adras Agric. J. 91 (1-3) : 19-22 January-March 2004

https://doi.org/10.29321/MAJ.10.A00059

lesign and performance of paired row drip irrigation system on yield ttributes of cotton

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Abstract: To study the effect of paired row system of 100/140 cm drip irrigation along with four levels of drip irrigation and three levels of fertilizer on the yield of TCHB 213 cotton, three set of experiments were conducted during 1996-2001 at the research farm of Tamil Nadu Agricultural University, Coimbatore. The number of bolls per plant and the kapas yield were recorded and analysed. From the individual year analysis it is revealed that 75% of control (IW/CPE=0.6) water through paired row drip combined with 75% of recommended dose of NPK for TCHB 213 cotton stood to be the optimum combination of the two factors (Irrigation and fertilizer) which consistently increased the Kapas yield of TCHB 213.

Key words : Drip irrigation, Paired row, Cotton yield.

troduction

Cotton is one of the main crops in Tamil adu covering about 2.5 lakh hectares. Though is mostly grown under rainfed conditions sizeable area is under irrigated conditions. he water consumption varies from 550 to 00 mm. Cotton is very sensitive to soil moisture onditions. Scheduling of irrigation at 0.6 IW/ PE ratio (approximately once in 7-20 days) as been found to be optimum under conventional rrigation methods for a good crop.

Having utilized 95 per cent of surface vater and 85 per cent of ground water the roductivity of cotton has to be increased only hrough the adoption of modern methods of rrigation like drip and sprinkler. Drip irrigation s most suitable system one when compared o sprinkler system because of non sprinkling ature. Also paired row technics can be tested long with drip system to find out the possible eduction of lateral requirement. Now a days he cost of fertilizer is very high, so saving n fertilizer application is very great help to he farming community.

It is in this context, the drip irrigation tudies in paired row system of 100/140 cm vith drip irrigation and fertilizer treatments of recommended dose, 75 per cent and 50 per cent of recommended dose for hybrid cotton variety of TCHB 213 were contemplated.

Bielorai (1982) revealed that water use efficiency was greater in the drip irrigated grapefruit plots than in the sprinkled ones, and also greater in the plots, which receivd the reduced water applications compard to plots, which received the full amount of irrigation. Sivanappan *et al.* (1987) carried out experiment in banana and reported 75 per cent saving of irrigation water in drip as compared to control. He also reported that the fruit yield was statistically on par and ranged between 18 and 24 kg/plant. Yella Reddy *et al.* (1990) conducted experiment to study the performance of drip emitters with ridge-furrow irrigation for raising tomato and cauliflower crops. The field water use and consumptive use efficiencies were found to be higher with drip irrigation method.

Mahaver and Rytwo (1991) used eddy correlation system to estimate evapotranspiration in a daily drip irrigated cotton field. Water use efficiency was calculated for four irrigation treatments. Evapotranspiration data were used to verify one-dimensional numerical model, which stimulates, in real time, the different energy

Table 1. Influence of irrigation treatments on yield attributes of cotton - TCHB 213

Irrigation treatments	No. of bolls/plant				Kapas yield, t ha^{-1}			
	Year I	Year II	Year III	Mean	Year I	Year II	Year III	Mean
T_1	17.33	21.67	20.67	19.89	0.78	1.60	1.49	1.29
T_2	21.67	28.67	26.00	25.45	1.08	1.66	1.67	1.47
T_3	14.00	20.33	18.67	17.67	0.98	1.55	1.41	1.31
T_4	9.00	17.67	12.33	13.00	0.7	1.05	0.96	0.9
Mean	15.5	22.1	19.4	19.0	0.89	1.47	1.38	1.24
SEd	0.60	0.55	0.42		0.005	0.005	0.004	
CD (0.05)	1.48	1.35	1.04		0.013	0.011	0.010	
CD (0.01)	2.24	2.04	1.57		0.019	0.017	0.015	
CV (%)	8.26	5.28	4.62		1.25	0.67	0.64	

Table 2. Influence of fertilizer treatments on yield attributes of cotton - TCHB 213

Fertilizer treatments	No. of bolls/plant				Kapas yield, t ha^{-1}			
	Year I	Year II	Year III	Mean	Year I	Year II	Year III	Mean
S_1	15.25	22.25	19.50	19.00	0.77	1.47	1.37	1.2
S_2	19.00	25.50	22.25	22.25	1.04	1.52	1.44	1.33
S_3	12.25	18.50	16.50	15.75	0.85	1.4	1.28	1.18
Mean	15.5	22.08	19.5	19.0	0.89	1.46	1.36	1.24
SEd	0.43	0.33	0.32		0.005	0.006	0.006	
CD (0.05)	0.92	0.71	0.68		0.010	0.012	0.012	
CD (0.01)	1.26	0.97	0.94		0.014	0.017	0.016	
CV (%)	6.84	3.70	4.07		1.32	0.95	1.01	

fluxes existing in the soil plant atmosphere system. In a field experiment at Rahuri, Maharashtra, groundnut ICGS-1 was drip irrigated at 30,50 and 70 per cent of cumulative pan evaporation (CPE) on alternate days or every third day. The higher yield (3.25 t ha^{-1}) was registered with irrigation level of 70 per cent CPE on alternate days (Wani *et al.* 1996).

Materials and Methods

Experiment setup

The drip experiment system was laid in the field no.37 of Eastern Block farm of Tamil Nadu Agricultural University, Coimbatore during 1996 to 2001 and this system consisted of a mainline of 75 mm outer diameter (OD) PVC pipeline, cylindrical mesh filter of size 0.5 m length and 0.15 m diameter, 63 mm OD PVC pipe, 16mm OD lateral pipe. 4 lit/h pressure compensating drippers were inserted into the 16 mm OD lateral at an espacement of 60cm. The entire mainline was buried 60 cm below the soil surface from the bore well point to the entrance of the experimental plot inorder to prevent mechanical damage due to the movement of farm implements, machineries and human beings. The lateral lines were provided with lateral end caps in order to flush the entire lateral system periodically. Flow control valves were fixed in the starting of the laterals. Necessary pressure gauges were fixed in the starting and ending points in the submain inorder to maintain the system trouble free.

Treatment details

Main plot treatments (irrigation)

T_1 = 100 per cent of water applied in control through drip

T_2 = 75 per cent of water applied in control through drip

T_3 = 50 per cent of water applied in control through drip

T_4 = control through flood irrigation (IW/CPE=0.6)

ub plot treatments (fertilizer)

= NPK, 120:60:60 kg/ha
= 75% of S1
= 50% of S1

peration of the experiment

In drip system, the irrigation was done ice in two days by calculating two days cumulative in evaporation. By multiplying the ratio of 6 with 2 days cumulative pan evaporation d the treatment percentage, the depth of irrigation ater and volume of water in litres were calculated. ith the dripper discharge rate and number drippers the operating time was calculated d the irrigation was done for the calculated ration for each set of treatments with the lp of flow control valve fitted in each lateral. e control plot was irrigated through the submain d cap by following IW/CPE=0.6 by closing l the lateral flow control valves. Number bolls per plant was recorded before bursting om the already identified five plants for each plication. The yield of cotton kapas was registered eatment wise after each picking.

Results and Discussion

olls per plant

In cotton crop the number of bolls/plant an important metric trait. This character ill have a direct relationship with the kapas eld under normal condition when the crop s not been affected by any pest and diseases. ot only the relationship with the kapas yield, e number of bolls/plant will ultimately decide e gross return of the crop may be per plot per hectare. Therefore an analysis of the mber of bolls with regard to irrigational eatments (Table 1) and fertilizer treatments able 2) a separate analysis has been carried t year wise. The results of the first year nalysis are presented below.

On an average the irrigational treatments corded 15.5 bolls per plant while the fertilizer eatment 15.5 bolls per plant. Therefore the verall mean number of bolls recorded per lant was 15.5 bolls per plant. From the analysis of variance table it is seen that the irrigational treatments and the fertilizer treatments were only significant at P=0.01 level. Therefore individually the main effects and the one interaction effect have been compared separately.

When the irrigational treatments were compared, 75 per cent of the recommended water given through drip irrigation has been followed by 100 per cent of the water, 50 per cent of the water and the flood irrigation. Each one of them has been significantly different. Among them, 75 per cent of the recommended water given through drip has been significantly superior to the rest recording 22 bolls per plant. Examination of the fertilizer treatments, 75 per cent of the recommended fertilizer through drip irrigation has turned to be significantly the best one whose average has been 19 bolls per plant. To see whether 75 per cent of the recommended water with the 75 per cent of the recommended fertilizer, the interaction effect was examined. It was non significant indicating that the irrigational treatments and fertilizer treatments independently influence the number of bolls but not jointly. That is to say the two factors do not interact with each other as far as the number of bolls per plant is concerned.

But the analyses of the second year data and third year data revealed that again the irrigational treatments and fertilizer treatments were significant as that of the first year analysis. In both the years again the irrigational treatment *i.e.* 75 per cent of recommended water through drip was the best irrigational treatment. Among the fertilizer treatments, again 75 per cent of the recommended fertilizer through drip was the best one. Thus in the second year, the overall mean has been 22 bolls/plant. In the third year the irrigational treatments have recorded an overall mean of 19 bolls/plant while the fertilizer treatment recorded 20 bolls/plant. Thus the overall mean was 19 bolls/plant. Surprisingly in the second and third year the interaction of the irrigational treatments and the fertilizer treatments was significant revealing that 75

per cent of the recommended water combined with 75 per cent of the recommended fertilizer has turned to be the best combination in both the years.

Kapas yield

The analysis of the yield of kapas in t/ha has been scrutinized as per the split plot design adopted in the experiment. The analysis was done by analysis of variance technique. The overall analysis revealed that the 'CV' for the main plot treatments (Irrigation treatments) was 1.25 per cent and for the fertilizer treatments the CV was 1.32 per cent. This clearly pronounces that the consistency of the data has been remarkable. The two factors considered in the experiment are four levels of irrigation and three levels of fertilizer application. From the analysis it is observed that both the factors and their interaction were highly significant.

The comparisons revealed that the second level of irrigation (T_2:75%) has been far superior to the other three irrigation levels. The increase in the kapas yield over T_3, T_1 and T_4 was 8.67 per cent, 27.56 per cent and 34.98 per cent, respectively. The increase has been remarkable. Therefore T_2 could be declared as the best irrigation to maximize the yield of kapas of the variety TCHB 213 hybrid cotton. This was followed by T_3 and T_1 and the three levels being significantly distinct treatments surpassing T_4 having ordinary conventional flood irrigation.

The comparison of the three fertilizer application, which included the normal dose, 75 per cent of the normal dose and 50 per cent of the normal dose of NPK are discussed as follows. From the analysis of variance it could be seen that all the three dosage levels significantly differed from each other. Among them, the 75 per cent (S_2) of recommended dose was the best treatment differing markedly from 50 per cent of the normal dose (S_3) and also from the normal application of NPK. The yield increases of S_2 over S_3 and S_1 was 18.27 per cent and 26.44 per cent. The yield increase was highly pronouncing and continue to be on the positive side only.

Since the main effects of both the facto have been highly remarkable, the interactic of the two factors was also examined for i significance. From the comparisons T_2 combination was the best combination recordir an yield of 1.47 t ha^{-1} whereas significant superior to the rest of the combination. Therefo 75 per cent of control water through drip combine with 75 per cent of recommended dose NPK stands to be the optimum combinatic of the two factors which will consistently increa the kapas yield of the selected cotton variet TCHB 213.

The above analysis pertains to the fi year data. Examination of the second and thi year kapas yield showed the same trend significance and again the irrigation water 75 per cent of the recommended level throug drip along with 75 per cent of the fertiliz of the recommended dose was found to l consistently and continuously the best combinatic in the other two years also.

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(Received: October 2003; Revised: December 200