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Study of Canopy Temperature Based Indices in Rapeseed and Mustard Varieties

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Stomatal closure during water stress condition causes increase in leaf temperature owing to lower rate of transpiration, canopy temperature can be used as good soil moisture stress indicator. Several workers used canopy temperature as an indicator of crop water stress (Idso *et al.*, 1981; Idso and Reginato, 1982; Jackson *et al.*, 1981). In the present study, an attempt has been made to study the relationship between canopy temperature and water-stress condition for rapeseed and mustard varieties.

The study was carried out in the farm of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, situated in the New Alluvial zone of West Bengal. The soil of the location comes under entisol order having sandy texture. The field capacity of the soil on weight basis was about 26.5%. The average bulk density of the experimental plot was 1.34 g/cc.

Three rapeseed and mustard varieties namely, B-9, Varuna and B-85 were sown on two different dates during the *rabi* season of 2000-2001. The crops were grown both under irrigated and rainfed conditions with recommended dose of fertilizer. All treatments were replicated thrice. While the entirefertilizer under rainfed treatment was given at the time of last ploughing, half of nitrogenous fertilizer was applied in irrigated treatment during last ploughing and the remaining was applied as top dressing. During different stages of growth period from branching to last flowering, canopy temperature was measured with the help of portable digital thermometer with external sensor probe at an interval of seven days. Simultaneously soil moisture was determined gravimetrically upto 60 cm depth of soil from each treatment plot. The required meteorological data were collected from the nearby observatory. The global solar radiation on the daily basis was calculated with the help of anstrom equation as modified by Prescott.

Variations of canopy-air temperature difference (CATD) along with soil moisture content under irrigated conditions are shown in Figure 1, which shows that in the irrigated situation values of CATD

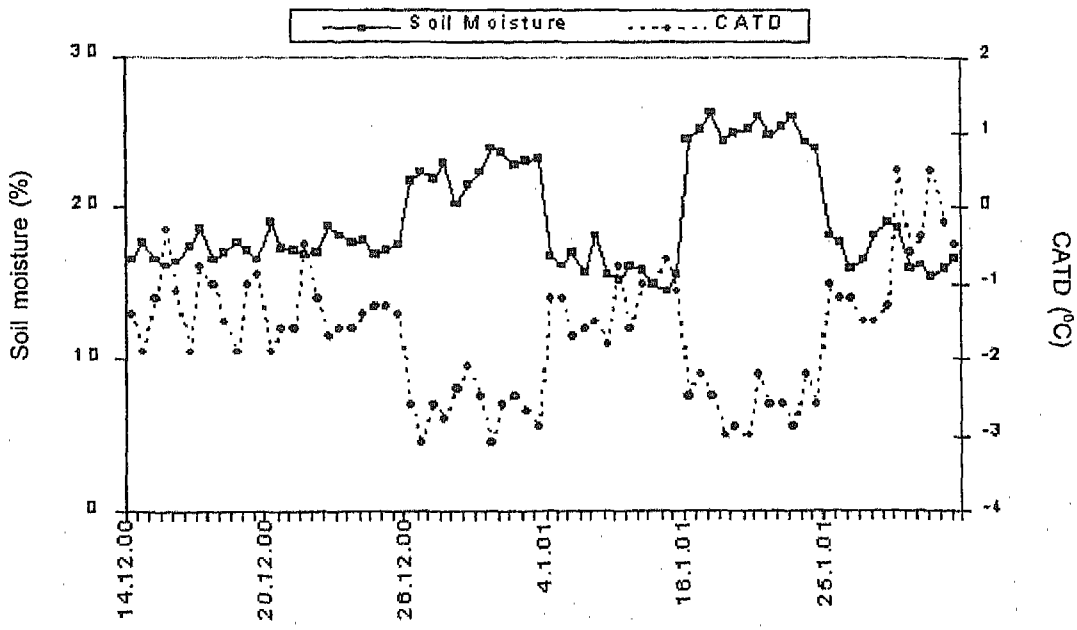

Fig. 1. Variation of soil moisture content and CATD under irrigated condition

were mostly negative. When the soil moisture content of the plot increased, the CATD value decreased accordingly due to decrease in canopy temperature. Within two days of irrigation when the soil moisture was near the field capacity, CATD attained higher value (-3.1°C).

Under rainfed conditions, the CATD values were positive in most of the cases (Fig. 2). Observations reveal that when soil moisture content was about half of the field capacity, CATD value was not below -1.2°C. When moisture content was around 15 per cent, the CATD values were exceeding 1°C. The canopy air temperature difference was found to be negatively correlated with soil-moisture content at root zone depth (r = -0.81 at 70 d.f.), indicating that it can be used as a good indicator of soil moisture status in the soil under study. High CATD value denotes moisture

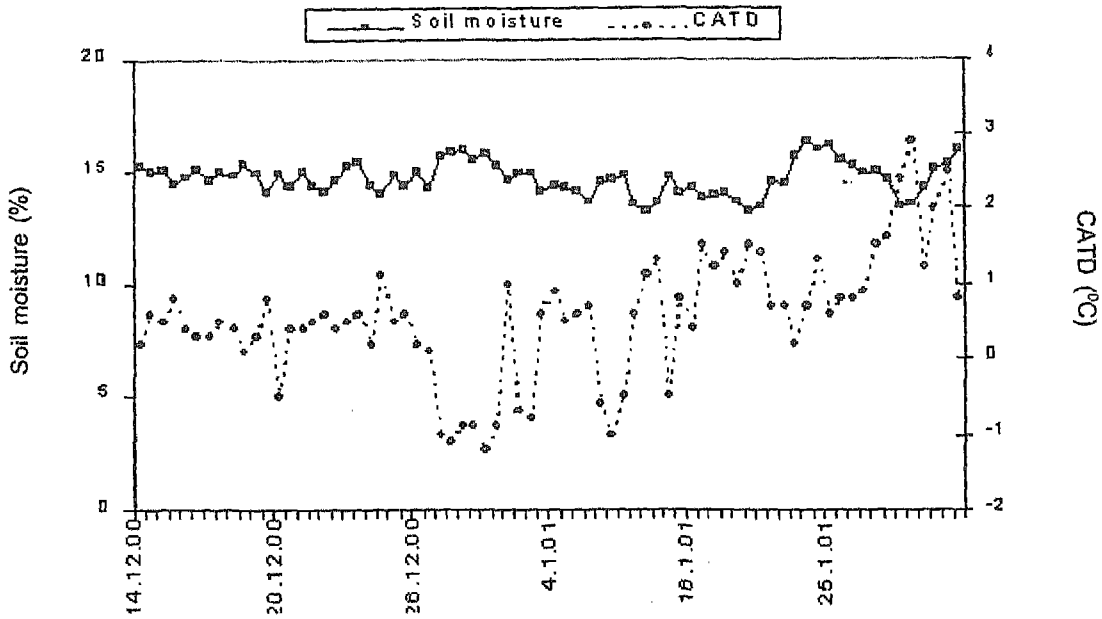

Fig. 2. Variation of soil moisture content and CATD under rainfed condition

Table 1. Canopy temperature variability of rape and mustard under irrigated and rainfed conditions

Date	Irrigated		Rainfed	
	CTV	Variation of moisture content (%)	CTV	Variation of moisture content (%)
14.12.00	0.49	16.2 - 18.6	0.22	14.1 - 15.3
20.12.00	0.35	16.9 - 19.0	0.37	14.0 - 15.4
23.12.00	Irrigation given	--	--	--
26.12.00	0.28	20.3 - 24.0	0.73	14.1 - 15.9
04.01.01	0.36	14.5 - 18.2	0.76	13.2 - 14.8
15.01.01	Irrigation given	--	--	--
16.01.01	0.30	23.9 - 26.3	0.44	13.2 - 16.3
25.01.01	0.70	15.4 - 19.0	0.78	13.4 - 16.1

stress condition of the crop.

The canopy temperature variability (CTV) was calculated as standard deviation of mid-day canopy temperatures of the treatments following Clawson and Blad (1982). The value of CTV was ± 0.28°C on 26.12.2000, just one day after irrigation, while after few days later when soil-moisture depleted sufficiently (moisture content varied from 15.4% to 19%), the variability was as high as ± 0.71°C (Table 1).

The estimated values of CTV for rainfed crop were higher than those of irrigated crop except for first day. Overall the values of CTV obtained here under rainfed plots are less than those obtained by Gardner *et al.* (1982) in case of corn.

Conclusion

The present study indicates that CATD exceeding 1°C may be used as an indicator of water stress condition of rape and mustard. The canopy temperature during particular measurement period showed greater variability when soil moisture is a limiting factor. So, Canopy-air Temperature Difference and Canopy Temperature Variability may be used successfully as indices for irrigation scheduling.

References

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