

Original Research Article

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***In-situ* Moisture Conservation in Rainfed Stressed Regions for Increasing Productivity of Cotton Crop**

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A field experiment was conducted during *kharif* season of 2015-16 to 2017-18 to study the *in-situ* moisture conservation in rainfed region for increasing productivity of cotton crop at Main Dry Farming Research Station, Junagadh Agricultural University, Targhadia of North Saurashtra Agro climatic Zone of Gujarat. The experiment comprising of three main plot treatments (*in-situ* moisture conservation practices) and three sub plot treatments (Mulching practices) laid out in split plot design with three (3) replications. Significantly higher soil moisture content was observed due to ridge and furrow practice (T_1) and plastic mulch (M_1) and it was remained at par with broad bed and furrow (T_2) and straw mulch, respectively. Seed cotton and stalk yield was also significantly higher in ridge and furrow practice (T_1) and plastic mulch (M_1) and it was remained at par with broad bed and furrow (T_2). Same trend observed in rain water use efficiency. Economic analysis revealed that the net profit and B:C ratio was recorded higher under ridge and furrow system with plastic mulch (25 micron) compared to control. Interaction effect of *in-situ* moisture conservation practices and mulching practices were found non significant for all the parameters.

Introduction

Cotton is important commercial crop of Gujarat. In saurashtra region cotton is the second most grown crop after groundnut. Gujarat is the single largest cotton producer state with 36 % (101 lakh bales) of the total national production from the area about 25.00 lakh hectares. Saurashtra account 65 % of the state and contributes 68 % in the total production of the state. However, cotton productivity in rainfed areas is still below the

potential productivity, mainly due to erratic distribution of rainfall and moisture stress during crop growth period which may results in partial failure of crops. Therefore there is a need of simple *in-situ* moisture conservation practices that meet out the adverse effect of moisture stress in standing crop.

In-situ moisture conservation practices viz., ridges and furrows + mulch, imparted beneficial effect on cluster bean for getting good growth and higher yields; which

subsequently led to higher net returns and B:C ratio (Allooli *et al.*, 2008). Mulching reduces the deterioration of soil by way of preventing the runoff and soil loss, minimizes the weed infestation and checks the water evaporation. Thus, it facilitates for more retention of soil moisture and helps in control of temperature fluctuations, improves physical, chemical and biological properties of soil, as it adds nutrients to the soil and ultimately enhances the growth and yield of crops. Further, reported that mulching boosts the yield by 50-60 per cent over no mulching under rainfed situations (Dilipkumar *et al.*, 1990).

Materials and Methods

The experiment on *in-situ* moisture conservation in rainfed region for increasing productivity of cotton crop was conducted at Main Dry Farming Research Station, JAU, Targhadia. The soil of experimental field was black and clayey in texture, pH 8.15, organic carbon 0.527 % and EC 0.28 mmhos/cm and available P₂O₅ 32.6 kg/ha, available K₂O 460 kg/ha at 0-15 cm depth of soil. The physical measure of soil are *viz.*, field capacity (33.8%), wilting point (17.0%), infiltration rate (10.4 mm/hr), apparent specific gravity (1.34 g/cc), maximum WHC (47.0%).

The experiment was laid out on split plot design with three replications. The treatments incorporated *in-situ* moisture conservation practices as main plot treatment are T₁ - Ridge and furrow, T₂ - Broad bed and furrow and T₃ - Control and sub plot treatment include mulching practices M₁ - Plastic mulch (25 micron), M₂ - Straw mulch @ 5 t/ha and M₃ - Control. *In-situ* moisture conservation practices were applied after 20 DAS and mulching were applied after withdrawn of monsoon in the month of September (38 to 39 std. week). Gross plot size-5.40 x 4.80 m and net plot-3.60 x 2.40 m. The spacing and seed

rate are 120 x 45 cm and 2.5 kg/ha respectively. The crop was fertilized with 80:00:00 kg NPK/ha.

Results and Discussion

Seed cotton and stalk yield

Effect of *in-situ* moisture conservation practices (T)

The pooled result of three years presented in (Table 1) revealed that significantly higher seed cotton yield (2141 kg/ha) and stalk yield (3646 kg/ha) were obtained in Ridge and furrow practices over the control, but both parameters seed cotton yield and stalk yield were at par with broad bed and furrow practices. Similar results were reported by S. Ganapathi *et al.*, (2018).

Effect of Mulching Practices (M)

Results presented in table 1 showed that seed cotton and stalk yield were significantly affected due to mulching practices. Significantly higher seed cotton yield (2135 kg/ha) was produced under application of plastic mulch as compared to control, but it was remained at par with straw mulch (1994 kg/ha). The similar trend was observed for cotton stalk yield (3645 kg/ha) in pooled results. These findings are close with findings of Prajapati *et al.*, (2018) and Dilipkumar *et al.*, (1990).

Interaction effect of *in-situ* moisture conservation and mulching practices (T X M)

Interaction effect of *in-situ* moisture conservation and mulching practices (T X M) was found non-significant in pooled results in respect of seed cotton yield and stalk yield (Table 1).

Table.1 Effect of In-situ moisture conservation practices on yield, soil moisture content, RWUE and economics of cotton

Sr. No	Treatment	Seed cotton yield (kg/ha)	Stalk yield (kg/ha)	Soil moisture content (%)	Rain water use efficiency (kg/ha-mm)	Gross return (Rs./ha)	Cost of cultivation (Rs./ha)	Net returns (Rs./ha)	B:C ratio
A. In-situ moisture conservation practices (T): Three									
1.	Ridge and furrow (T ₁)	2141	3646	24.38	5.22	115082	33033	82049	3.48
2.	Broad bed and furrow (T ₂)	2043	3499	22.54	5.01	109824	32633	77191	3.37
3.	Control (T ₃)	1788	3232	20.54	4.40	96201	32233	63968	2.98
	S. Em.±	44	81	0.44	-	-	-	-	-
	C.D.at 5%	135	251	1.36	-	-	-	-	-
	C.V.%	11.45	12.22	10.17	-	-	-	-	-
B. Mulching practices (M): Three									
1.	Plastic mulch (25 micron) (M ₁)	2135	3645	23.93	5.23	114764	34100	80664	3.37
2.	Straw mulch (M ₂)	1994	3444	22.85	4.88	107205	32900	74305	3.26
3.	Control (M ₃)	1843	3289	20.67	4.52	99139	30900	68239	3.21
	S.Em.±	39	62	0.42	-	-	-	-	-
	C.D.at 5%	113	177	1.19	-	-	-	-	-
C. Interaction Effect of TxM:									
	S.Em.±	68	107	0.72	-	-	-	-	-
	C.D.at 5%	NS	NS	NS	-	-	-	-	-
	C.V.%	10.30	9.26	9.60	-	-	-	-	-

Soil moisture content (%)

Effect of *in-situ* moisture conservation practices (T)

The pooled result revealed that soil moisture content (%) was significantly affected due to *in-situ* moisture conservation practices. Significantly higher soil moisture content (%) was recorded under ridge and furrow practice (24.38%) followed by broad bed and furrow practice (22.54%) as compared to control (20.54%). These results confirm the findings of Vekariya *et al.*, (2015), Patode *et al.*, (2017).

Effect of Mulching Practices (M)

The soil moisture content (%) was significantly affected due to mulching practices during all the three years of experimentation and pooled results (Table 1). Significantly higher soil moisture content (%) was recorded under application of plastic mulch (23.93%) as compared to control (20.67%), but it was remained at par with straw mulch (22.85%) in pooled results. The findings are close with findings of Chen and Katan (1980) and Lalitha *et al.*, (2010).

Interaction effect of *in-situ* moisture conservation and mulching practices (T X M)

Interaction effect of *in-situ* moisture conservation and mulching practices (T X M) was found non-significant during all the three years and pooled results in respect of soil moisture content (%).

Rain water use efficiency

Rain water use efficiency (Table 1) was also calculated under different treatments of *in-situ* moisture conservation and mulching practices. Maximum rain water use efficiency

was recorded in ridge and furrow practice (5.22 kg/ha-mm) followed by broad bed and furrow practice (5.01kg/ha-mm) and application of plastic mulch (5.23 kg/ha-mm) followed by straw mulch (4.88 kg/ha-mm) under *in-situ* moisture conservation and mulching practices, respectively in pooled results.

Economics

Economics of different treatments was worked out on the basis of pooled results and presented in Table 1. The data indicated that the highest gross return (Rs. 115082/ha), net return (Rs. 82049/ha) and B: C ratio (3.48) was obtained by the ridge and furrow practice (T₁) followed by broad bed and furrow practice (T₂) (Rs.109824, 77191/ha and 3.37) as compared to control (T₃) (Rs. 96201, 63968/ha and 2.98) under *in-situ* moisture conservation practices, similar results were obtained by Basediya *et al.*, (2018).

While in mulching practices, application of plastic mulch (M₁) gave the maximum gross return (Rs.114764/ha), net returns (Rs.80664/ha) with B: C ratio of 3.37 followed by straw mulch (M₂) (Rs.107205, 74305/ha and 3.26) as compared to control (M₃) (Rs. 99139, 68239/ha and 3.21). Similar results were also observed by RajuLalBhardwaj (2013).

From the results of experiment it is concluded that growing Bt. cotton at the distance of 120 cm x 45 cm with ridge and furrow between 2 rows OR broad bed (180 cm width) and furrow (60 cm) with 2 rows at 20 days after sowing and apply plastic mulch (25 micron) OR straw mulch @ 5 t/ha at withdrawn of monsoon in the month of September (38 to 39 Std. week) for gave higher productivity and maximum net returns as well as maximum *in-situ* moisture conservation and rain water use efficiency under dry farming conditions.

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