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Quality Parameters of Cotton as Influenced by Depth of Tillage and Irrigation Scheduling in Black Cotton Soil of Southern Gujarat, India

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A B S T R A C T

A field experiment was conducted during *Kharif* season of 2008 -2009 at the Main Cotton Research Station, Surat, Navsari Agricultural University to study the "Effect of tillage depth and irrigation levels on cotton under South Gujarat condition". Nine treatment combinations comprising three tillage depth in main plot *viz.* normal tillage up to7.5 cm (Di), *tillage* up to 15 cm (D_2) and tillage up to 22.5 cm (D_3) as well as *three* irrigation levels in sub plot *viz.* two irrigations at 25 and 50 days after cessation of rainfall with 80 mm diw at each irrigation (I_2), two irrigations at 25 and 75 days after cessation of rainfall with 60 mm diw at each irrigation (I_2) and three irrigations at 25, 50 and 75 days after cessation of rainfall with 60 mm diw at each irrigation (l_3) were evaluated in split plot design with three replications. Ginning percent failed to get level of significance because it is genetically controlled character. Lint index were significantly higher with treatment D_3 (tillage upto 22.5 cm). Fibre strength, maturity ratio and elongation showed significant effect due to increase in tillage depth. Significantly the highest fibre strength, maturity ratio and elongation were recorded under treatment D_3 (tillage upto 22.5 cm). Fibre fineness, 2.5 per cent span length, length uniformity ratio did not show any significant effect because these are genetically controlled character. Scheduling of irrigation to the crop with three irrigations at 25, 50 and 75 days after cessation of rainfall with 60 mm diw at each Irrigation (l_3) resulted in significantly the highest fibre elongation and in case of fibre strength

Introduction

Cotton is a natural fiber of plant origin, like linen jute or hemp. Mostly composed of cellulose (a carbohydrate plant substance) and formed by twisted, ribbon – line shaped fibers, cotton is the fruit of a shrubby plant commonly referred to as the "cotton plant'. The cotton plant, variety of plants of the genus (*Gossypium spp*) belongs to the *Malvacae* family. The plant, growing up to 10 meters high in the wild, has been domesticated to range between 1 to 2 meters under commercial cultivation in order to facilitate picking The increase in productivity alone could not benefit the cotton growers as quality of cotton fibre is primary concern for fetching higher price. The genetic character of cotton plant regulates these fibre traits but the growing conditions available throughout the life cycle determine the quality of the. Tillage depth by acting on root depth and irrigation levels by

providing lavish environment affect fiber quality. Water is a key factor to enhance crop productivity. In cotton crop, continuous wetness within rooting zone adversely affects the quality of fiber. However, proper depth of tillage and irrigation levels most important while determining the quality of cotton.

Materials and Methods

The field experiment was conducted in plot No. 10 of Main Cotton Research Station. Surat, Navsari Agricultural University during the *Kharif* season of 2008-09

The Main Cotton Research Station, Surat is situated in South Gujarat at a cross point of 20^{o} – 12 'N latitude and 72^{o} – 52' longitude at elevation of 11.34 meters above the mean sea level and is about 18 kilometers away from the Arabian seashore. Cotton variety RCH-2 was suitable for Kharif sowing, which mature with 175 to 190 days and performs better under rained as well as irrigated condition. The quality parameters should be calculated by following formulae,

Ginning percentage

Laboratory model gin designed by the Cotton Technological Research Laboratory, Mumbai was used for ginning the seed cotton samples for estimation of ginning percentage. Bulk produce of seed cotton of each plot was ginned. Seed and lint were weighed separately and ginning percentage was calculated by using the following formula.

$$\text{Ginning (\%)} = \frac{\text{Weight of lint (g)}}{\text{Weight of lint (g) + Weight of seed (g)}} \times 100$$

Lint index

The lint index represents the absolute weight of lint produced by 100 seed in grams. It was computed using the formula of Hutchison and Ramiah (1938)

$$\text{Lint index (\%)} = \frac{\text{Seed Index (g) X Ginning percentage}}{\text{100 – Ginning percentage}}$$

Per cent span length (mm)

Span length is a new concept of length parameter. This term can be defined as the distance spanned by specified percentage of fibers in the specimen being test when the fibers are parallelized and randomly distributed. The most commonly used measure is 2.5 per cent spar length which corresponds well with the American classer's staple length.

Fiber strength (g tex^{-1})

Fiber strength was measured at zero gauge on the stelometer.

It was calculated by following formula.

$$\text{Tenacity (g tex}^{-1}\text{)} = \frac{\text{Breaking load of bundle in kg X 11.8}}{\text{Weight of bundle in mg}} \times 100$$

Fiber fineness (mv)

The micron air value indicates the extent of resistance of flow by fire plugs. It is expressed as micrograms $inch^{-1}$ (*i.e.* 10 g $inch^{-1}$)

The higher value of micronaire (above 4.5mv) indicated finer fibers.

Maturity ratio

It is a unit of expression signifying the multiple character of fiber maturity usually represented by the percentage of mature and immature fibers. It was calculated from the empirical formula established by CIRCOT, Mumbai.

Table.1 Effect of tillage depth and irrigation levels on ginning percent, seed index (g), 2.5 percent span length (mm), Fiber strength (g tex^{-1}) and fibre finesses (mv) of cotton

Treatment	Ginning percent (g)	Seed index (g)	Lint index (g)	2.5 percent span length (mm)	Fibre strength (g tex-1)	Fibre fineness (mv)
Depth of tillage (D)						
Tillage upto 7.5 cm	32.5	9.7	4.5	29.4	19.4	3.6
Tillage upto 15 cm	33.0	10.3	4.9	30.3	20.1	3.9
Tillage upto 22.5 cm	32.4	10.9	5.1	30.8	21.8	4.2
S.E.±	0.3	0.1	0.0	0.3	0.3	0.1
CD (P = 0.05)	NS	0.7	0.2	NS	1.4	NS
C.V. %	3.5	5.5	4.5	3.0	5.4	9.0
Irrigation level (I)						
2 irrigations at 25 and 50 DACR with 80 mm diw at each irrigation	32.4	10.2	4.8	29.7	19.9	3.9
2 irrigations at 25 and 75 DACR with 60 mm diw at each irrigation	32.5	10.3	4.8	30.2	20.6	3.9
3 irrigations at 25 and 50 and 75 DACR with 60 mm diw at each irrigation	33.0	10.5	4.9	30.7	20.8	4.0
S.Em. ±	0.3	0.0	0.0	0.2	0.2	0.0
CD (P = 0.05)	NS	NS	NS	NS	0.6	NS
C.V.%	3.1	2.6	3.7	2.7	3.2	3.7
Interaction (D X I)						
S.Em.±	0.6	0.1	0.1	0.4	0.3	0.0
CD (P=0.05)	NS	NS	NS	NS	NS	NS
C.V.%	3.1	2.6	3.7	2.7	3.2	3.7

Note: DACR: Days After Cessation of Rainfall

Table.2 Effect of tillage depth and irrigation levels on water expenses efficiency (kg ha mm^{1})

Treatment	Maturity ratio	Length uniformity ratio	Elongation (%)
Tillage upto 7.5 cm	0.8	45.5	5.8
Tillage upto 15 cm	0.8	46.0	5.9
Tillage upto 22.5 cm	0.8	46.7	5.9
S.E.±	0.0	0.3	0.0
CD (P = 0.05)	0.0	NS	0.0
C.V. %	0.8	2.5	0.6
2 irrigations at 25 and 50 DACR with 80 mm diw at each irrigation	0.8	46.2	5.8
2 irrigations at 25 and 75 DACR with 60 mm diw at each irrigation	0.8	46.0	5.9
3 irrigations at 25 and 50 and 75 DACR with 60 mm diw at each irrigation	0.8	46.1	5.9
S.Em. ±	0.0	0.3	0.0
CD (P = 0.05)	NS	NS	NS
C.V.%	0.7	2.4	0.5
S.Em.±	0.0	0.6	0.0
CD (P=0.05)	NS	NS	NS
C.V.%	0.7	2.4	0.5

Note: DACR: Days After Cessation of Rainfall

Mc = 0.270 X log (Mic. X st.) + 0.303.

Length uniformity ratio

It is the ratio of 50 span length to 2.5 per cent span length expressed as a percentage. Length uniformity ratio gives an idea about variability in sample.

Elongation (%)

Extension of cotton fiber before it breaks when load is applied which is expressed in percentage.

Results and Discussion

Effect of tillage depth on quality

It is evident from (Table 1) that seed and lint index were significantly higher with tillage depth upto 22.5 cm which was at par with tillage depth upto 15 cm over tillage depth upto 7.5 cm. Ginning percent failed to get level of significance because it is genetically controlled character. Balkcom *et al.,* (2006) noticed significant improvement in lint yield due to conventional tillage. Whereas, Nayakatawa *et al.,* (2000), Boquet *et al.,* (2004) and Wiatrak *et al.,* (2005) reported significantly increase in lint yield.

Fibre strength, maturity ratio and elongation (Table 2) showed significant effect due to increase in tillage depth. Significantly the highest fibre strength, maturity ratio and elongation were recorded under tillage depth upto 22.5 cm and the lowest in tillage depth upto 7.5 cm.

Fibre fineness, 2.5 per cent span length, length uniformity ratio did not show any significant effect because these are genetically controlled character. Boquet *et al.,* (2004) observed that surface tillage significantly increased the fibre quality, length, strength and elongation. Balkcom *et al.,* (2006) observed that conventional tillage system significantly influenced fibre strength.

Effect of irrigation schedule on quality

Irrigation the crop with three irrigations at 25, 50 and 75 days after cessation of rainfall with 60 mm diw at each Irrigation (l_3) resulted in significantly the highest fibre elongation and in case of fibre strength it was at par with I_2 (two irrigations at 25 and 75 days after cessation of rainfall with 60 mm diw at each irrigation) whereas the lowest value was observed at two irrigations at 25 and 50 days after cessation of rainfall with 80 mm diw at each irrigation. This was attributed to favorable effect of irrigation water applied at proper time with, appropriate quantity. Maturity ratio, 2.5 per cent span length, fibre fineness, and length uniformity ratio showed non-significant results because these are varietal character. These findings are in accordance with reported by Jackson and Tilt (1968), Parmar *et al.,* (1975) as well asy8lngh and Bhan (1993).

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