
## TMC MM I 2.3: Mechanization of cotton production

### INTRODUCTION

tThe project on Mechanization of Cotton Production under TMC MM-I was undertaken to save the cost of different operations which results in reducing the cost of cultivation. Timely operation with reducing drudgery to human labour can be achieved through the use of improved implements. The project was undertaken to enable cotton farmers to save labour cost, reduce input use with better efficiency have timely operation such as sowing, spraying and picking as well as reduce the drudgery of human labour. The project is operated in network mode at TNAU, Coimbatore,PAU, Ludhiana, PDKV,Akola, UAS, Raichurand GTC, CIRCOT,, Nagpur

### OBJECTIVES

+ Design, development and evaluation of implements for cotton production, meeting the gaps in machanisation
+ Evaluation of mechanical cotton picking on new cotton genotypes
+ Standardization of defoliation process as an aid to mechanical picking
+ Development and evaluation of cleaning machinery for mechanically picked seed cotton

### SALIENT FINDINGS

**Development of twin row organic mulch cum fertilizer applicator**

Subsoil mulching with coir pith is a new concept.. Deep loosening of soil and placement of coir pith in the subsoil layers as mulch directly below the crop rows would improve the root zone, which would not re-compact during subsequent years. A Prototype subsoil coir pith applicator was developed and investigations were done to demonstrate the effect of sub soil mulching on yield of cotton crop. Since the operation of sub soil mulching has to be optimized for different materials, application rate and depth of application, the detailed investigation was laid out with an experimental mulching machine that accurately controls the depth and quantity of mulch. Net profit increased by 29 percent in com posted coirpith mulching.

It was found that the the root length in the com posted coir pith, raw coir pith and sub soiled treatment plots was respectively 32.4, 29.0 and 43.2 per cent higher over control.. Composted coir pith mulch registered 8.3 per cent higher root spread than raw coir pith mulch. The deep loosening and placement of mulch at the subsoil layer just below the plant rows resulted in reduction of soil strength which helped the plant roots to penetrate deep into this layer and proliferate in vertical subsoil trenches. The re-compaction of subsoil trenches was prevented due to the presence of raw and com posted coir pith mulch. Among the mulch materials used, com posted coir pith mulch increased the available N, P and K of soil by 114.0, 32.0 and 109.6 when compared to raw coir pith mulch. The raw and com posted coir pith mulched plots recorded 35.7 and 37.5 per cent increase in yield respectively confirming the persistence effect of mulching on second crop yield during the subsequent year also. The application of 20 t ha'1 coir pith at 350 to 450 mm depth in subsoil zone resulted in additional profit of 28.5 per cent when compared to un-mulched treatment.. It is expected that similar gains can be obtained in the subsequent two to three years without incurring any cost for mulching.

**Development and evaluation of tractor drawn ridge planter**

A prototype for accomplishing the task of planting on the ridges as followed in certain parts of southern cotton growing zone, has been developed (Fig.2.3.2). The planting mechanism consists of a seed hopper with two

compartments: one for seed storage and another for seed metering. The seed metering is cup feed type as it was found effective for various types of seeds. The cup feed mechanism also has the advantage of minimum seed damage compared to other common types of seed metering devices. The soil thrown by wings of the ridgers, formed the ridges and provisions were made to place the seeds while the formation of ridges itself and hence the need for separate furrow openers and furrow closers were eliminated. Amild steel tube fixed on one side of the ridger bottom was used for placement of seeds. No separate device was provided for covering the dropped seeds, as the soil thrown by the wings of the ridgers itself covered the dropped seed. Preliminary trials with the prototype ridger indicated that the field capacity and field efficiency of tractor drawn ridge planter was 0.55 ha/hr and 68 per cent, respectively. The cost of operation of tractor drawn ridge planter was Rs. 656 per hectare.

Development Evaluation of Single row manually operated self propelled weeder

A self propelled machine used for weeding and tillage operation in orchards and in wider row crops like cotton has been developed (Fig.2.3.1). It consisted of a 4.8 hp light- weight diesel engine mounted on the power tiller chassis, power transmission system, two M.S. wheels, a frame and rotary blades. The power from the engine has been transmitted with the help of belt & chains to the rotary blades & ground wheels through a gear train. The width of the rotary shaft is 45 cm. The rotary shaft has four flanges. On each flange four blades of L-type hinged. A power cut *off* device has been provided to engage or disengage the power supply to rotary system.

It was found that The field capacity of self propelled rotary weeder was 0.07-0.09 ha/h and of tractor operated weeders was 0.25 -0.33 ha/h respectively. Injury to plant was less than 1 % in self propelled weeders but in tractor operated weeders it was 1-4 percent.. Re-emergence of weeds was less in case of rotary weeders as compared to sweep weeder. Saving of labour requirement was about 64to 67 %.

Fig. 2.3.1 : Stationary view of single row manually operated self propelled weeder

Development and evaluation of self propelled weeder cum sprayer

A self propelled weeder cum sprayer will carry out intercultivation and spraying at a time. More area can be covered in a day using only one or two operators, (Fig2.3.2).The weeding efficiency of self propelled weeder cum sprayer was found to be 60-70 %, with a field capacity of 0.20 ha/hr and field efficiency of 83-88 %.

Fig. 2.3.4: view of self propelled weeder cum sprayer

Desigr. and Fabrication of prototype of fertilizer applicator as Blade Harrow (bakhar) attachment

A prototype of Fertilizer applicator for Blade Harrow as an attachment is being developed with a view to save time and labour by combining two operations in one pass especially for the rainfed cotton farmers using bullock power (Fig.2.3.3). Rate of application of the fertiliser was found to vary from 70 to 140 kg/ha. Data was collected under laboratory conditions to assess the rate of devlivery of the fertiliser and the variation of delivery rates of both the tubes. The results revealed that the distribution of fertilizer in the two tynes does not vary significantly when the distribution lever is in the maximum position, discharging an average of 140 kg/ha of fertilizer. However, the distribution is not uniform at minimum and central positions of the lever. Therefore, modification needs to be done in the distributor assembly so that distribution from two tubes is uniform over all the positions of the lever ..

Fig. 2.3.3: Fertiliser applicator attachment with Bakhar

Evaluation of different sprayers for cotton crop

Evaluation of Knapsack, Power Knapsack, Self - Propelled, Aeroblast (15 m), and Air assisted (2.5 km/h) sprayers for their effectiveness in spraying of cotton

crops was done. It was found that the uniformity coefficient was least for the air assisted sprayer which means that air assisted sprayer gives the most uniform droplet size among the sprayers under study.

Air assisted sprayer gave uniform droplet size among the sprayers under study..Under side of the leaves of any position on plant received effective number of drops when air-assistance was provided with the sprayer, but without air-assistance under side of leaves remained almost unsprayed

Evaluation of Solar powered knapsack sprayer

In order to overcome the disadvantages of a knapsack sprayerviz., variations in pressure leading to non uniform generation of spray droplet sizes and hence ineffective sprayings and wastage of pesticide, and disadvantages of a battery operated sprayer due to long hours of load shedding in rural areas and inability of charging of battery, a novel Solar Operated Knapsack Sprayer has been developed, tested and modified. It has a field capacity of 4 hrs/ha. The weight of the sprayer without pesticide is 9 kg, with a swath of 90cm giving 10 sprays with a single charge. (Photo enclosed). The sprayer was evaluated for the sustenance of pressure under solar spraying cum charging against the normal battery operated operation. The AN OVA results indicate that the solar operated sprayer sustained a pressure of 20+1 0% psi for a significantly longer time (44%) over the battery operated sprayer, thus generating uniform droplet size spectrum over a longer period of time.

Cotton stalk management

The implements available and being used in other crops were evaluated for their suitability in cotton stalk management..

Fig. 2.3.4: A stationary view of tractor operated paddy straw chopper

Fig. 2.3.5 : A view of Flail type chopper cum loader for paddy straw cutting and loading

Locally available machines like paddy straw chopper, tractor operated rotavator and flail type chopper cum loader were found to have application in effective management of cotton stocks .. Approx. 70 to 80 % cotton stalks were shredded in size range of up to 20 cm for all three cotton varieties by paddy straw chopper. Field capacity of paddy straw chopper for cotton stalk shredding varied from 0.22 to 0.36 hath and fuel consumption varied from 6.6 to 7.66 l/h. Mixing of standing cotton residue in soil with rotavator was not very effective however mixing of shredded cotton stalks with rotavator yielded good results as approx. 83 % of both the varieties viz. RCH 134 and IT 905 were mixed in the soil.. .Approx. 70 % cotton stalks were shredded in size range of up to 20 cm for all three cotton varieties with Flail type chopper cum loader. Field capacity of flail type chopper cum loader varied from 0.25 to 0.35 hath.

## SPECIFIC TECHNOLOGIES/RECOMMENDATIONS

Following implements developed under the project TMC MM2.5 and 2.3 have been filed for patents with provisional application

- Bullock drawn vertical rotor planter for vertisols (Prov. Pat. No.1559/MUM/2009)
- Cotton Seed Blower (Prov. Pat. No. 1560/ MUM /2009)
- Solar powered knapsack sprayer (Prov. Pat. No. 1561/MUM/2009)