MM 2.2 Integrated Water Management System for Quality Fibre Production

Principal Investigator: D. K. Shelke, MAU, Parbhani

Target & Achievements

Target/Activity	Achievements (during 2004-2005)	Shortfall/constraints	How to overcome
Rain water management through different agrotechniques.	1. Intercropping of cotton with soybean resulted higher seed cotton equivalent yield followed by cotton + blackgram and cotton +green gram, and proved superior over sole cotton. WUE was increased with intercropping over sole cropping. 2. Out of all land configurations for moisture conservation opening of furrow in every row in cotton at 9 WAS proved better. 3. In general quality parameters were not influenced by either intercropping/land configurations.	**A) Budget** The budgetary provision should be uniform. At Lead Center, the provision under recurring expenditure is low as compared to CICR, Nagpur; CICR, Coimbatore; MCRS, GAU, Athwa Farm, Surat and NBSS & LUP, Nagpur.	Being the policy matter, Director, CICR, Nagpur and ICAR may look into this and this anomaly may be removed.
Response of different critical growth stages of cotton to protective irrigation.	1. Flowering and boll development stages found critical for irrigation. 2. Irrigation of cotton at 0.8 IW/CPE ratio gave higher yields. 3. Quality parameters were not influenced due to irrigation.	**B) Non-recurring items** Some provision may be made for testing quality parameters at Lead Center for timely interpretation of results.	

❖ **Studies on rain water management through different agro-techniques in cotton**

T_1 Rainfed control (sole crop)

T_2 Opening of furrows in each row (sole crop) after last interculture.

T_3 Opening of furrows in alternate rows (sole crop) after last interculture.

T_4 Tied hoeing.

T_5 Recommended interculture.

T_6 Intercrop of one row of soybean (JS 335) in cotton (90 x 60 cm).

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T_7 Intercrop of one row of blackgram in cotton (90 x 60 cm)

T_8 Intercrop of one row of greengram in cotton (90 x 60 cm)

on and Quality components

MAU, Parbhani : Different *in-situ* rain water conservation techniques proved superior over control (852.49 kg/ha) in respect of seed cotton equivalent yields. Among the different *in-situ* rainwater conservation techniques intercropping of cotton with soybean resulted in significantly higher seed cotton equivalent yield (1734.10 kg/ha), which was at par with cotton intercropped with blackgram (1362.10 kg/ha) and greengram (1447.10 kg/ha). Further cotton + soybean gave significantly higher seed cotton equivalent yield over T_2 (1283.30 kg/ha), T_3 (1098.20 kg/ha), T_4 (1245.10 kg/ha) and T_5 (1184.30 kg/ha). Opening of furrow in every row proved better than opening of furrow in alternate row. Tied hoeing and recommended interculture were at par with each other**.**

Different agro-techniques increased seed cotton yield significantly over no package for rain water conservation was followed. Amongst the different interventions intercropping cotton with either soybean, blackgram or greengram proved better than other interventions. Three intercrops gave seed cotton equivalents at par with each other. Opening of furrow in alternate row or every row was at par.

NAU, Surat : Different agro-techniques increased seed cotton yield significantly over no package for rain water conservation was followed. Amongst the different interventions intercropping cotton with either soybean, blackgram or greengram proved better than other interventions. Three intercrops gave seed cotton equivalents at par with each other. Opening of furrow in alternate row or every row was at par.

Most of the quality parameters did not differ under various treatments.

MPKV, Rahuri : Data revealed that the treatment T_6 i.e. intercrop of one row of soybean in cotton (90 x60 cm) produced significantly more seed cotton yield (1176.69 kg/ha) as compared to other treatments. Similar trend was observed in respect with plant height, number of sympodia, no. of picked bolls. The boll weight was more or less similar. The treatments T_3 and T_4 produced more or less similar seed cotton yield and which was at par over each other. Likewise the treatment T_7 and T8 recorded more or less same seed cotton yield and which were at par over each other. In respect of intercrop yield, soybean as a

intercrop in cotton i.e. treatment T_6 recorded more soybean yield i.e. 300 kg/ha followed by Black gram (200 kg/ha) and Mung (190 kg/ha).

CICR, Nagpur : Intercrop of one row of green gram in cotton was at par with intercrop of one row of black gram but it proved superior over intercropping of cotton with soybean, tied hoeing and opening furrows in every and alternate rows. Opening of furrow either in alternate or every row proved beneficial over the treatment where no interventions was done . Ginning percentage was higher with cotton + greengram and opening of furrow in every row.

PDKV, Akola : Among the various agro-techniques, opening of furrow in every row recorded highest seed cotton yield (2169 kg/ha) and it was at par with all the treatments except, intercropping of cotton either with soybean, blackgram or greengram. The next best treatment was opening of furrow in alternate row which was at par with all other treatments except intercropping of cotton with soybean.

The seed equivalent yields were not influenced significantly due to poor performance of intercrops due to unfavourable weather condition at flowering and pod maturity and severe infestations of mosaic in blackgram.

ANGRAU, LAM : Intercropping of cotton + soybean (2 rows) resulted in highest seed cotton equivalent yield (2806 kg seed cotton 1317 kg soybean) and proved superior over other treatments. Next best treatment was opening of furrow in every row (3459 kg/ha). Grain yields of green gram and black gram were very low due to long dry spell prevailed during 30 + 57 days after sowing, which coincided with reproductive stage of blackgram and greengram.

Quality parameters were not influenced by various treatments

UAS, Dharwad : Intercropping of cotton + greengram recorded highest seed cotton equivalent (2115 kg/ha) followed by cotton + soybean (2066 kg/ha). Similarly both theses treatments gave significantly higher seed cotton yield over rainfed control. In-situ mulching of sunhemp at 35 DAS in ridges and furrow also proved superior over rainfed control and other treatments also.. Among different treatments *in-situ* mulching of sunhemp has produced highest WUE of 2.49 kg/ha mm followed by intercropping of greengram or soybean between cotton.

Different treatments have no significant effect on various quality parameters.

NBSS&LUP, Nagpur : Among the different agro-techniques, paired row planting and protective irrigation of harvested water at flowering and boll development stage (T_7) recorded significantly higher seed cotton yield (27 q/ha) than other treatments. Irrigation at 0.8 or 0.6 IW/CPE with harvested water found next best treatment.

The highest seed cotton equivalent yield was recorded with T_7 treatments which was statistically significant over other treatments. Farmer's practice (16.3 q/ha) and rainfed control (17.29 q/ha) recorded the lowest seed cotton equivalent yields.

WUE was highest when irrigation was given at early boll development stage followed by irrigation at flowering and boll development stage, irrigation at 0.8 IW/CPE and irrigation at 0.6 IW/CPE.

The fibre length was not significantly influenced by integrated water management treatments in first and second pickings whereas in third picking paired row planting (T_3) recorded significantly higher fibre length of 28.8 mm as compared to other treatments.

The uniformity ratio was significantly influenced by different integrated water management treatments at second and third pickings. Farmer's practice of growing 8 rows of cotton and two rows of pigeonpea (T_1) and paired row planting of cotton with opening of ridge and furrow (T_5) recorded significantly higher uniformity ratio compared to other treatments in second and third pickings respectively. Whereas intercropping of pigeonpea in between paired rows of cotton (T_3) recorded higher UR in first picking.

CICR, Coimbatore : Maximum gross returns were accrued with intercropping of cotton either with blackgram or greengram or soybean followed by protective irrigation and opening furrow every row.

Most of the quality parameters were not influenced due to different treatments. However it was noted that application of supplementary irrigation could improve 2.5% span length, fibre quality index and least micronaire value.

- **Response of Different Critical Growth Stages of Cotton to Protective Irrigation**

Treatments :

T_1 - Rainfed control.

T_2 - Irrigation at square formation stage.
T_3 - Irrigation at Flowering stage.
T_4 - Irrigation at boll development stage.
T_5 - T_2 + T_3
T_6 - T_3 + T_4
T_7 - T_2 + T_3 + T_4
T_8 - Irrigation at 0.8 IW/CPE (60 mm 1W

MAU, Parbhani : It was observed that during the year of experimentation there was no dry spell at square and flowering stages. Therefore irrigation was not given in treatments T_2 and T_3. Similarly although there was dry spell during boll formation stage, however, the heavy rains were received after the irrigation. This has resulted into heavy infestation of bollworm incidence. It was very difficult to control the same even if the recommended plant protection schedule was adopted. Hence this experiment may be treated as vitiated.

NAU, Surat : Irrigating cotton at square, flowering and boll development gave significantly higher yield over irrigation at square and flowering. But it was at par with irrigation at boll development, flowering + boll development and irrigation scheduled at 0.8 IW/CPE ratio.

Different treatments did not have any significant effect on different quality parameters under study.

MPKV, Rahuri : It was revealed that highest seed cotton yield (1140.42 kg/ha) was recorded by treatment T_8 i.e. irrigation at 0.8 IW/CPE ratio and it was statistically significant over remaining treatments. Similar trends were observed with respect to plant height, no. of sympodia per plant, no. of picked bolls/plant, weight of picked bolls per plant and boll weight.

The maximum leaf area (52.92 dm^2/plant) was recorded by treatment T_8 and it was statistically significant over remaining treatment. The maximum leaf area index (9.80 dm^2/plant) and dry matter yield (49.50 g) was recorded by treatment T_8 and it was significantly superior over remaining treatments.

CICR, Nagpur : Irrigating cotton at flowering and early boll development stage gave highest seed cotton yield (23.30 q/ha) and proved at par with irrigation at peak boll development stage and irrigation at flower + early boll development and

peak boll development stage and it was significantly superior over rest of treatments.

Irrigation at 0.8 IW/CPE also proved superior over rainfed control. Among different critical stages flowering or peak boll development stage proved critical for irrigation.

Irrigation efficiency was highest with irrigation at flowering and peak boll development stage (3.20 kg/ha mm) and next best was irrigation at peak boll development (3.11 kg/ha mm).

Ginning outturn was not influenced by different treatments.

PDKV, Akola : Irrigating cotton at 0.8 IW/CPE ratio recorded highest seed cotton yield (2014 kg/ha) although it was not significantly superior over other treatments. Irrigation could not be applied at critical stages of cotton i.e. at square formation and flowering due to incessant rains. Though the irrigation was applied at boll development, it was followed by rains (45 mm) during 36th Meteorological week.

ANGRAU, LAM : Irrigating cotton either at boll development, square + flowering, and square + flowering + boll development and irrigation scheduled at 0.8 IW/CPE ratio proved superior to rainfed control. Boll development stage found to be more critical than other stages.

Quality parameters were not significantly influenced by various treatments.

UAS, Dharwad : Irrigation at flowering, square formation + flowering + boll development and irrigation at 0.8 IW/CPE ratio were at par and produced significantly higher cotton yield over irrigation at square formation or boll development or flowering + boll development.

Various treatments have no significant effect on different quality parameters of cotton. Among different treatments irrigation at flowering produced highest WUE (2.56 kg/ha mm).

NBSS & LUP, Nagpur : Irrigation of harvested water at flowering and boll development stage (T_7) and paired row planting of cotton (T_4) improved significantly the fineness of fibre (4.033) as compared to other treatments in first picking. In second picking, irrigation at 0.8 IW/CPE ratio recorded significantly higher micronaire values.

Paired row planting of cotton and opening of ridges and furrows recorded significantly higher bundle strength of 22.27 and 20.0 g/t at first and third picking, respectively as compared to other treatments. But in second picking the treatment effect were in significant.

CICR, Coimbatore : Irrigation at boll development stage and at 0.8 IW/CPE gave significantly higher yield over rainfed control. Irrigation at 0.8 IW/CPE ratio gave highest seed cotton yield (19.50 q/ha) and it was at par with all irrigation treatments where irrigation at boll development stage was involved and it was proved superior over irrigation at either square or flowering or square – flowering. Application of irrigation at boll development stage was observed with highest WUE (4.89 kg/ha. mm).

Ginning % was not influenced by different treatments. Different quality parameters were not influenced due to different interventions.

RAU, Sriganganagar :

- **Effect of irrigation scheduling through drip on cotton productivity**

Treatments : Irrigation scheduling through drip on alternate day based on crop evapo transpiration (ETc)

I_1 – Drip irrigation at 0.6 ETc
I_2 – Drip irrigation at 0.8 ETc
I_3 – Drip irrigation at 1.0 ETc
I_4 – Flood irrigation at IW/CPE 0.7
I_5 – Furrow irrigation

The irrigation though drip scheduled at 1.0 ETc gave highest (2856 kg/ha) seed cotton yield which was significantly superior over all other treatments except drip irrigation at 0.8 ETc (2703 kg/ha).

The maximum water-use-efficiency was recorded in drip irrigation at 0.6 ETc treatments (4.49 kg/ha mm) followed by drip irrigation at 0.8 ETc (4.21 kg/ha mm). The minimum water-use-efficiency was recorded in flood irrigation (3.18 kg/ha mm) treatment.

Irrigation through drip improved the quality of cotton lint by increasing the 2.5% span length and fibre strength and decreasing short fibre content in comparison to irrigation.

❖ **Effect of Fertigation on Cotton Productivity**

Treatments (5)

F_1A_1 = 100% recommended dose of N (150 kg N/ha) and K (20 kg K_2O/ha) in four splits (25% each at sowing, 35 DAS, flower and boll development stages)

F_1A_2 = 100% recommended dose of N (150 kg N/ha) and K (20 kg K_2O/ha) in six splits (20% at sowing and remaining dose in 5 equal splits at 20 days interval).

F_2A_1 = 75% recommended dose of N (112.5 kg N/ha) and K (15 kg K_2O/ha) in four splits.

F_2A_2 = 75% recommended dose of N and K in six splits

Flood irrigation (RP) = Recommended dose of N K as per package of practices (control)

Note : **Phosphorus (40 kg P_2O_5/ha) was applied as basal dose in all treatments**

Fertigation significantly influenced the seed cotton yield. Application of 100% RDF (N & K levels) through drip in six splits recorded maximum seed cotton yield (3374 kg/ha). It was at par with 100% recommended dose of N and K in four splits and 75% recommended dose of N ad K in six splits and significantly superior over 75% recommended dose of N and K in four splits and control (Recommended practice). The minimum seed cotton yield (2315 kg/ha) was recorded under recommended practice of irrigation and fertilizer application.

The fertigation treatments also gave higher fertilizer use efficiency in comparison to recommended practice of irrigation and fertilizer application.

Fertigation to cotton improved the quality of cotton lint by increasing the 2.5% span length and fineness of cotton fibre and decreasing the short fibre content in comparison to flood irrigation.