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DIURNAL COURSE OF CERTAIN LEAF MOISTURE CHARACTERS IN IRRIGATED AND UNIRRIGATED BLACK GRAM

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ABSTRACT

The effect of irrigation on diurnal changes of certain leaf moisture characteristics was studied during early bean filling in black gram. There was a reduction in leaf water potential and transpiration, while there was an increase in leaf temperature and stomatal resistance as the day advanced from 8 to 14 h. Irrigation had favourable influence on the leaf moisture characters while non- irrigation proved deleterious. Mid-day observations of the leaf moisture parameters are advisable in the screening of black gram cultivars for drought.

KEY WORDS : Leaf Moisture Characters, Black gram, Drought Response

The yield differences between irrigated and unirrigated crops are often significant and could largely be attributed to the plant-moisture status and its effect on the physiology of the crop in question. Changes in leaf water potential resulted in the alteration of the diurnal course of transpiration and leaf temperature (O' Toole and Tomar, 1982). Information regarding differences in the diurnal course of leaf moisture characteristics under irrigated and water limited conditions in the field may help in understanding the wide differences in productivity between irrigated and rainfed crops. The present study was, thus undertaken to gather information on the effect of moisture stress on the diurnal course of certain leaf moisture parameters in black gram (*Vigna mungo* L. Hepper), a proteinaecious crop which is mostly cultivated under limited water supply in India.

MATERIALS AND METHODS

The cultivar, TMV 1 black gram chosen for the study is a short duration (65 days) high yielding variety widely cultivated in Tamil Nadu. It is a drought sensitive variety and suffers 30-40 per cent yield reduction under rainfed condition. The crop was raised in an experimental plot during rain-free summer months. The soil was red loamy and had the following properties: bulk density = 1.6 g cm^{-3}; field capacity = 15.6% permanent wilting point = 7.5%; effective rooting zone = 60 cm. For the control plots, irrigation was done regularly at every

Table I. Diurnal changes in air temperature and radiation intensity

Time of day (h)	Weather variable		
	Tempcarature (C°)	Light Intensity (Klux)	Photon Flux Density ($\mu E\ cm^{-2}\ S^{-1}$)
8	30.4	44.0	1345
9	31.0	68.1	1380
10	31.8	82.3	1543
11	32.2	94.6	1895
12	32.8	104.6	2055
13	33.2	103.4	1823
14	32.8	95.2	1738
15	32.6	82.3	1208
16	32.0	59.3	927
17	31.1	35.3	745
Mean	31.99	76.91	1465.9
SD	0.915	±24.44	±426.5
SE	0.868	23.19	404.6

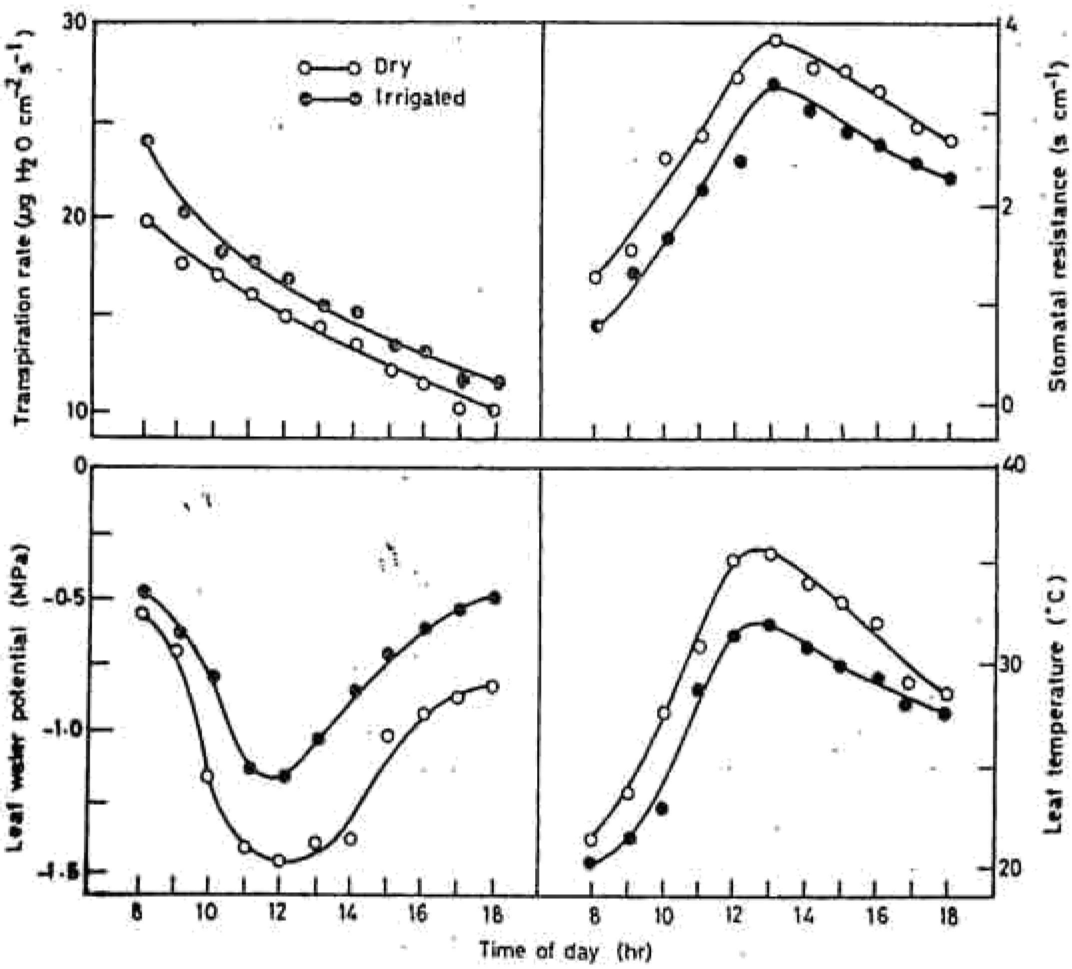

Fig.1 Effect of moisture stress on certain leaf physiological characters in black gram CV. TMV 1

60 per cent depletion of available soil moisture from field capacity. In the unirrigated plot, irrigation was withheld during bean filling stage (40-45 days from sowing) allowing the available soil moisture to reach a level (7.8%) which is very near to permanent wilting point. Observations on the diurnal course of various parameters were made using the fully expanded top most leaves during this stage. Transpiration and stomatal resistance on the abaxial surface were recorded using a steady state porometer-model Li 1600 of Li-Cor Inc., Nebraska. Leaf and air temperatures were monitored with a Infrared Thermometer- model AG 42 of Telatemp Corporation, Ohio (Jackson, 1982). Leaf water potential was determined through a pressure bomb apparatus - model 3005 of Soil Moisture Equipment Corporation, California (Scholender *et al.,* 1965). Radiation intensity and photon flux density were taken using an Integrating quantum radiometer/photometer-model Li-188 of Li-Cor Inc., Nebraska.

RESULTS AND DISCUSSION

The diurnal course of leaf moisture parameters showed considerable differences between irrigated and unirrigated plants of black gram (Fig. 1).

Leaf temperature

Leaf temperature both in irrigated plants and in plants under stress showed an increasing trend during the morning reaching a maximum at 13 h. Afterwards, leaf temperature started decreasing towards evening. Leaf temperature was higher than the ambient air temperature throughout the day (Table 1). At noon, the abaxial leaf surface was about 2.8 to 3.6°C cooler in irrigated than in unirrigated black gram, indicating higher transpirational cooling under irrigated conditions. Palmer (1967) recorded a difference up to 5°C between wilted and turgid cotton leaves. The low soil moisture in unirrigated condition resulted in reduced plant water status and stomatal conductance leading to elevated leaf temperatures (Mtui *et al.,* 1981).

Leaf water potential

Leaf water potential decreased progressively from 8 h to 12 h and recovered between 14 h and 18 h. Plants under unirrigated conditions recorded lower leaf water potentials than those of the irrigated ones throughout the day. Minimum leaf water potential of the plants under stress reached -1.46 MPa by about 12 h. The better soil moisture under irrigated plots probably helped in maintaining higher water potentials in the irrigated black gram.

Stomatal resistance

Stomatal resistance followed the course of solar radiation (Table 1) during the day reaching maximum values around 13 h. Differences were noticed in stomatal resistance due to irrigation. Irrigated plants showed lesser leaf stomatal resistance than the unirrigated ones. Begg and Turner (1981) suggested that gradually increasing soil moisture stress caused water deficit inside the leaf leading to the reduction of photosynthesis which could in turn increase the stomatal resistance.

Transpiration rate

Transpiration rate decreased gradually with increase in radiation reaching a minimum at 16 h. Transpiration is more a function of stomatal regulation rather than of internal plant water status and solar radiation. Irrigated black gram maintained higher transpiration indicating greater plant water status than the unirrigated plants. The transpiration rate steadily declined from morning till evening in black gram. There seems to be sufficient resistance to water flow through the rhizosphere to cause a lag in absorption (Taitt and Spence, 1976). This is more true in black gram whose working depth of the root hardly goes below 10-12cm from the soil surface (Chiang and Hubbell, 1977).

It may be summed up that as the soil moisture becomes a limiting factor, resistance to water uptake through the rhizosphere increases and water absorption tends to lag behind transpiration leading to lower leaf water potential and increased stomatal resistance and leaf temperature. These factors would tend to reduce the physiological yield efficiency of the crop in question. The differences in these leaf characters around noon between irrigated and unirrigated blackgram may be useful for screening germplams for drought tolerance.

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EFFECT OF MODIFIED ENVIRONMENTS ON PLANT GROWTH AND FLOWERING PRODUCTION OF GERBERA

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ABSTRACT

Twenty four weeks old seedlings of gerbera, *Gerbera jamesonii*L. were maintained under Rambo-plastic nets permitting 85% and 75% natural - light intensity from May 15,1991 to October 15, 1991. The significant differences among plants grown under reduced light intensities were observed for leaf number, leaf area, flower number and flower quality as compared to the plants grown under 100% natural light intensity. Plants grown under plastic nets produced double the number of leaves (37) and flowers (10) with better stem length and flower diameter, as compared to plants grown under uninterrupted natural light intensity. The chlorophyll content of leaves was maximum (2,417 mg/g of fresh weight) from the plants grown under net permitting 75% of natural light intensity and was minimum (1.551 mg/g of fresh weight) from plants grown under natural conditions throughout the growing period. It is concluded that increased rate of plant growth and flower production is the result of reduced light intensity only, because air temperature under nets did not differ from the open due to free movement of air through nets. In the second experiment, 72, weeks old seedlings were covered with plastic cover (as complete cover, overhead cover, without cover for control) from November 1990 to February, 1991. The highest number of flowers (32/plant) was produced by the plants maintained under completely covered plastic film but the difference in flower yield and flower quality was only numerically significant.

KEY WORDS : Gerbera, Growth, Flower Production, Modified Environments

Number of studies especially related to green-house environments have been attempted on the production media, nutrition of plants and requirements of light and temperature for the optimum growth and flower production in various countries of temperate region. Flower yield in gerbera, *Gerbera jamesonii*L., depends on the production of lateral shoots by the plants which (Leffring, 1975) is promoted by 13°C night and 17°C day temperature under short day conditions of 8 h. In Europe, production of flowers of gerbera got reduced in winter when planted under glass-house due to poor light transmission and low temperature. As the amount of light increased after mid-February, the flower production also increased (Leffring, 1981). Both flower yield and stem length in some gerbera cultivars were substantially increased by root-zone warming (Tsujita, and Dutton, 1987). Berninger (1979) observed that the appearance of new buds, length of maturation period of flower and stem length elongation rate were influenced both by air and soil temperature. Pohly and Goldsberry (1989) observed that flowering was enhanced by 5-8 days and overall flower production was 12 per cent higher in heated green-houses (12°C night) than in unheated in three gerbera cultivars. The present paper presents data on the [illegible]