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STUDIES ON SEASONAL VARIATION IN EVAPOTRANSPIRATION OVER WHEAT CROP USING EDDY CORRELATION TECHNIQUE

1. Limited information is available on Eddy Correlation (EC) technique, its accuracy and reliability under varied climatic conditions. Similarly, very little is known about the processes controlling evapotranspiration (ET) of wheat in semi-arid tropics of India.

2. An experiment was conducted in the post-monsoon (*rabi*) season of 1992-93 at the Centre of Advanced Studies in Agricultural Meteorology Farm, College of Agriculture, Pune (18° 32'N, 73° 51'E; 559 m above msl. Wheat (*Triticum aestivium L.*) variety HD 2189 was sown on an area of ~3.0 ha (275 m E-W by 110 m N-S) in N-S direction at 22.5 cm row distance. The field provided necessary fetch required for micro-meteorological measurements. The soil was vertisol and clayey in texture. The recommended agronomic practices were followed. The EC technique was used to determine latent (LE) and sensible (H) heat fluxes at various growth stages of wheat. The closure error (δ); (*i.e.*, Rn — H — LE — G ≠ O) was calculated for all data sets. Where, Rn is net radiation and G is the surface soil heat flux.

3. The δ varied between 13 to 55% of Rn with highest error at tillering stage (55%). Sensible heat advection was observed at all growth stages. It was maximum at tillering and resulted in the highest error (Table 1).

The evapotranspiration (ET) was lower in the early growth stages of the crop, then became higher in mid-stages and then declined after soft dough stage during later part of the crop growth showing normal pattern. The highest ET (3.3 mmd^{-1}) was observed at soft dough stage because of high physiological demand at this stage (Table 2). Similar

TABLE 1

Comparison of LE and δ at various growth stages of wheat

%	DAS								
	21	32	42	52	62	72	82	92	104
LE/Rn	46	49	40	56	63	50	48	57	38
δ/Rn	19	22	55	19	35	38	35	33	13

TABLE 2

ET measured and ETmax estimated at various growth stages of wheat

Growth stage	DAS	LE (mmd^{-1})	ET (mmd^{-1})	LE+δ (mmd^{-1})	ETmax (mmd^{-1})
CRI	21	2595.2	1.91	3720.4	2.73
—	32	2737.3	2.01	3875.5	2.85
Tillering	42	2226.4	1.64	5305.1	3.89
Jointing	52	3171.5	2.33	4265.2	3.13
Heading	62	4142.0	3.04	6456.1	4.74
Flowering	72	3535.7	2.60	6198.1	4.55
—	82	3810.2	2.80	6596.6	4.85
Soft dough	92	4494.2	3.30	7102.9	5.23
Hard dough	104	3198.0	2.35	4259.1	3.13

TABLE 3

Cumulative ET, PET and Ep at various growth stages of wheat

Growth stage	DAS	ET (mm)	PET (mm)	Ep (mm)
CRI	21	41.5	69.1	76.6
—	32	21.1	32.4	38.8
Tillering	42	16.0	31.4	34.5
Jointing	52	23.7	32.4	38.4
Heading	62	32.1	38.2	46.4
Flowering	72	25.1	36.9	52.9
—	82	33.2	42.5	58.9
Soft dough	92	30.2	46.5	57.6
Hard dough	104	27.8	64.6	76.4
Total	—	250.7	394.0	480.5

trend was reported by Mokate (1992) at the same site but he observed the highest ET of 6.4 mmd^{-1} at hard dough stage of wheat. The trend in results are supported by lysimetric studies at Pune carried out by Venkatraman *et al.* (1976). However, ET measured by EC technique was on lower side at all growth stages compared to the values reported by other investigators (Venkatraman *et al.* 1976 and Mokate 1992) indicating that EC technique underestimated LE and hence ET (Dugas *et al.* 1991). Therefore, the closure error (δ) was added to LE to estimate maximum ET possible (Table 2).

The crop factor (Kc) obtained in the present investigation was multiplied by the daily potential evapotranspiration (PET) to obtain daily ET. The cumulative ET upto each stage was obtained by summing up the daily ET values till the stage was reached. The cumulative ET thus obtained was less than corresponding cumulative PET throughout the crop growth period (Table 3). The cumulative ET of wheat from CRI to hard dough stage measured was 250.7 mm; which was much lower than 520.0, 432.6 and 507.1 mm at Pune reported by Venkatraman *et al.* (1976), Jadhav (1991) and Mokate (1992), respectively. The cumulative ET/PET ratio ranged between 0.60 to 0.84 showing that ET was underestimated by EC technique. Similar findings were also recorded by Saylan and Bernhofer (1993). Venkatraman *et al.* (1976) reported that ET losses exceeded pan evaporation (Ep) for a larger part of crop life. Whereas, the cumulative ET/Ep ratio ranged between 0.36 to 0.69.

4. The cumulative ET varied between 60 to 84% of cumulative PET at various growth stages of wheat. It is obvious that ET values were underestimated because of under-estimation of LE by EC technique.

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