

## MM 2.3 : Bioinoculants for Sustainable and Cost Effective Production of High Quality Fibre

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### Target & Achievements

Target	Activity	Achievement
Survey, Isolation and enumeration of <i>Azospirillum</i> , PSB, PGPR from cotton based cropping system	Isolation of different isolates for further screening	In all the centers, survey on the population of different inoculants was conducted and different isolates were collected
Screening of Isolates	Selection of efficient isolates of the inoculants suitable for each location	Efficient isolates suitable for each location were selected by vigor index and other studies.
Field trial I Testing of promising bioinoculants for potential utilization in cotton	Rescheduling of fertilizer recommendations/INM module based on the utilization of efficient strains of bio-inoculants	In all the centres except HAU, the performance of bioinoculants was significant at 75% N & P. In HAU, the bioinoculants performed well at 100N & P.
Field trial II To study the individual effect of the bioinoculants on cotton	To evaluate the performance of individual and combined effect of bio-inoculants alone on the yield and quality of cotton	The saving of 25 % of fertilizer N & P was observed in all the centers.

### Laboratory studies

**Survey, isolation and enumeration of bio inoculant from rhizosphere soils of cotton and cotton based cropping system.**

**Table 2.3.1: To isolate different strains of *Azospirillum*, PSB and PPFM.**

Center	Result
Indore	Five <i>Azospirillum</i> native strains and three native strains of PSB were isolated.
Khandwa	Nil
Parbani	<i>Azospirillum</i> was present in the range of 21-33 x 10 <sup>3</sup> CFU/g soil, PSB in the range of 10-23 x 10 <sup>2</sup> CFU/g soil and PPFM in the range of 2-7 x 10 <sup>1</sup> CFU/g soil.
Rahuri	The isolation and screening of 'P' solubilization and rhizobacteria is in progress.
Hissar	The survival count was observed 2.2x10 <sup>4</sup> – 4.4x10 <sup>4</sup>
CICR - CBE	From suvey of the cotton field, different isolates of <i>Azospirillum</i> sp(46), Phosphorus solubilizing bacteria (36) , PPFM(46) were obtained.

Nandyal	Nil
TNAU	The population of <i>Azospirillum</i> and PGPR was in the range of 2 – 8 x 10 <sup>4</sup> CFU/g soil. The population of PSB and PPFM were in the range of 0.8 - 4 x 10 <sup>5</sup> CFU/g soil.

**Table 2.3.2 : Screening of Isolates -- To select efficient strains of *Azospirillum* PSB and PPFM.**

Center	Result
Indore	<i>Azospirillum</i> native strains KAZ-1 & PSB native strain KP-1 recorded the maximum root length and shoot length.
Khandwa	Nil
Parbani	25 isolates of each inoculant were screened and isolate No.9 of <i>Azospirillum</i> , isolate No.9 of PSB, isolate No.14 of PGPR and isolate No. 14 of PPFM recorded the maximum results.
Rahuri	The <i>Azospirillum</i> has been isolated from the rhizosphere soil of cotton. Screening of isolated <i>Azospirillum</i> will be done during summer/Kharif, 2005.
Hissar	Isolation of new strains PSB 1, 2, 3 <i>Azospirillum</i> 11, 12, 13 and <i>Azotobacter</i> 31, 32, 33
CICR - CBE	From potculture experiment and vigor index studies, isolates of
Nandyal	Nil
TNAU	A new isolate of PPFM (PYR – 2) was selected based on vigor index studies

### Field trial studies

**Field trial I : Testing of promising bioinoculants for potential utilization in cotton at different levels of fertilizers.**

**Rescheduling of fertilizer recommendations/INM module based on the utilization of efficient strains of bio-inoculants.**

Center	Result
Indore	The treatment of 75 % N and P of RDF with – <i>Azospirillum</i> TNAU + PSB TNAU + PPFM recorded the maximum seed cotton yield (875 kg ha <sup>-1</sup> )
Khandwa	The treatment of 75 % N and P of RDF with – <i>Azospirillum</i> TNAU + PSB TNAU + PPFM recorded the maximum seed cotton yield (1334.88 kg ha <sup>-1</sup> )
Parbani	The plots receiving 100 per cent fertilizers along with surat strain of <i>Azospirillum</i> + PSB and PPFM has recorded the maximum seed cotton yield of 1033.34 kg/ha.
Rahuri	The season of 2004-05 was very unusual. Excessive rainfall was received. Hence, the experiments conducted during 2004-05 are treated as vitiated.
Hissar	The treatments 100% RDF and bioinoculants <i>Azospirillum</i> Surat gave highest seed cotton yield over other treatment
CICR - CBE	The treatment of 75 % N and P of RDF with – <i>Azospirillum</i> HAU + PSB TNAU + PPFM recorded the maximum seed cotton yield (1334.88 kg ha <sup>-1</sup> )
Nandyal	Application of 100% RDF and Surat culture of <i>Azospirillum</i> with PSB and PPFM recorded significantly higher seed cotton yield per plant (50.1 g) and accordingly seed cotton yield (1069 kg/ha)
TNAU	Application of 75 % RDF and <i>Azospirillum</i> TNAU with PSB and PPFM recorded higher single plant yield and seed cotton yield per ha <sup>-1</sup> .

**Field trial II - To study the individual effect of the bio inoculants on cotton**

**To find out individual and combined effect of *Azospirillum*, PSB and PPFM at 75% N&P of recommended dose.**

Center	Result
Indore	The treatment of 75% RDF + <i>Azospirillum</i> TNAU + PSB + PPFM recorded the maximum boll number per plant, seed cotton yield per plant and maximum seed cotton yield per ha (1002 kg ha <sup>-1</sup> ).
Khandwa	The treatment 75% RDF+ <i>Azospirillum</i> TNAU + PPFM recorded the maximum seed cotton yield of 1223.76 kg ha <sup>-1</sup> .
Parbani	The highest seed cotton yield of 1306.8 kg/ha was recorded on the plots receiving 75 per cent recommended dose of fertilizer along with PPFM.
Rahuri	The season of 2004-05 was very unusual. Excessive rainfall was received. Hence, the experiments conducted during 2004-05 are treated as vitiated.
Hissar	The saving of 25 kg N/ha was observed in the treatment 75% RDF + <i>Azospirillum</i> Surat + PSB TNAU <sub>1</sub> + PPFM
CICR - CBE	The treatment of 75% RDF + <i>Azospirillum</i> TNAU + PSB + PPFM recorded the maximum boll number per plant, seed cotton yield per plant and maximum seed cotton yield per ha (2982 kg ha <sup>-1</sup> ).
Nandyal	Significantly higher number of bolls per plant, boll weight, seed cotton per plant and seed cotton yield per ha were produced with combined application of <i>Azospirillum</i> + PSB + PPFM at 75% RDF
TNAU	The treatment of 75% RDF + <i>Azospirillum</i> TNAU + PSB + PPFM recorded the maximum boll number per plant, seed cotton yield per plant and maximum seed cotton yield per ha (1020 kg ha <sup>-1</sup> ).

Except in Khandwa, biofertilizer inoculation at 75% RDF recorded the maximum seed cotton yield per Ha when compared with uninoculated, unfertilized control and 100% RDF alone applied treatments. In Indore, Parbani, Nandyal, CICR – CBE and TNAU centers inoculation of *Azospirillum*, PSB and PPFM at 75% RDF recorded the maximum seed cotton yield per ha (1002, 1298, 2982, 724, 1020 kg per ha respectively).

Inoculation of biofertilizers made significant difference in % increase over control of seed cotton yield. In Indore, CICR –CBE, Nandyal and TNAU centers inoculation of *Azospirillum*, PSB and PPFM at 75% RDF recorded the maximum % increase over

control (15.70, 27.44, 91.03, 34.21 respectively). In Khandwa, inoculation of *Azospirillum* and PPFM recorded the maximum % increase over control (14.43). In Parbhani, inoculation of PPFM recorded the maximum % increase over control (22.12).

Except in Hissar, in all other centers, biofertilizer inoculation recorded the maximum Benefit cost ratio than uninoculated control and 100% RDF alone applied plants (Indore – 2.47, Khandwa – 2.60, Parbhani – 2.11, Nandyal – 1.02, TNAU – 1.64). All the above said centers have recorded the 25% saving of N&P of RDF.

**Parbhani** : The data on different fibre quality parameters clearly indicated that different treatments brought about the changes in fibre quality. However, these changes could not attain the level of significance.

**Nandyal** : Application of PSB alone registered higher staple length (26.0 mm) followed by PPFM (24.8 mm). However, there was no much variation among the treatments. The values for uniformity ratio are ranging from a low of 44.9 to a high of 48.7 (PSB application). *Azospirillum* + PPFM recorded lower MIC value (3.12) and the higher MIC value was observed with control (4.21). Higher values for fibre strength was observed with PSB (22.2) while the lower value was observed with *Azospirillum* + PSB (17.6).

**CICR, Coimbatore** : None of the fiber quality parameters were influenced significantly due to chemical fertilizers and or bio inoculants

**TNAU, Coimbatore** : Bioinoculants application has brought numerical difference in the fibre quality parameters of different treatments. But the differences were not to the level of significance on all days of observation

#### **Implementable Technology :**

- ❖ The field experiments conducted at various centres indicated there could be possible reduction of 25% of recommended dose of N & P inorganic fertilizers by applying *Azospirillum* along with Phosphate solubilizing bacteria and PPFM.
- ❖ However, there was difference in the response of *Azospirillum* strains in various centres. At Indore, Khandwa and TNAU, *Azospirillum* TNAU strain performed better than other strains.

- ❖ Likewise at Parbhani, Hissar and Nadyal *Azospirillum* GAU strain was good and at CICR Coimbatore, the performance of *Azospirillum* HAU and TNAU was better.
- ❖ In all the centres except HAU, the performance of bioinoculants was significant at 75% N & P. In HAU, the bioinoculants performed well at 100N & P.