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Relative Effects of Soil Moisture Regimes and Fertilizer Levels on Growth and Yield of Lerma Rojo Wheat

By

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ABSTRACT

The study revealed that a grain yield of 41.37 q/ha was obtained when 352.26 mm of irrigation water was applied giving irrigation at 50 mm evaporation from the tin-evaporimeter. Fertilizer application at 180 N+90 P_2O_5+60 K_2O kg/ha gave 41.47 q/ha. Maximum daily rate of dry matter accumulation was obtained between the period of 32 to 55 days after sowing by providing irrigation when 50 mm evaporation occurred in tin-evaporimeter and with 180 N+90 P_2O_5+60 K_2O kg/ha fertilizer application.

INTRODUCTION

Wheat is an important *rabi* crop grown in north-eastern part of Karnataka state. With the introduction of high yielding and fairly rust resistant Mexican varieties, area under irrigated wheat has increased rapidly. Robins and Domingo (1962) stated that moisture stress during and following the heading of wheat resulted in fewer earheads, spikelets per spike and grains per spike and reduction in grain yield by about 30 per cent. Tiwari and Singh (1969) reported that N and P application increases plant height, tiller number, number of grains and yield of wheat. Hence, this experiment was initiated to investigate the relative effects of different moisture regimes and fertilizer levels on growth and yield of Lerma Rooj wheat.

MATERIAL AND METHODS

An experiment was conducted at the Agricultural College Farm, Dharwar on black clay loan soil during 1969-70. Single value physical constants of the soil of the experimental plot are given in Table 1. The depth of water table in the area was more than six feet. The experiment consisted of nine treatment combinations with three levels of fertilizers as 60 kg N + 30 kg P_2O_5 + 20 kg K_2O, 120 kg N + 60 kg P_2O_5 + 40 kg K_2O and 180 kg N+90 kg P_2O_5+60 kg K_2O per ha. The experiment was laid out in a randomised block design with four replications. The size of the gross and net plot was 2.52 m × 5 m and

TABLE 1. Single value physical constants of the soil in the experimental site

Particulars	Depth in cm		
	0–15	15–30	30–60
Field capacity in per cent	26.50	28.00	23.50
Permanent wilting point in per cent	14.00	15.00	15.00
Bulk density	1.10	1.12	1.20
Available water holding capacity in cm	2.06	2.18	4.86

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1.87 m × 4.6 m. respectively. Lerma Rojo wheat was sown on October 29, 1969 with 18 cm spacing between rows and seed rate of 200 kg/ha. Nitrogen was applied in two split doses, first at sowing and the second at 23 days after sowing.

Short period consumptive use of water studied in the wheat crop were made by direct soil moisture determinations before irrigation. Soil moisture determinations were made from sample taken to a depth of 0 to 60 cm at 15 cm interval upto 30 cm and then 30 to 60 cm depth was taken as one sample. Soil moisture was determined after oven drying the samples to constant weight at 105°C. The moisture deficit was found out by substracting the moisture present in the soil from that held at field capacity. This deficit of moisture percentage was converted to depth of water. The percent soil moisture deficit was determined for each layer. The quantity of water irrigated was equal to the deficit in the soil and represented the moisture loss due to consumptive use during the period.

Irrigation was given on the basis of evaporation obtained from the tin-evaporimeters. Number of irrigations were 5 (352.26 mm), 4 (277.99 mm) and 3 (244.61 mm) for the treatments receiving irrigation at 50 mm, 75 mm and 100 mm, evaporation respectively.

RESULTS AND DISCUSSION

The rate of dry matter accumulation was maximum between the period of 32 to 55 days after sowing (Table 2). Maximum daily rate of drymatter accumulation of 4.82 g/meter row was obtained by providing irrigations when 50 mm evaporation occurred in the tin-evaporimeter. The moisture stress due to prolongation of irrigation interval during this growth period caused reduction in the rate of drymatter accumulation. Highest drymatter production of 116.75 q/ha (Table 2) was obtained with the treatment receiving irrigation at 50 mm evaporation.

The grain yield increased with increase in the number of irrigations (Table 3). The maximum yield of 41.37 q/ha was obtained with the treatment receiving irrigation at 50 mm evaporation. There was positive correlation between the grain yield and total consumptive use of water (r=0.757). This increase in grain yield with irrigation may be due to adequate supply of moisture during tillering to grain developmental stages. With the decrease in frequency of irrigation, there was decrease in grain yield. When irrigation was given at 100 mm evaporation the grain yield was 36.51 q/ha. By providing irrigation at 50 mm evaporation, drymatter accumulation at boot stage and grain yield were highly correlated (r=0.942). There was reduction in the earbearing shoots and number of grains per ear (Table 2). The number of earbearing shoots was positively correlated (r=0.955) with the grain yield. Similarly, the number of grains per ear was high as the irrigation level increased. The highest number of 39 grains per ear was produced in the treatment receiving irrigation at 50 mm evaporation, whereas the lowest number of 32 grains per ear was produced in the treatment receiving irrigation at 100 mm evaporation. Moisture stress at the

TABLE 2. Varying soil moisture regimes and fertilizer levels on the daily rate of drymatter accumulation

Irrigation	Days after sowing															
	0—31				32—55				56—71				72—114			
	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean
	g/m row length															
At 50 mm evaporation from the tin-evaporimeter	0.81	0.89	1.06	0.92	4.07	5.00	5.39	4.82	3.41	2.50	2.25	2.72	0.75	0.98	1.65	1.13
At 75 mm evaporation from the tin-evaporimeter	0.76	0.83	0.92	0.84	3.82	4.21	5.13	4.39	1.66	2.16	1.63	1.82	1.02	0.96	0.97	0.98
At 100 mm evaporation from the tin-evaporimeter	0.76	0.92	1.01	0.90	3.30	3.72	3.85	3.62	1.93	2.43	2.93	2.43	0.85	0.90	1.60	1.12
Mean	0.78	0.88	0.99	0.88	3.73	4.31	4.79	4.28	2.33	2.36	2.27	2.32	0.87	0.95	1.41	1.08
C. D. at 5% for moisture regimes and fertilizer levels				NS				0.13				0.15				0.43
C. D. at 5% for interaction				NS				0.22				0.26				NS

Note: F_1 = 60 N + 30 P_2O_5 + 20 K_2O Kg/ha

F_2 = 120 N + 60 P_2O_5 + 40 K_2O kg/ha

F_3 = 180 N + 90 P_2O_5 + 60 K_2O kg/ha

TABLE 3. Varying soil moisture regimes and fertilizer levels on ear bearing shoots, number of grains per ear, grain and straw yield

	Ear bearing shoots per meter row length				Number of grains per ear				Grain yield (q/ha)				Straw yield (q/ha)			
	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean	F_1	F_2	F_3	Mean
At 50 mm evaporation from the tin-evaporimeter	191.50	116.50	128.75	115.58	34.98	37.38	44.03	38.80	38.20	42.38	43.53	41.37	68.63	74.50	83.00	75.38
At 75 mm evaporation from the tin-evaporimeter	96.00	113.00	116.75	108.58	32.33	36.28	39.28	35.96	36.53	41.00	41.69	39.74	61.25	63.38	75.75	66.79
At 100 mm evaporation from the tin-evaporimeter	93.75	103.25	107.50	101.50	27.40	31.75	35.28	31.48	33.94	36.38	39.21	36.51	58.88	67.38	77.25	67.83
Mean	97.08	110.92	117.67	108.56	31.57	35.14	39.53	35.41	36.22	39.92	41.47	39.21	62.92	68.42	78.67	70.00
C. D. at 5% for moisture regimes and fertilizer levels				9.88				2.04				1.75				7.10
C. D. at 5% for interaction				NS				NS				NS				NS

Note: F_1 = 60 N + 30 P_2O_5 + 20 K_2O kg/ha

F_2 = 120 N + 60 P_2O_5 + 40 K_2O kg/ha

F_3 = 180 N + 90 P_2O_5 + 60 K_2O kg/ha stage of floral initiation could markedly reduce the potential number of grains per ear (Williams, 1966). The number of grains per ear was also positively correlated with grain yield (r—0.984).

The rate of drymatter accumulation per day with different levels of fertilizer is given in Table 2. With increase in the level of fertilizer application the rate of dry matter accumulation was increased markedly during the period from 32 to 55 days after sowing. The maximum rate of drymatter accumulation of 4.79 g per day per meter row during this period was obtained with 180 N+90 P_2O_5+60 K_2O kg/ha fertilizer application. The maximum grain yield of 41.47 q/ha was obtained with 180 N+90 P_2O_5+60 K_2O kg/ha fertilizer application. With 60 N+30 P_2O_5+ 20 K_2O kg/ha, the grain yield obtained was 36.22 q/ha. The maximum earbearing shoots of 188 per meter row were produced with 180 N+ 90 P_2O_5+60 K_2O kg/ha, while the fertilizer levels of 120 N+60 P_2O+ 40 K_2O and 60 N+30 P_2O_5+20 K_2O kg/ha, the earbearing shoots were 111 and 97, respectively. The highest number of 40 grains per ear was produced with 180 N+90 P_2O_5+ 60 K_2O kg/ha fertilizer application.

Giving irrigation at 50 mm evaporation with 180 N+90 P_2O_5+60 K_2O kg/ha gave the highest yield of straw. However, the difference between irrigation at 75 mm and 100 mm evaporation and fertilizer levals at 120 N+60 P_2O_5+40 K_2O kg/ha and 60 N+30 P_2O_5+20 K_2O kg/ha were not significant.

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