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Short Communication

Radiation use efficiency of wheat (*Triticum aestivum* L.) crop as influenced by date of sowing, row spacing and row orientation

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Radiation and moisture are the basic meteorological parameters of significance to agriculture. Under potential conditions, with adequate moisture and fertility, radiation plays the role of a decisive factor for crop growth and development. The radiation ultimately influences the biological and economic yield of the crop. Manipulation of radiant energy within a crop field by an appropriate adoption of crop stand geometry, like row orientation and row spacing can provide a means to create light saturated conditions for crop canopy for the purpose of efficient harvest of solar energy for agricultural production. The present investigation was undertaken to study the effect of row orientation, spacing and date of sowing on radiation use efficiency of Wheat crop (*Triticum aestivum* L.) in Anand conditions.

A field experiment was conducted on the sandy loam soil of B A College of Agriculture, AAU, Anand (22°35'N, 72°55'E; 45.1 m AMSL) during *rabi* season of 2003-2004. Wheat cultivar GW-496 was sown in two orientations (R_1:NS and R_2:EW), with two row spacings (S_1:15 cm and S_2:22.5 cm) and two dates of sowing (D_1:12 November and D_2:27 November of 2003); in Split plot design with four replications, following the recommended cultural operations and plant protection measures were adopted. The Photosynthetically active radiation (PAR) was measured between 0900-1000 h, 1200-1300 h and 1500-1600 h at 10 day interval with SunScan Canopy Analysis System (Delta-T Devices, UK) from 23 days after sowing. Transmitted PAR was measured by keeping Sunscan probe perpendicular to the rows at ground level and incoming PAR was measured with Beam Fraction sensor (BF2) of the system at top of the crop canopy. Daily incident Solar radiation was recorded at the Pyranometer sensor installed in meteorological observatory located near the experimental site and converted into PAR using a multiplier 0.5 (Monteith and Unsworth, 1990; Campbell and Norman, 1998). The plant samples were uprooted from ring area, dried and weighed to determine the dry matter (g m^{-2}). The radiation use efficiency (RUE) was calculated as the ratio of dry biomass to the radiant energy intercepted by the plants (Gallagher and Biscoe, 1978).

The results (Table1) showed that wheat sown on 27'November, produced

Table 1: Effect of date of sowing and treatment combinations of row orientation and row spacing on yield attributes

Treatment	Harvest Index	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	1000 Grains test weight (gm)	Number effective of tillers (m^{-2})	Ear head length (cm)
Date of sowing (D)						
D_1 : 12 Nov2003	0.45	4914.3	5942.75	41.42	542.36	9.07
D_2 : 27 Nov2003	0.43	5464.66	7153.91	39.14	508.19	9.84
CD (P = 0.05)	NS	302.69	520.44	1.50	NS	0.13
Row spacing (S)						
S_1 : 15 cm	0.44	5191.9	6588.25	39.49	578.33	9.43
S_2 : 22.5 cm	0.44	5187.05	6508.41	41.08	472.22	9.48
CD (P = 0.05)	NS	NS	NS	1.48	44.11	NS
Row orientation (R)						
R_1 : NS	0.45	5297.31	6609.87	41.16	507.92	9.35
R_2 : EW	0.44	5081.64	6486.79	39.40	542.64	9.56
CD (P = 0.05)	NS	NS	NS	1.48	NS	0.19

Table 2: Effect of date of sowing and treatment combinations of row orientation and row spacing on RUE

Treatment	RUE (g $MJ^{-1}m^{-2}$)
Date of sowing (D)	
D_1 : 12 Nov'2003	2.00
D_2 : 27 Nov'2003	2.02
CD (P = 0.05)	NS
Row spacing (S)	
S_1 : 15 cm	2.02
S_2 : 22.5 cm	2.00
CD (P = 0.05)	NS
Row orientation (R)	
R_1 : NS	1.99
R_2 : EW	2.03
CD (P = 0.05)	NS

significantly higher straw yield (7153.91 kg ha^{-1}), grain yield (5464.66 kg ha^{-1}) and ear head length (9.84 cm). The differences in yield parameters of other two treatments were statistically not significant.

The test weight was found significantly superior in the first date of sowing as compared to the second date. However in case of row spacing and row orientation, Grain and Straw yields were found to be nonsignificant with respect to these treatments. Test weight was significantly higher in case of widely spaced rows (22.5 cm apart; 41.42 g) than in narrow spaced rows. In case of number of effective tillers narrow spacing produced higher number of effective tillers. Influence of row orientation on the yield attributes was significant except

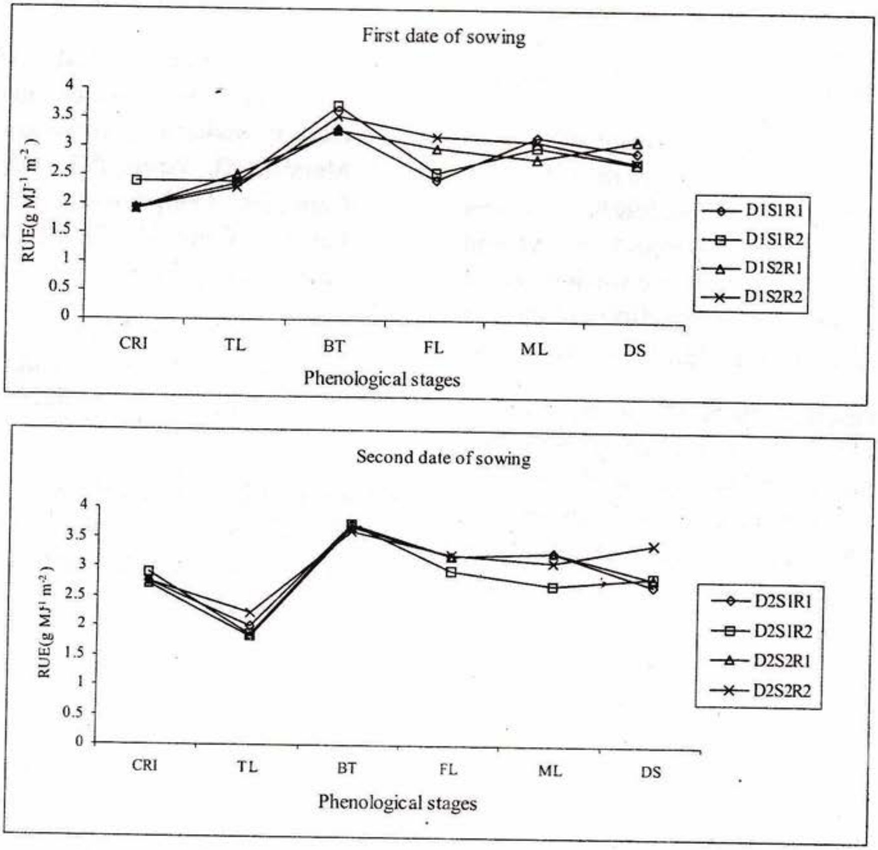

Fig. 1: RUE *(based on total biomass)* at different phenological stages

in case of test weight and ear head length. Which were significantly higher in EW rows.

Radiation use efficiency (RUE)

The values of radiation use efficiency at different growth stages (Fig.1; CRI-crown root initiation, TL-tillering, BT-booting, FL-flowering, ML-milking and DS-dough stage) were found to range from 1.6 to 3.8 g $MJ^{-1}m^{-2}$. The first date of sowing showed the appreciable difference in treatments at flowering stage while the difference was not so in case of the second date of sowing. The seasonal trends of RUE for different treatments showed a pattern, which was in tune with that of the PAR interception. The RUE at the Booting showed the highest values (>3 g $MJ^{-1}m^{-2}$) with a slight decline after that stage. The RUE was high in narrow EW rows in early stages. There was comparatively high RUE in widely spaced EW and NS rows till the flowering stage. No one particular treatment was found distinctly different from the other.

There was no significant difference among the RUE values in different treatments (Table 2). The lowest RUE was observed in wider NW rows (i.e. 1.96 and 1.97 g MJm^{-2} for respective sowing dates). Also in case of RUE for different date of sowing there was no significant difference.

Thus, it is concluded that radiation use efficiency of wheat crop was not significantly influenced by the date of sowing, row orientation and row spacing during the *rabi'2003*-2004 season at this location. The yield attributes favored the late sowing.

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