Increased canopy temperature was recorded with irrigation scheduled based on 0.50 IW/CPE ratio due to less frequent and inadequate irrigation. Cooler canopies were associated with adequate moisture content and canopy temperature was progressively higher with increasing soil moisture stress at all stages of the growth. Higher does of nitrogen application reduced the canopy temperature at all stages of the crop growth. Higher grain yield was recorded at 0.75 IW/CPE ratio with all furrow method of irrigation and with 175 kg N ha-1. ha^{-1}

KEY WORDS : Irrigation, Nitrogen, Plant Water, Maize

Water deficit at various phases of crop growth has direct effect on different physiological parameters and crop yield. Canopy temperature (TC) has been used to ascertain the plant water status of various crops (Blum *et al.,* 1982). Differential responses of stomata to varying degrees of water stress have been reported in maize by Turner (1975). If a plant is well watered, the transpiration cooling occurs, as the plant experiences water stress due to soil moisture deficit, transpiration reduced progressively (Mtui *et al.*, 1981). Nitrogen application also plays a major role in altering the stomatal conductance and transpiration rate (Bataglia *et al.* 1985). But the degree of change of physiological parameters due to water and nitrogen was not studied in detail. The purpose of this study was to assess the effect of irrigation, methods of irrigation and nitrogen levels on plant status of maize at different days after sowing.

MATERIALS AND METHODS

CO1 maize was sown in moderately well drained sandy clay loam soil at the Tamil Nadu Agricultural University Farm, Coimbatore (11^0N, 77^0E), during monsoon season (1989) and winter (1989-90). Investigations were carried out in a split plot design replicated three times with two levels of irrigation (0.50 IW/CPE ratio (I_1) and 0.75 IW/CPE ratio (I_2) and three methods of irrigation, *viz.*, every furrow (S_1), alternate furrow (S_2), and skip furrow (S_3) in main plot and three levels of nitrogen 75 (N_1), 125 (N_2), 175 (N_3) kg N ha^{-1} in sub plots. As per the treatments, N was applied in three splits *viz.*, basal, 25 and 45 days after sowing. The entire 62.5 kg ha^{-1} P_2O_5 and 50 kg ha^{-1} K_2O was applied to all the plots uniformly as basal dressing. Stomatal conductance (reciprocal of the stomatal diffusive resistance) and transpiration rate was measured (steady state porometer Model LI.1600) in fully expanded young leaf between 11 and 13 h. The canopy temperatures (TC) were recorded with infra-red thermometer.

RESULTS AND DISCUSSION

Water stress resulted in decreased stomatal conductance and transpiration rate (Table 1) to varying degrees, In general, stomatal conductance and transpiration rates increased from 25 DAS (knee-high stage) to 50 DAS (tasseling stage) and thereafter declined up to maturity. These two parameters were higher in adequately watered plants (0.75 IW/CPE ratio -I_2) compared to those under stress (0.50 IW/CPE ratio-I_1). Unrestricted absorption of water under I_2 maintained favourable leaf water potential thereby offering minimum stomatal resistance thus increased stomatal conductance. Reduction in stomatal conductance was associated with moisture stress (Dwyer and Stewart, 1985). Among the methods of irrigation, every furrow method recorded highest values of stomatal conductance and transpiration rate

Table 1. Effect of treatments on stomatal conductance and transpiration rate*

Treatments	Stomatal conductance (cm S^{-1})			Transpiration rate (µg cm^{-1} S^{-1})		
	25 DAS	50 DAS	80 DAS	25 DAS	50 DAS	80 DAS
Irrigation levels						
I_1	0.413	0.483	0.480	8.41	8.92	8.54
I_2	0.536	0.561	0.524	11.38	12.54	11.42
CD (P=0.05)	0.021	0.019	0.020	0.56	0.74	0.68
Methods of irrigation						
S_1	0.489	0.540	0.513	10.26	11.16	10.32
S_2	0.481	0.536	0.508	10.24	11.04	10.30
S_3	0.452	0.491	0.485	9.16	9.98	9.32
CD (P=0.05)	0.022	0.028	0.021	0.61	0.75	0.68
N levels						
N_1	0.460	0.482	0.477	[illegible]	[illegible]	9.18
N_2	0.478	0.526	0.510	[illegible]	[illegible]	9.82
N_3	0.488	0.588	0.519	[illegible]	[illegible]	10.94
CD (P=0.05)	0.010	0.019	0.011	[illegible]		0.70

DAS = Days after sowing * Mean of two experiments

Table 2. Effect of treatments on canopy temperature (TC) yield attributes and grain yield of maize*

Treatments	Canopy temperature (°C)			Yield attributes		Grain yield (kg ha^{-1})
	25 DAS	50 DAS	80 DAS	Grain No. cob^{-1}	100 grain weight (g)	
Irrigation levels						
I_1	32.60	33.10	33.15	286	25.7	3910
I_2	28.83	29.31	29.96	356	28.3	4736
CD (P=0.05)	0.64	0.41	0.40	5	0.9	46
Methods of irrigation						
S_1	30.23	30.72	30.92	334	27.5	4490
S_2	30.50	30.89	31.82	332	27.5	4422
S_3	31.43	32.02	31.93	297	25.9	4057
CD (P=0.05)	0.67	0.48	0.65	8	0.3	49
N levels						
N_1	31.40	31.86	32.50	300	25.7	4007
N_2	30.72	31.38	31.52	325	27.3	4368
N_3	30.03	30.46	30.65	338	28.1	4593
CD (P=0.05)	0.49	0.48	0.68	7	0.57	96

* Mean of two experiments

followed by alternate furrow and skip furrow methods. This might be due to unlimited water availability under the every furrow method, while, water stress experienced under skip furrow due to less water application and closer spacing, recorded reduced values of these parameters. If a plant is well watered , the transpiration cooling occurs and as the plant experience water stress due to soil moisture deficit, transpiration reduced progressively. Among the N levels, application of N at N_3 recorded highest stomatal conductance and transpiration rate in all three stages of the plant growth. Adequate N could adjust osmotic potential by accumulating N compounds and other assimulates, with more efficient utilization of available soil moisture (Bataglia *et al.,* 1985).

Increased canopy temperature was recorded at I_1 due to moisture stress (Table 2). Lower canopy temperature was recorded with I_2 due to judicious water supply. Lowest canopy temperatures were registered under every furrow method than alternate and skip furrow method of irrigation. Skip furrow method recorded highest TC in all the stages of the crop growth. Cooler canopies were associated with adequate moisture content and canopy temperature was progresively higher with increasing soil moisture stress. Adequate soil moisture favours transpiration and thereby reduced leaf temperature considerably.

Nitrogen application marginally decreased the canopy temperature and less values of this parameter recorded with higher doses of N (175 kg N ha^{-1}). This might be due to the increased N application which increases the transpiration rate, thereby canopy temperature (Bataglia *et al.*, 1985).

Highest yield attribute, grain yield was recorded at S_1 and N_3. Increased yield under I_2 milates to satisfy the potential sink capacity resulting from more amount moisture. Application of less amount of water which led to competition between plants resulted in lowest yield attributes under skip furrow method of irrigation (Balaswamy *et al* ., 1986). Application N at N_1 recorded lowest yield attributes and yield due to to less availability of nutrients to the crop plants. N deficiencies can alter the physiological response of maize crop (Radin *et al.,* 1985). Total water used I_2 S_1 N_3 combination was highest (541.4mm). Average water requirement under S_1 is 479.4 mm, whereas it is only 342 mm under S_2 method of irrigation.

The present study reveals the quantification of water and fertiliser stress, the important production facts of maize growth. It suggests that stomatal conductance, transpiration rate and canopy temperature is a combined effect of water deficit and nitrogen fertilization and may be used to assess crop water status.

REFERENCES

BALASWAMY, K., BASKER REDDY, B., ANAND REDDY, K., BUCHA REDDY, B., and MADAVA REDDY, V. (1986). Effect of plating patterns, mulches and soil moisture regimes on growth and yield attributes of maize (*Zea mays*) L. **Madras agric. J., 73:** 553-557.

BATAGLIA, O.C., QUAGGIO, J.A., BRUNINI, O. and CIARELLI, D.M. (1985). Effect of nitrogen fertilizer on osmotic adjustment in maize and sorghum. **Pesquisa Agro pecuaria Brasileira 20:** 659-665

BLUM, A., MAYER, J. and GOZLAN, G. (1982). Infra red thermal sensing of plant canopies as a screening technique for dehydration avoidance in wheat. **Field Crops Rs., 5:** 137-146.

DWYER, L.M. and STEWART, D.W. (1985) Water extraction patterns and development of plant water deficits in corn. **Can. J. Plant Sci., 65:** 921-933

MTUI, T.A., KANEMASU, E.T. and WASSOM, C. (1981). Canopy temperatures, water use and water use efficiency of corn genotypes. **Agron.J., 73:** 639-643

RADIN, J.W., MAUNEY, J.R. and BRUIN, G. (1985). Effects of nitrogen fertility on plant water relations and stomatal response to water stress in irrigated cotton. **Crop Sci., 25** 110-115.

TURNER, N.C.(1975) Concurrent comparisons of stomatal behaviour, water status, and evaporation of maize in soil at high or low water potential. **Plant Physiol., 55:** 932-936.

Madras Agric. J., 82(2): 103-104 February, 1995

K 10: A GRAIN-CUM-FODDER SORGHUM FOR SOUTH TAMIL NADU

R.SANKARAPANDIAN and A.AMIRTHADEVARATHINAM

Agricultural Research Station, Tamil Nadu Agricultural University, Kovilpatti 627 701.

ABSTRACT

A medium duration (115 days) and medium stature sorghum strain K 10 which is an improvement over K7 has been developed and released during 1991 for rainfed cultivation in *Purattasi Pattam* (September-October) season in south and south central districts of Tamil Nadu. K 10 produced a mean dry fodder (straw) of 11.36 t/ha registering 34.2 per cent increase over K 3 and 14 per cent increase over K 7. It gave a mean grain yield of 1680 kg/ha registering 31.7 per cent increase over K 3 and 18 per cent increase over K.7. It has got better resistance to leaf diseases and pests both at field and controlled conditions.

KEY WORDS : Grain-Fodder Sorghum, K10, TamilNadu

Fodder sorghum is cultivated as a pure crop in an area of 2 lakh ha in Tamil Nadu. The crop is grown with a thick seed rate of 75 to 100 kg/ha in order to get thin stems which will be palatable for animals. The whole plant is cut at maturity after removing ear heads, dried and stalked to be used as dry fodder. Two fodder sorghum strains *viz.*, K3 and K7 are now being extensively cultivated. To improve quality and yield over K 3 and K 7, hybridisation and selection were made at the Agricultural Research Station, Kovilpatti that resulted in release of an improved fodder sorghum strain, K 10 for general cultivation.

MATERIALS AND METHODS

Sorghum strain improvements were made in terms of yield and quality over K 7. A high yielding culture KS 7629 was identified from the derivations of the cross between K 7 and SPV 102. The dry fodder and grain yield performances were confirmed through a series of station trials and adaptive research trials. This culture was also screened for reaction to major pests and diseases. Quality tests were also conducted.

RESULTS AND DISCUSSION

The performance of K 10 for dry fodder and grain was assessed in 6 Research station trials (1985-89) and 52 Adaptive Research Trials during 1987-89. K 10 produced a mean dry fodder of 11.36 t/ha registering 34.2 per cent increase over K 3 and 14 per cent increase over K 7. As regards grain, K 10 gave a mean yield of 1680 kg/ha registering 31.6 percent increase over K 3 and 18 per cent increase over K 7 (Table 1.)

K 10 is a green and glabrous plant type and has a dull white leaf mid rib. The stalk is thin, juicy and sweet. The panicle is erect, loose and semi-open. Glumes are red in colour and the grains are partly exposed outside the glume; seeds are dull white and lustrous.

K 10 has a high content of crude protein (7.3%) and minerals in straw and high content of