



**Title: Identification of Innovative Bt Cotton based Cropping Systems, improvement of water and nutrient use efficiency with precision farming techniques**

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|---------------------------------------|---|--|
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### INTRODUCTION

Bt cotton is gaining rapid acceptability among cotton growers. However, unlike conventional cotton, the shorter duration, changed morphoframe and boll setting points in Bt cotton may necessitate new and more acceptable intercropping systems for improved water use efficiency. This project was conceived to study the feasibility and economics of innovative inter and double cropping systems in Bt cotton.

### OBJECTIVES

1. To identify remunerative and sustainable Bt cotton based intercropping systems for rainfed conditions
2. To study the resource complementarity under Bt cotton-legume intercropping systems
3. To explore avenues for diversification of Bt cotton based cropping systems and evaluate their economic viability and practical feasibility

### ACTIVITIES

On station field experiments were conducted under two sub-projects

**Sub-project 1:** Studies on soil plant narrations in intercropped kharif legumes with Bt cotton under rainfed conditions

**Sub-project 2:** Intensification of cotton based cropping systems for maximizing the use of natural resources under

irrigated conditions

Locally relevant inter and double cropping systems were evaluated at each centre. The soil type, rainfall received and experimental details are summarized in (Table 1).

### SALIENT FINDINGS

Transplanted Bt cotton performed well by recording 4-7% more seed cotton yield than that of direct sown cotton as observed in north zone. Bt cotton under normal planting gave superior yield than that of paired row planting in all three zones. Intercropping by paired row planting of cotton with soybean, blackgram, radish, spinach and green gram in 1:1 ratio, cotton with redgram in 4:1/6: 2 ratio produced significantly superior seed cotton yield than sole cotton crop in both central and south zones. In north zone, no intercrop was found to be beneficial even under irrigated condition. Fodder jowar, fodder maize, wheat and sesamum for Gujarat, whereas groundnut, green gram, sunflower, okra for Maharashtra, wheat, okra, onion and cowpea for M.P. were found beneficial in black cotton soils of central zone. Bt cotton followed by wheat in north zone, Bt cotton followed by vegetable crops such as cucumber, ridge gourd, coriander, watermelon recorded higher production in soils of South zone.

Under irrigated conditions Bt cotton (RCH-134) gave the highest cotton equivalent yield under paired row system at Sirsa and normal row configuration at Faraidkot.



Based on the cotton equivalent yield, net returns and Benefit Cost Ratio the following intercropping systems were found to be promising.

The promising intercropping systems identified also improved the water use efficiency under rainfed conditions (Table:2)

**Table 1 : Soil type, rainfall (mm) and experimental details at each centre**

| Centre         | Soil type              | Rainfall (mm) | Rainfed/ Irrigated  | Sub project 1 (Intercrops)  | Sub-project 2 (sequential crop)  |
|----------------|------------------------|---------------|---------------------|---|--|
| Lam, Guntur    | Clay soils             | 1096          | Rainfed & Irrigated | Redgram (LRG 41)<br>Greengram (LGG 460)   | Cotton - Maize (Ruchi)<br>Cotton-greengram (LGG460)<br>Cotton - Sesamum (Gowri)<br>Cotton-Chillies (LCA - 960)<br>Cotton - Coriander (Swathi)<br>Cotton -Cucumber(Yellow Round)<br>Cotton -Watermelon( Sweety) + Fenugreek (LS1)   |
| UAS, Dharwar   | Medium deep black soil | 1084          | Rainfed             | Greengram<br>Soybean<br>Groundnut<br>Pegionpea<br>Beans<br>Coriander  | Cotton - Groundnut (K) -<br>Jowar (II year)<br>Cotton - Greengram (K) -<br>Jowar (II year)<br>Cotton - Maize (K) -<br>Jowar (II year)<br>Cotton - Soybean (K) -<br>Jowar (II year)<br>Cotton - Groundnut (K) -<br>Bengalgram<br>Cotton - Greengram (K) -<br>Bengalgram<br>Cotton - Maize (K) -<br>Bengalgram<br>Cotton - Soybean (K) -<br>Bengal gram<br>Cotton - Groundnut (K) -<br>Wheat<br>Cotton - Green gram (K) -<br>Wheat<br>Cotton - Maize (K) -<br>Wheat<br>Cotton - Soybean (K) -<br>Wheat |
| UAS, Siruguppa | Heavy deep black soil  | 898           | Irrigated           | ---   | Cotton - Tomato<br>Cotton - Maize<br>Cotton - Bajra<br>Cotton - Sunflower<br>Cotton - Sesamum<br>Cotton - Ridgegourd   |
| MAU, Nanded    | Medium deep            | -             | Rainfed & Irrigated | Pegionpea (BSMR 853)<br>Soybean (MAUS 71)<br>Mungbean (BM 4)<br>Greengram<br>Clusterbean (Jyothi)<br>Blackgram (T9) | Cotton - Groundnut<br>Cotton - Green gram<br>Cotton - Sunflower<br>Cotton - Maize<br>Cotton - Bajra<br>Cotton - Cluster Bean   |



|                   |                              |      |                        |  |   |
|-------------------|------------------------------|------|------------------------|--|---|
| MPKV,<br>Rahuri   | Medium<br>Deep<br>black soil | 729  | Rainfed &<br>Irrigated | Pigeon pea (Vipula)<br>Soybean (JS - 335)<br>Mungbean (Vaibhav)<br>Cowpea (VCM - 8)<br>Blackgram (TPU - 4)<br>Clusterbean<br>(Sadafully)   | Cotton - Wheat<br>Cotton - Okra<br>Cotton - Fodder Maize<br>Cotton - Sunflower<br>Cotton - Bengal gram  |
| Dr PDKV,<br>Akola | Medium<br>black              | 771  | Rainfed                | Pegion pea (Asha)<br>Soybean (TAMS 38)<br>Greengram (AKM<br>9911)<br>Clusterbean<br>(NIRMAL 67)<br>Blackgram (TAU)   |   |
| CICR,<br>Nagpur   | Medium<br>Deep               | 1057 | Rainfed                | Pegionpea (BSMR<br>763)<br>Soybean (JS 335)<br>Greengram<br>(Kopargaon)<br>Cowpea (Pusa<br>Dofasli) Clusterbean<br>(Local)<br>Blackgram (T 9)<br>Marygold (African<br>Tall)<br>Radish<br>Spinach (Local) |   |
| JNKW,<br>Indore   | Clay                         | 1043 | Rainfed &<br>Irrigated | Soybean (JS 9560)<br>Pegionpea (JKM 189)<br>Greengram (JM 721)<br>Clusterbean (Pusa<br>Navbahar)<br>Blackgram (JU 86)  | Cotton - Wheat<br>Cotton - Maize<br>Cotton - Cowpea<br>Cotton - Onion<br>Cotton - Greengram<br>Cotton - Okra  |
| JAU,<br>Junagarh  | Shallow -<br>medium<br>black | 1416 | Irrigated              | ---  | Cotton - Wheat<br>Cotton - Maize<br>Cotton - Jowar<br>Cotton - Groundnut<br>Cotton - Sesamum<br>Cotton - Okra<br>Cotton - Moongbean<br>Cotton - Onion                                     |
| CICR , Sirsa      | Sandy<br>loam                | 316  | Irrigated              | GroundNut (HNG 10)<br>Mungbean (SML<br>668)<br>Sesamum (RM 40)<br>Clusterbean (HG 365)   | Direct sown Cotton - Wheat<br>Transplanted Cotton - Wheat<br>Direct sown Cotton - Barley<br>Transplanted Cotton - Barley<br>Direct sown Cotton - Mustard<br>Transplanted Cotton - Mustard |
| PAU,<br>Faridkot  | Alluvial                     | 359  | Irrigated              | Gnut (M522)<br>Mungbean (SML668)<br>Sesamum (TC289)<br>Mash (Mash338)  | Wheat<br>Barley<br>Mustard  |





**Table 2: The most promising intercropping system identified at various centers**

| Centre          | Promising intercropping system                      |
|-----------------|---|
| Lam, Guntur     | Cotton + green gram (1:1)                           |
| UAS, Dharwar    | Cotton + coriander (paired row)                     |
| MAU, Nanded     | Cotton + soybean (1:1) or Cotton + green gram (1:3) |
| MPKV, Rahuri    | Cotton + green gram (1:1)                           |
| Dr. PDKV, Akola | Cotton + green gram (1:1)                           |
| CICR, Nagpur    | Cotton + radish (1:1)                               |
| JNKW, Indore    | Cotton + soybean (1:2)                              |



**Cotton- Marigold**



**Cotton- Soybean**



**Cotton- Pigeonpea**



**Cotton- Cowpea**

