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RESEARCH ARTICLE :

Land configuration as a tool for higher yields in rainfed cotton (*Gossypium hirsutum* L.)

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SUMMARY : A field experiment was conducted at Warangal, Telangana State during *Kharif* 2014 and 2015 to study the effect of land configuration on growth, yield and, moisture content in the soil and nutrient uptake of rainfed cotton cultivation. The experiment was laid out in Randomized Block Design with treatments land configuration of consists of five methods of cotton sowings *viz*., ridge and furrow (RF), broad bed furrow (BBF), dust mulching with blade harrow (with appearing hair line soil cracks), deep furrow opening near to crop row at 30 DAS and flat bed (farmers practices). The ridge and furrow method of sowing was found superior as was evident from significant increase in growth and yield attributes, seed cotton yield (1208 kg/ha) and stalk yield (2700 kg/ha), moisture use efficiency (3.6 kg/ha/mm) NPK up take (168, 52 and 240 kg/ha) and harvesting index 44.5% and decrease available NPK in the soil after harvest. The land configuration of ridges and furrow was found most effective and feasible for soil moisture conservation and producing the highest cotton yield on sandy loam soil under assured rainfall condition.

KEY WORDS :
Cotton, Growth, Yield, Nutrient uptake, Crop, Ridges

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BACKGROUND AND OBJECTIVES

Cotton(*Gossypium hirsutum* L.) is important commercial crop cultivated over 12.9 m ha in India, representing about a quarter of the global area of 33 m. ha (*www.indiastat.com*) more than 70% of which is cultivated under rainfed situation. Rainfed cotton yields are low owing to erratic and un even distribution of rainfall and sometimes it inadequate to meet soil moisture requirement for crop production. Crop was suffers from moisture stress during post monsoon season which coincides with flowering and boll development stages adversely affects the growth and later the shedding of reproductive parts resulting in crop yield. Land configuration is mechanical measure for better *in situ* moisture conservation as the soil profile act as reservoir for moisture storage and the facility need to exploit to the maximum extent. This can be achieved by cultural and mechanical method of tillage operations, ridges and furrow, broad

bed furrows, opening of furrow and mulch, contour cultivation (Pendke *et al*., 2000). In the experimental state (Telangana), the crop is mostly cultivated under shallow soils (<25 cm depth) with heavy investments. The failure of the crop due to biotic or abiotic constraints often leading to tragedy end to the farming community.

RESOURCES AND METHODS

The experiment was conducted at the Regional Agricultural Research Station, Warangal, Telangana State to study the effect of land configuration on growth, yield and moisture content in the soil during *Kharif* 2014 and 2015. The experimental site is geographically located at 18°03' N latitude and 79°22' E longitude at an altitude of 270 m above the mean sea level. The experimental soil was sandy loam, alkaline in reaction (pH 7.8), low in organic carbon (0.38%), low in available N (259.0 kg/ha), medium in available P (13.1 kg/ha) and available K (435 kg/ha). The treatments land configuration of consists of five methods of cotton sowings *viz*., ridge and furrow (RF), broad bed furrow (BBF), dust mulching with blade harrow (with appearing hair line soil cracks), deep furrow opening near to crop row at 30 DAS and flat bed (farmers practices). The land configuration layout prepared manually at predetermined spacing (90 x 60 cm). The experiment was laid out in randomized block design with four replications. Cotton hybrid seeds Jaadoo of Kavery hybrid BG-II was sown by dibbling on 22nd June in 2014 and on 29th June in 2015. Crop was harvested in two picking upto last week of November. The recommended dose of 120-60- 40 NPK kg/ha was applied to crop. The total rainfall received during crop growth period was 334 mm in 2014 and 553 mm in 2015 over normal rainfall (deficit 45.3 and 16.5 %) respectively. For the determination of moisture content in the soil, samples were taken to a depth 0-30 cm with the help of screw auger. The soil moisture was estimated at flower initiation and boll development stage of the crop.

$$\text{MUE} = \frac{Y}{ET}$$

where, MUE-Moisture use efficiency kg/ha/mm, Y-Economic yield in kg, ET-Total evapotranspiration in mm. Soil was analyzed before sowing, after harvest and uptake of crop at maturity was also determined for budgeting of NPK. Soil and plant samples were analyzed with standard procedures.

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

Growth attributes :

Growth attributes *viz*., plant height, dry matter accumulation, fruiting branches per plant, bolls per plant showed significant improvement under ridge and furrow method of sowing as compared over other land configuration (Table 1). Improvement in growth attributes may be due to favourable aeration, due to seepage of excess rain water, leading to a more conductive environment for better root growth and respiration and higher soil biological activity as compared to conventional sowing on flat beds.

Table 1 : Effect of land configuration on growth and yield attributes, yield and harvesting index of rainfed cotton during *Kharif* season (pooled data of two years)

Treatments	Plant height at maturity (cm)	Fruiting branches at maturity	Dry mass at maturity (g/plant)	Open bolls/ plant	Boll weight (g)	Ginning (%)	Seed index (g)	Yield (kg/ha)		Harvesting index (%)
								Seed cotton	Stalk	
Ridge and furrow	129	16.9	249.3	29.4	2.7	33.8	9.2	1208	2700	44.5
Broad bed furrow	130	15.7	233.5	24.3	2.9	30.7	8.6	1101	2610	42.4
Deep furrow opening near to crop row at 30 DAS	123	14.5	227.0	23.5	2.7	30.4	8.2	1050	2450	42.8
Dust mulching with blade harrow	121	14.2	208.0	20.0	2.6	29.1	8.0	947	2330	41.1
Falt bed sowing (No moisture conservations) / Farmer practice	116	12.9	199.0	19.4	2.5	27.7	7.7	884	2200	40.1
S.E.±	3.0	0.3	1.0	0.4	0.1	0.5	0.2	25.0	29.0	0.8
C.D. (P=0.05)	8.0	0.9	3.0	1.2	0.18	1.7	0.5	76.0	89.0	2.5
CV (%)	4.0	3.4	0.9	3.2	4.2	3.5	4.0	5.0	2.0	3.7

Table 2 : Effect of land configuration on soil moisture content, moisture use efficiency and N, P and K total plant uptake and available NPK in the soil after harvest of cotton (pooled data of two years)

Treatments	Soil moisture content (%) at 30 cm depth		Moisture use efficiency (kg/ha/mm)	Total plant Nutrients uptake at maturity (kg/ha)			Available nutrients in soil after crop harvest (kg/ha)		
	At flowering	At boll development		N	P	K	N	P	K
Ridge and furrow	18.8	21.7	3.6	168	52	245	223	11.5	350
Broad bed furrow	17.4	20.5	3.2	147	45	222	230	11.8	362
Deep furrow opening near to crop row at 30 DAS	16.7	18.9	3.1	136	41	213	245	12.1	365
Dust mulching with blade harrow	15.9	16.5	2.8	118	39	188	240	12.0	380
Falt bed sowing / Farmers practice	14.5	15.4	2.6	112	36	179	248	12.5	389
S.E.+	0.3	0.4	0.1	1.6	1.0	1.7	2.6	0.13	1.3
C.D. (P=0.05)	0.7	1.1	0.3	5.0	3.0	5.3	8.0	0.4	4.0
CV (%)	2.4	3.8	0.1	2.3	4.3	1.6	2.2	2.0	1.8

Yield attributes and yield :

Land configuration had significant effects on yield attributes and yield of cotton. Boll weight, ginning percentage, seed index was significantly higher under ridge and furrow method of sowing as compared to other methods of sowing (Table 1). This can be attributed to better growth of plants in terms of dry matter accumulation number of fruiting branches per plant, number of bolls per plant under ridge and furrow method which in turn improved photosynthesis and nutrient utilization for development of sink. Similarly, sowing on ridge and furrow improved seed cotton and stalk yield of cotton by 36.7 and 22.7%, respectively as compared to conventional sowing flat bed in the years of study. This might have been caused by significant improvement in overall growth and yield attributes of cotton due to sowing on ridge and furrow, which led to higher crop yield (1208 kg/ha). These results are in conformity with those of Narkhed *et al*. (2015); Paslawar and Deotalu (2015); Jadhav *et al.* (2008) in cotton and Ram *et al*. (2012) in greengram.

Soil moisture content and moisture use efficiency :

To know the beneficial effect of different *in situ* moisture conservation practices, moisture content in soil profile was analyzed at flowering and boll development stages at 0-30 cm soil depth. Maximum moisture conservation was observed in the ridge and furrow was significantly higher at flowering and boll development crop stages over other moisture conservation methods (18.8 and 21.7%), respectively. Jadhav *et al.* (2008) revealed the land configuration of ridges and furrow was found most effective and feasible for soil moisture conservation and producing the highest cotton yield on black cotton soil under assured rainfall condition.

Moisture use efficiency increased significantly when cotton was sown on ridge and furrow (38.5%) compared to flat beds, which is attributed to higher seed cotton yield (3.6 kg/ha/mm) on ridge and furrow compared to flat beds. These results support the finding of Narkhede *et al.* (2015).

Nutrient uptake and available NPK in soil after harvest of crop :

The uptake of N, P and K by plants was significantly higher under ridge and furrow method of sowing as compared to other land configuration methods. This might be due to better root growth and moisture extraction from deeper layer of soil and consequently higher N, P and K uptake (168,52 and 240 kg/ha), respectively, resulting in higher yield of both seed cotton and stalk under ridge and furrow sowing. Similar findings have also been reported by Ram *et al*. (2012) in greengram. Land configuration methods significantly affect the available N, P and K in soil after harvest of the crop (Table 2). These results are differed with Dhimmar (2003) in cowpea.

The land configuration of ridges and furrow was found most effective ad feasible for soil moisture conservation and producing the highest cotton yield on sandy loam soil under assured rainfall condition.

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