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Effect of In-Situ Moisture Conservation Practices on Soil Moisture Content of Rainfed Bt Cotton (*Gossypium hirsutum* L.)

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A B S T R A C T

A field experiment conducted on clay soil of Regional Agricultural Research Station, Lam, Guntur, during *kharif* 2017-18. The treatments were T3 - 100 % RDF (120:60:60) + opening furrow for every row during last intercultural operation, T4 - 125% RDF (150:75:75) + opening furrow for every row during last intercultural operation, T7 - 100% RDF (120:60:60)+ opening furrow for every row during last intercultural operation + foliar nutrition with 2% KNO_3 at square formation, flowering and boll development and T8 - 125% RDF (150:75:75)+ opening furrow for every row during last intercultural operation + Foliar nutrition with 2% KNO_3 at square formation, flowering and boll development. Found to be more soil moisture conserve these treatments are soil moisture percentage decreased gradually from 60 DAS to harvest.

Introduction

Cotton " white gold" is an important fibre as well as cash crop of India. In India, *Bt* cotton is grown in an area of 12.2 m. ha with an annual production of 377 lakh bales and a productivity of 524 kg lint ha^{-1}. In the state of Andhra Pradesh, *Bt* cotton occupies an area of 5.44 lakh hectares with an annual production of 22 lakh bales and productivity of 688 kg lint ha^{-1} (AICCIP, Annual Report, 2017-2018).

In Andhra Pradesh, *Bt* Cotton is mainly grown under rainfed condition. The vagaries of monsoon have maligned even in the assured rainfall areas in the recent years. Cotton, being a long duration crop, needs a fairly sufficient soil moisture to sustain the growth at later stages of reproductive phase. In this backdrop, efficient utilization of rain water plays a pivotal role which can be achieved by various agronomic management practices, of which *in-situ* moisture conservation is the most important one that reduce the runoff there by storing more soil moisture (Asewar *et al.*, 2008).

In-situ rain water conservation practice like opening furrows in between rows, often help in conserving soil moisture and ultimately enhance water use efficiency as well. The cost effective technologies for efficient utilization of rain water management as *in - situ* moisture conservation comprising the opening of furrow, may prove vital in enhancing and stabilizing the yield (Gokhale *et al.*, 2011).

The significance of *in-situ* soil moisture conservation measures is to conserve maximum possible rainwater at a place where it falls and make effective efficient use of it. The practices of opening furrow in between row of crop is also beneficial for improving the drainage system in field during the high rainfall period and for decomposing the added biomass later on. Ridge may serve as micro-watershed accumulating water in furrow. Practices of making ridge by opening furrow may have an advantage in concentration of more rain water on the bed which enrich soil moisture content (Gidda and Morey, 1981) and the yield levels could be increased (Redder *et al.,* 1991).

Materials and Methods

A field experiment was conducted during *kharif* 2017-18 at Regional Agricultural Research Station, Lam, Guntur, the soil of the experimental field was clay in texture, neutral in reaction (7.45), low in total nitrogen and high in available phosphorus and potassium. The experiment was laid out in a randomized block design with three replications and eight treatments. The allocated treatments were T_1 - 100 % RDF (120:60:60) NPK kg ha$^{-,1}$ T_2 - 125% RDF (150:75:75) NPK kg ha^{-1}, T_3 - 100 % RDF (120:60:60) + opening furrow for every row during last intercultural operation, T_4 - 125% RDF (150:75:75) + opening furrow for every row during last intercultural operation, T_5 - 100% RDF (120:60:60) + Foliar nutrition with 2% KNO_3 at square formation, flowering and boll development, T_6 - 125% RDF (150:75:75) + Foliar nutrition with 2% KNO_3 at square formation, flowering and boll development, T_7 - 100% RDF (120:60:60)+ opening furrow for every row during last intercultural operation + foliar nutrition with 2% KNO_3 at square formation, flowering and boll development and T_8 - 125% RDF (150:75:75)+ opening furrow for every row during last intercultural operation + Foliar nutrition with 2% KNO_3 at square formation, flowering and boll development. Phosphorus was applied as basal through SSP as per the treatments. Nitrogen and potassium was applied through urea and Murete of potash 1/3 at basal, 1/3 at 60 DAS and 1/3 at square initiation stage. The hirsutum Bt hybrid (jadoo) was sown at spacing of 105 cm x 60 cm on 15 july, 2017-18. The data on plant height, boll weight and number of bolls per plant were recorded from randomly selected five plants from each plot and seed cotton yield was recorded on /plot basis. other agronomic practices and plant protection measures were followed as per recommendation.

Results and Discussion

The soil moisture (%) at different crop growth stages of cotton was recorded (Table 1). The soil moisture percentage decreased gradually from 60 DAS to 120 DAS**.** In the study, the nutrient management and moisture conservation practices influenced the soil moisture percentage Fig. 4.2 and Table 4.5. A total rainfall of (466 mm) was received during the crop growing season in 36 rainy days. The moisture conservation treatments of opening the furrows were imposed during the last intercultural operation and the data on soil moisture was recorded at 60, 90 and 120 DAS revealed that maximum soil moisture (%) was recorded in 125% RDF (150:75:75) + opening furrow for every row during last intercultural operation + foliar nutrition with 2% KNO_3 at square formation, flowering and boll development, 100% RDF (120:60:60) +opening furrow for every row during last intercultural operation + foliar nutrition with 2% KNO_3 at square formation, flowering and boll development, 125% RDF (150:75:75) +opening furrow for every row during last intercultural operation and 100% RDF (120:60:60) + opening furrow for every row during last intercultural operation and the lowest soil moisture (%) was recorded with 100% RDF (120:60:60). The availability of more soil moisture in these treatments might be due to practice of opening furrows which acts as drainage during heavy rains and serves for *in situ* infiltration and retention of moisture during the dry spells. These results are in conformity with Narayana *et al.,* (2011), Tayade and Meshram (2013) and Paslawar and Deotalu (2015). At harvest the maximum drymatter accumulation (11915 kg ha^{-1}) (Table 1) was recorded with 125% RDF (150:75:75) + opening furrow for every row during last intercultural operation + foliar nutrition with 2% KNO_3 at square formation, flowering and boll development. The lowest drymatter accumulation (9391 kg ha^{-1}) was recorded at 100% RDF (120:60:60) NPK kg ha^{-1}. The increased drymatter accumulation with 125% RDF might be due to the fact that increased fertilization made the plants more efficient in photosynthetic activity by enhancing the carbohydrate metabolism and hence resulted in increased drymatter accumulation. Squaring, blooming and boll development are the stages when cotton requires higher nutrition and augment of nutrient supply through foliar application at such critical stages help in increased growth parameters especially drymatter accumulation, which might be due to adequate supply of nutrients with foliar application (Rajendran *et al.*, 2011; Devraj *et al.*, 2011; Sandeep *et al.*, 2015 and Santhosh *et al.*, 2016).

At harvest, the maximum number of sympodial branches per plant (Table 1) (23.2) were recorded with application of 125% RDF (150:75:75) + opening furrow for every row during last intercultural operation + foliar nutrition with 2% KNO_3 at square formation, flowering, and boll development. The lowest sympodial branches (16.8) per plant was recorded with 100% RDF (120:60:60) NPK kg ha^{-1}. Similar trend in number of sympodial branches was recorded at 60, 90, and 120 DAS as well. The more number of sympodial branches per plant with opening of furrows at every row might be due to increase the soil moisture availability to crops as well as increase in the nutrient use efficiency. Similar results were reported made by Santhosh *et al.*, (2016), Narayana *et al.,* (2011) and Rajendran *et al.*, (2011).

The maximum numbers of bolls per plant (78**.**1) were recorded (Table 1) with 125% RDF (150:75:75) +opening furrow for every row during last intercultural operation + foliar nutrition with 2% KNO_3 at square formation, flowering and boll development and lowest recorded with 100% RDF (120:60:60) NPK kg ha^{-1}(56.7 bolls $plant^{-1}$ and 63.7 bolls m^2). The increase in boll number per plant was obtained with opening furrow for every row during last intercultural operation might be due to better soil moisture retention that might have helped for better utilization of nitrogen, phosphorus and potassium fertilizer applied **(** Keshava *et al.*, 2013; Saravanan *et al.*, 2012 and Nehra and Yadav, 2013).

Significantly affected by soil moisture conservation practices Maximum seed cotton yield (3411 kg ha^{-1}) was recorded with (Table 1) 125% RDF (150:75:75) +opening furrow for every row during last intercultural operation + foliar nutrition with 2% KNO_3 at square formation, flowering and boll development and lowest seed cotton yield (2285 kg ha^{-1}) was recorded with RDF (120:60:60) NPK kg ha^{-1} and stalk yield of cotton as influenced by nutrient management and soil moisture conservation practices Fig. 4.4 and Table 4**.**9 presented maximum stalk yield was (5877 kg ha^{-1}) recorded with 125% RDF (150:75:75)+opening furrow for every row during last intercultural operation + foliar nutrition with 2% KNO_3 at square formation, flowering and boll development and Lowest stalk yield was (5282 kg ha^{-1}) was recorded with RDF (120:60:60).

Table.1 Effect of in-situ soil moisture conservation practices on growth parameters, yield attributes and yield of Bt cotton

Treatments	Soil Moisture (%)			Dry matter accumulation (kg ha^{-1})	Sympodial branches plant^{-1}	Number of bolls plant^{-1}	Seed cotton yield (kg ha^{-1})	Stalk yield (kg ha^{-1})	GOT (%)
	60 DAS	**90 DAS**	**At Harvest**	**At Harvest**	**At Harvest**	**At Harvest**			
T_1- 100 % RDF (120:60:60) NPK	9.4	8.6	4.3	9391	16.8	56.7	2285	5282	33.3
T_2- 125% RDF(150:75:75) NPK	10.0	9.4	4.1	9788	19.4	64.0	2460	5505	33.2
T3- T1+ Opening furrow for every row during last intercultural operation.	14.1	13.6	8.2	9655	18.2	59.6	2519	5431	33.9
T4- T2+ Opening furrow for every row during last intercultural operation.	14.3	13.9	8.3	10053	20.4	70.8	2947	5654	33.8
T5- T1+ Foliar nutrition with 2% KNO3 at square formation, flowering, and boll development.	10.2	8.8	5.1	9920	19.6	68.4	2831	5580	33.3
T6- T2+ Foliar nutrition with 2% KNO3 at square formation, flowering, and boll development.	10.0	9.7	4.6	11283	21.4	74.1	3266	5803	33.1
T7- T3+ Foliar nutrition with 2% KNO3 at square formation, flowering, and boll development.	14.1	13.4	8.3	10650	20.8	71.3	3177	5712	33.5
T8- T4+ Foliar nutrition with 2% KNO3 at square formation, flowering, and boll development.	14.8	13.9	8.4	11915	23.2	78.1	3411	5877	33.1
S.Em ±	0.3	1.0	0.4	682.3	0.6	4.8	96.2	131.5	2.2
CD (P=0.05)	1.1	3.1	1.5	1964.7	2.4	7.8	292.0	394.6	NS
CV (%)	5.3	15.8	13.3	11.4	5.2	12.3	5.8	12.1	11.5

Table.2 Economics of different treatments of Bt cotton as influenced by nutrient management and moisture conservation practices

Treatments	Seed cotton yield (kg ha^{-1})	Gross Returns (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net Returns (Rs. ha^{-1})	B:C Ratio
T_1- 100 % RDF (120:60:60) NPK	2285	99401	42231	57169	1.35
T_2- 125% RDF(150:75:75) NPK	2460	107029	46590	60439	1.30
T_3- T_1+ Opening furrow for every row during last intercultural operation.	2519	109613	44809	64803	1.44
T_4- T_2+ Opening furrow for every row during last intercultural operation.	2947	128219	51000	77219	1.51
T_5- T_1+ Foliar nutrition with 2% KNO_3 at square formation, flowering, and boll development.	2831	123170	47103	76067	1.61
T_6- T_2+ Foliar nutrition with 2% KNO_3 at square formation, flowering, and boll development.	3266	142086	52017	90069	1.73
T_7- T_3+ Foliar nutrition with 2% KNO_3 at square formation, flowering, and boll development.	3177	138202	51368	86835	1.69
T_8- T_4+ Foliar nutrition with 2% KNO_3 at square formation, flowering, and boll development.	3411	148380	53174	95205	1.79
S.Em ±	96.2	4188.41	-	4188.41	0.084
CD (P=0.05)	292.0	12704.3	-	12704.3	0.25
CV (%)	5.8	5.8	-	9.5	9.3

NPK kg ha $^{-1}$ the increase in stalk yield might be due to favorable effect of macro nutrients on cell elongation, cell wall thickening, stem and leaf thickness and more of leaf and stem weight**.** Similar results were observed by Halemani *et al.,* (2004) and Rajendran *et al.,* (2011) and Sandeep *et al.,* (2015).

The higher gross returns, net income and benefit cost ratio were obtained (Table 2) with 125% RDF (150**:**75**:**75) +opening furrow for every row during last intercultural operation + Foliar nutrition with 2% KNO_3 at square formation, flowering, and boll development and was similar with 125% RDF (150**:**75**:**75) + foliar nutrition with 2% KNO_3 at square formation, flowering and boll development followed by 100% RDF (120:60:60) + opening furrow for every row during last intercultural operation + foliar nutrition with 2% KNO_3 at square formation, flowering, and boll development and125% RDF(150:75:75)+ opening furrow for every row during last intercultural operation and boll development. Which, might be due to higher seed cotton yield obtained per unit area. Similar result obtained by Narayana *et al.,* (2011) and Santhosh *et al.,* (2016).

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