

## Sustainable Mechanical Solution (Cotton Stalk Shredder Cum Uprooter) to Control Pink Bollworm

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**ABSTRACT:** Cotton is one of the most important economic crop in India. About 124.4 Mha was cultivated in 2018–2019, with total production of 370 lakhs bales. The pink bollworm is one of the most vicious pests of the cotton crop. Physical, chemical and biological techniques can be used to control it. This bollworm cotton worst enemy, by which yield and quality of cotton fiber will be affect. The chemical application does not kill the bollworm pest due to hidden in cotton bolls. Hence the chemical treatment does not control the bollworm effectively. Challenging task to control the pink bollworm in cotton field, *i.e.*, sustainable mechanical solution was considered for the study. Cotton stalk shredder cum uprooter will shred the cotton stalk/ boll into tiny pieces by which oviposition site of bollworm destroyed and uprooter will uproot the cotton stubbles which are erected. 80 % of green boll are destroyed by the cotton stalk shredder and 76 % of larvae were killed. Cotton stalk shredder is very effective in decreasing the larval population present in the field after harvesting. It's found has best sustainable solution for controlling pink boll worm.

**Keywords:** Cotton stalk shredder, pink bollworm, and uprooter.

### INTRODUCTION

In India, cotton is the most significant cash crop. A total of 370 lakhs bales were produced in 2018–2019 on an area of cultivation of approximately 124.4 million hectares (Anon., 2020). Due to rising pest and insect invasions, greater input prices, and the crop's nonprofitability, less land was previously set aside for the cultivation of cotton. A significant danger to the sustainable production of cotton is the bollworm. Because it can easily complete its life cycle in one year, its consequences become more severe every year. Therefore, it is vital to demolish the pink bollworm dwelling facilities during the off-season. Cotton stalk are harvested manually from field and transferred to storage location during the final stages of harvesting of cotton crops. The life cycle of hidden bollworm will get completes and start reproduces inside the bolls during storage, which allows it to spread to the following crop. Egg, larva, pupa and adult are the four life cycle stages of bollworm. The amount of time between eggs varies depending on temperature and other factors, but in average, during the summer, it takes about one month. After hatching, larvae start to make hole into squares or bolls right away. They tunnel into cotton bolls to consume the cotton seeds while obliterating the cotton lint in the process. About 38 mm in length, the adult pink bollworm is a spotted, brown to grey moth. Males

and females of bollworms emerge from pupae at a ratio of about 1:1. After emerging for two to three days, the female mates and is ready to lay eggs. The life cycle of boll worm continues in this manner. There are normally five to six generations throughout season of a cotton-growing since the bollworm develops from an egg to an adult in 25-35 days (Ahmad *et al.*, 2020).

Dried cotton plants are commonly utilised as fuel for household daily routine activities like cooking and heating because energy resources are insufficiently accessible to the rural people. This activity also contributes to environmental problems such CO<sub>2</sub> and NO<sub>x</sub> emissions (Guoliang *et al.*, 2008).

Present situation, some forward-thinking farmers are removing cotton stalk after harvesting using either rotavator or disc ploughs. According to a report, only 50% of cotton stalks were removed from field by rotavators, which has an adverse effect on how the seed bed is prepared for the following crop (Karale *et al.*, 2014). The biggest problem with using a rotavator to cotton bolls don't get shredded properly. The rotavator's consumption higher fuel contributes to its high operating costs per acre as well.

Now, available techniques and equipment used to take cotton stalks out of the ground don't meet standards and don't help prevent pink bollworm. As a result, there isn't a machine that can draw, chop, shred cotton plant and uproot the stubble. A cotton stalk shredder cum

uprooter was modified and developed in UAS Raichur, India, to address the need for cotton plant/stalk removal in the field's cleaning for the following crop. When it came time to harvest the cotton crop, the major purpose of this machine was to cut the cotton stalk and shred it and uproot the stubble in the field.

The main aim of this study is check whether cotton stalk shredder cum uprooter for best solution for pink bollworm.

**MATERIALS AND METHODS**

In order reduce pink bollworm larval populations remained in contaminated fields after harvest, field tests were carried out at the university of agricultural science, Raichur in 2020. Study was carried out close to agricultural fields. The majority of the crop residue was made up of damaged and unopened green bolls that were left on the field after the crop was manually picked. Stalks ranged in height from 0.9 to 1.2 m. Plots were 12.5 m long and two rows broad. Tests on a cotton stalk shredder cum uprooter. The speed of the cotton stalk shredder cum uprooter is 4 km/h operated by 45 hp tractor.

**Green boll before and after shredding.** For recording the observation on green boll, all green bolls randomly selected from five plants from each net plot were assessed at the end of third pickings for pink bollworm damage. Accordingly, the per cent green boll before and after shredding worked out (Fig. 1).



**Fig. 1.** Before and after shredding by cotton stalk shredder.

**Larval count before shredding.** For recording the observation on larvae count, 25 unopened green bolls randomly selected from each net plot were assessed at the end of third pickings for pink bollworm damage. Accordingly, larvae count at before were worked out.

**Larval count after shredding.** For recording the observation on larvae count. The entire seed cotton and boll residue was gathered from the stalk and dug out from the ground over a 0.25 acre area in the check plots. Rectangular frame was used to collect the sample. All seed cotton and boll material contained within the frame, which was randomly positioned in two plot in five different location, was collected. Following shredding, samples were gathered from the two plots, containing both the shredded material and any waste cotton that had previously been lying on the ground. The 201 measuring tubes were filled with the harvested crop material. The tops of the containers had screened apertures to allow ventilation. The tubes were kept in a room with a constant temperature of 27±5 C°. Records were kept every day until the moths stopped emerging.

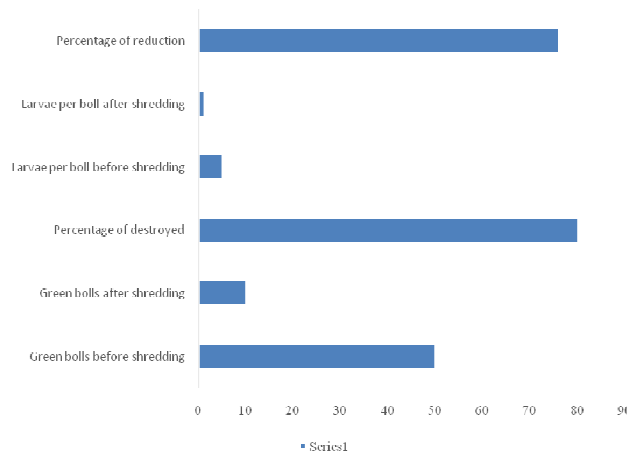
**RESULTS AND DISCUSSION**

Results are presented in Table 1. The cotton stalk shredder cum uprooter more efficient in destroying green bolls. This machine destroyed 76% of the green bolls.

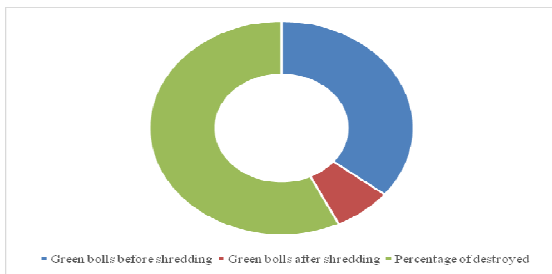
**Green boll before and after shredding.** Green boll initially was 50. After shredding operation the green boll count was reduced by 10 (Fig. 3 and 4). Percentage of destroying of green boll by cotton stalk shredder was 80 %.

**Table 1: Efficiency of cotton stalk shredder cum uprooter for destroying green bolls and for reducing pink bollworm larval populations in green bolls.**

Variables	Cotton stalk shredder cum uprooter
Green bolls before shredding	50
Green bolls after shredding	10
Percentage of destroyed	80
Larvae per boll before shredding	5
Larvae per boll after shredding	1.2
Percentage of reduction	76



**Fig. 2.** Percentage of reduction and destroyed pink bollworm.

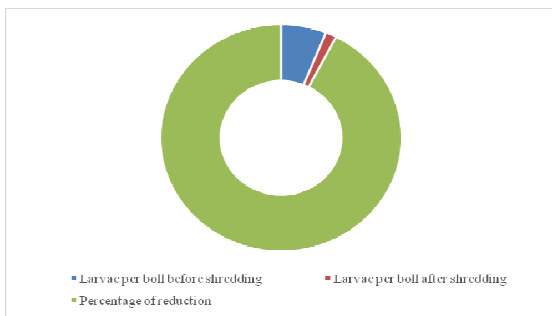


**Fig. 3.** Green boll before and after shredding.



**Fig. 4.** Destroying of green boll by cotton stalk shredder cum uprooter larval count before and after shredding.

The average pink bollworm infestation before shredding was 5 larvae per boll. Results indicated that the cotton stalk shredder cum uprooter was more effective in reduction the pink bollworm population in the apparently unharmed or slightly damaged green bolls. These results are presented in table 1. If it can be assumed that all the pink bollworms were killed in the 80 % of green bolls destroyed by the cotton stalk shredder and 76 % of larvae were killed would indicate that the machine was very effective in decreasing the total over wintering larval population found in green bolls left in the field after harvest. Same result was reported by Adkisson *et al.* (1960).



**Fig. 5.** Larval count before and after shredding.

## CONCLUSIONS

Cotton stalk shredder cum uprooter is used by the farmer for shredding and uprooting the cotton stalk and stubble left after in the field. Pink bollworm is major threat pest in left in the field after harvesting operation. This egg and larvae present in the unopened green boll will grown and causes effect to next season cotton crop. Cotton stalk shredder cum uprooter will shred the green boll and stalk in small pieces. 80 % of green boll are destroyed by the cotton stalk shredder and 76 % of larvae were killed. Cotton stalk shredder is very effective in decreasing the larval population present in the field after harvesting. It's found has best sustainable solution for controlling pink boll worm.

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**Conflict of Interest.** None.

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