Title: Development of production technologies for Bt cotton and improvement of water and nutrient use efficiency with precision farming techniques

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INTRODUCTION

Bt cotton is gaining rapid acceptability among cotton growers. Currently, the agronomic recommendations developed for conventional hybrids are being advocated to Bt hybrids also. However, considering the higher yield potential, altered morphoframe, shorter duration and more synchronous boll setting, it would be appropriate to develop site-specific nutrient and water management technologies to harness the higher yield potential of Bt cotton. The project aims to develop site-specific water and nutrient management practices for higher water and nutrient use efficiency.

OBJECTIVES

1. To study the effect of in-situ moisture conservation measures in conjunction with integrated nutrient management on the productivity and fibre quality of Bt cotton in rainfed situation.
2. To find out optimum irrigation schedule and nutrient requirement with drip and fertigation and its synergetic effect on water and nutrient use efficiency.
3. To synchronise nutrient application with crop demand.

ACTIVITIES

On- station field experiments were conducted under three sub-projects. The technical programme under each of them is summarized below.

SUB PROJECT- I : Effect of rainwater and integrated nutrient management for improvement in productivity and fibre quality of Bt cotton

A) Soil moisture conservation techniques (3)

T_1 - Opening of furrow in alternate row

T_2 - Cotton intercropped with legumes (soybean / green gram /blackgram)

T_3 - Straw mulch / green manuring

B) Integrated Nutrient Management (6)

F_1- Recommended dose of fertilizer.

F_2- Application of RDF with soil testing 75% inorganic + 25% FYM.

F_3- Application of RDF with soil testing 75% inorganic + 25% Vermicompost.

F_4- Application of RDF with soil testing 50% inorganic + 50% FYM.

F_5- Application of RDF with soil testing 50% inorganic + 50% Vermicompost.

F_6- Application of RDF + micronutrients Zn, Fe, B based on soil test.

Design: Split plot

SUB PROJECT -II : Effect of precision application of irrigation and fertilizers through drip on productivity and fibre quality of Bt cotton

Treatments: Design: Split plot design

A] Main Plot: Irrigation scheduling through drip (4) (Alternate day based on ETc)

I1 -Irrigation at 0.6 ETc
I2 -Irrigationat 0.8 ETc
I3 -Irrigation at 1.0 ETc
I4 -Irrigation in furrows at 0.6IW/CPE

B] Sub Plot: Fertilizer levels: 4: Fertilizer application through drip in 6 splits with 15 days interval.

F_1-75% RDF
F_2-100% RDF
F_3-125% RDF
F_4-100% RDF in 3 splits through soil application.

Fertilizer application through drips in six splits with 10 to 15 days interval. N and K through drip and P was applied through SSP at sowing.

Depth: Depth of water to be calculated based on ETc. Etc = Eox Kc x Kp ; where, Eo= Pan evaporation of two days, Kc = Crop factor of the month and Kp = Panfactor 0.7

SUB PROJECT -III : Synchronizing N and K supply with crop demand to enhance use efficiency

Treatment details: Design : FRBD

SALIENT FINDINGS:

CENTRAL ZONE

M.A.U., PARBHANI

- Intercropping of cotton with soybean resulted in significantly higher seed cotton equivalent yield, higher gross returns, net returns and benefit : cost ratio as compared to other moisture conservation techniques.
- Application of RDF + micronutrients (Zn and Fe) recorded highest cotton equivalent yield followed by RDF only.
- Drip irrigation scheduled at 0.8 ETc and 1.0 ETc recorded highest seed cotton yield followed by irrigation scheduled at 0.6IW/CPE ratio.
- Highest WUE (10.73 kg/ha mm) and water productivity was observed in scheduling irrigation at 0.8 Etc where as highest fertilizer use efficiency (16.45 kg/hakg of fertilizer) was observed in scheduling irrigation at 1.0 ETc.
- Application at 100% RDF and 125% RDF through drip in six splits recorded highest seed cotton.
- Three or four splits or three of nitrogen only at early stage of crop growth before flowering resulted in recording highest seed cotton yield and economics of Bt cotton.

DR. PDKV, AKOLA:

- Spreading of wheat straw @ 5 t/ha. after last hoeing recorded significantly higher seed cotton yield than opening of furrows in cotton but it was at par with mulching of blackgram. Water use efficiency was maximum with mulching of wheat straw.
- Irrigation applied at 1.0 ETc through drip, recorded significantly highest yield than all other treatments. Higher values of water use efficiency and water productivity were noticed under irrigation scheduling at 1.0 ETc.

CICR, NAGPUR

- Compared to RDF, significantly higher seed cotton yield was obtained with 50% organic manure + 50% inorganic fertilizer and 75% inorganic + 25% organic manure.
- Highest WUE and water productivity of rain water used in Bt cotton was found in (cotton + green gram) as compared to (Ridges and furrows) and (mulching) assuming 70.5 cm rain water utilized by cotton.
- Seed cotton yield of Bt cotton with scheduling of irrigation at 0.6 Etc through drip was statistically on par with that of 0.8 and 1.0 Etc as well as furrow irrigation.
- Application of N only in 3 splits (10, 30 and 60 DAS) gave higher seed cotton yield as compared to other treatments.
- Significantly higher gross monetary return was obtained in intercropping (soybean) based moisture conservation system

COTTON RESEARCH STATION, NAU, SURAT

- Application of nitrogen at five split (30, 60, 75, 90 and 105 DAS) was best compared to four, three and two splits of nitrogen. However, four and five splits of nitrogen also recorded similar seed cotton yield.

CRS, J.N.K.V.V., Khandawa

- Use of straw mulch significantly increased the seed cotton production followed by opening of furrow in alternate rows.

- The seed cotton yield was higher with three splits of nitrogen before early flowering stage of Bt cotton.

EASTERN ZONE

OUAT, Bhavanipatnum

- Cotton + blackgram intercropping produced highest seed cotton equivalent yield followed by straw mulch and alternate opening offurrows.
- Three splits of nitrogen at 10, 30 and 75 OAS gave significantly higher seed cotton yield followed by four splits at 10, 30, 45 and 75 OAS.

SOUTH ZONE

RARS, Lam, Guntur

- Application of ROF + 2 sprays of 2% spray KNO_3 recorded significantly highest seed cotton yield and maximum BCR of 3.27but it was closely followed by ROF through 75% inorganic and 25% FYM.
- Although the seed cotton yield was maximum with three splits of nitrogen at 15, 45 and 75 OAS yet the highest net return and BCR was realized with five split application of nitrogen.

ARS, Dharwad

- Significantly higher cotton equivalent yield was obtained with intercropping of green gram followed by bio-mulching with sunhemp.
- Application of ROF micronutrients (Zn and Fe) recorded highest cotton equivalent yield followed by ROFonly.
- Significantly higher seed cotton yield was obtained with drip irrigation at 1.0 ETcwhich was on par with irrigation at 0.8 ETcand both were superiorto irrigation at 0.6 ETc.
- Higher seed cotton yield was obtained with four splits applied at 10, 30, 45 and 60 OAS which was closely followed by three splits at 10, 45 and 60 OAS.

CICR, Coimbatore

- Fertigation @ 100% ROF followed by 125% ROF registered significantly higher seed cotton yield over that in soil application. Thus, ROFwas sufficient to restore the current level of production.
- Highest WUE (expressed in kg/ha.cm) was observed with drip irrigation at 0.6 Etc (64.5) followed by 0.8 (48.5), 1.0 Etc (38.2) and 0.6IW/CPE (31.7),
- Nitrogen applied in 2 splits at 10 and 45 OAS realized highest seed cotton yield although it was at par with split applications.

NORTH ZONE

ARS, Sriganganagar

- Green manuring of Ohaincha gave significantly higher seed cotton yield over intercropping of short duration legume like moong, but it was at par with opening of alternate furrows during last inter culture.
- As regards to nutrient management, ROF + Zn gave significantly higher seed cotton yield over ROF and rest of the INM treatments.
- Seed cotton yield was maximum under three splits of nitrogen closely followed by four splits.

CRS, Sirsa

- Seed cotton yield was higher under scheduling of irrigation at 1.0 Etc and application of fertilizer from 75% ROF to 125% ROF. However, the highest seed cotton yield was obtained at irrigation level1.0 ETcwith 125% ROF.
- The consumptive use of water was highest in furrow irrigation (600.53mm) and lowest in (448.25mm) was at 0.6Etc irrigation level. The WUE was highest (5.50 Kgha-1mm) at 1.0 ETc irrigation level and lowest (4.12 Kgha-1mm-1) was observed in furrow irrigated plots.
- The highest seed cotton yield was observed when four split of NK was applied at Basal, 30, 45 and 60 OAS.

PAU, Research Station, Abohar

- Scheduling of irrigation at 0.8 ETc and 1.0 ETc recorded higher seed cotton yield than other irrigation schedule
- Nitrogen use efficiency was found to be higher in the drip irrigation plots with 0.8 and 1.0 ETc levels followed by furrow irrigation and 0.6 ETc.
- The fertilizer in splits dose when applied as basal, at 30 and 45 OAS or when applied as basal, at 30 and 60 OAS completed before initiation of flowering, gave significantly higher seed cotton yield.

Fig. 1 : Drip irrigation in alternate furrows

Fig. 2 : Intercropping for moisture conservation