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DESIGN AND DEVELOPMENT OF SELF PROPELLED WALK BEHIND FINGER TYPE COTTON STRIPPER

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***Abstract*:** In India, cotton is still picked manually by ladies pickers. Shortage of labor availability for cotton picking on farms results delayed picking of cotton crop and loss in term of cotton production. Commercially available cotton harvesters were tried for Indian varieties, but there were some issues regarding the cotton harvesting. Knowing the conditions of Indian farms, a conceptual design of self-propelled finger type cotton stripper is generated to pick/harvest the local high density and dwarf cotton varieties mechanically. In this self propelled finger type cotton stripper, the stripping fingers of 70 cm length were welded to the front part of engine frame at an angle of 21º. The width of the developed head was 64 cm. A rotating paddle/kicker, having a speed in the range of 120-250 min^{-1}, was designed to push the stripped materials (cotton bolls i.e. opened and closed along with sticks and burs) in to the collecting tank. A collecting drum/tank, having capacity 15-20 kg, was attached just behind the cotton stripper head for collecting stripped cotton materials. The developed prototype was evaluated on F-2383 and RCH-773 cotton varieties to observe its performance. The average value picking efficiency and picking capacity of developed cotton stripper was observed to be in the range of 76-80% and 135-325 $kg \cdot hr^{-1}$, respectively. The observed value of seed-cotton was observed in the range of 74-80% by using boll crusher/seed-cotton extractor, operational at Bathinda in Punjab.

***Key words**: cotton crop, cotton stripper, crop attributes, machine performance attributes, boll crusher, seed-cotton output*

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INTRODUCTION

Cotton, the most important fibre crop playing a key role in economic and social affairs of the world, continues to be acclaimed as 'King Fibre'. India is currently first in area, second in yarn production and third in raw cotton production in the world [2]. The cost of cotton production especially cost on labour during harvesting is excessively high, reducing the profit margin available to the farmer. Among all cotton crop production operations, cotton picking/harvesting is most difficult, tiresome and hard manual job. In advanced countries like USA, Brazil, Australia, cotton pickers and strippers are available for mechanical picking of cotton. Cotton pickers with different mechanisms such as Drum type spindle and Chain belt type spindle likewise cotton stripper with different mechanisms like finger type and brush type are available and working successfully in advanced countries.

Despite of these mechanical cotton harvesters available worldwide, the cotton picking is still done manually in most of the countries including India. The main reasons of not using these mechanical harvesters in India are their high cost, difficulty in operation due to small/marginal farms and indiscriminate type cotton varieties grown in India. In recent years it has been observed that labor shortage appear during the harvesting time of cotton results delayed picking and subsequent sowing of next crop. Knowing the conditions of Indian Farms and to overcome this situation of manual picking, efforts were made by different Institutions and Universities for the development of different types of cotton picker. Punjab Agricultural University (*PAU*), Ludhiana reported the development of pneumatic picker by using an industrial type vacuum cleaner for picking cotton in the field. Same type of study was done by *TNAU*, Coimbatore [3]. A tractor mounted vacuum type cotton picker was developed and evaluated by *PAU*, Ludhiana [1]. The picking efficiency of the developed picker was in the range of 70-75 percent, but the output of these machines was very low. Portable handheld type cotton picking machines were evaluated for different cotton varieties and found that there was no significant difference in the picking rate among chain, roller and manual picking at 5 percent level of significance. The average picking rate of both chain type and roller type cotton picking machines was measured to be 3.44 and 3.09 $kg \cdot hr^{-1}$, respectively for selected cotton varieties which was lesser as compared to manual picking rate i.e. 6.63 $kg \cdot hr^{-1}$. The percentage of trash content for both chain and roller type cotton pickers was also higher i.e. 11.52 and 10.44 percent as compared to trash content of 7.43 percent measured for cotton picked manually [6].

The idea of development of indigenous cotton stripper was conceptualised from the study, in which a Multiple Attributes Decision Making (*MADM*) technique was applied for selection and development of the mechanical cotton harvester, suitable for the local cotton varieties and agronomic practices [4]. It was observed that if relative ranking was given to the pertinent attributes then the best mechanical cotton harvesters for existing planting system prevalent in India and high density planting system was brush and finger type cotton strippers, respectively. But, the big challenge in development of cotton stripper was crop geometry, agronomic practices for cultivation of crop and seed-cotton extraction from the cotton bolls harvested with boll shells and cleaning prior to ginning. To view these earlier made efforts, a self propelled walk behind type cotton stripper was developed due to its low cost and easy operation as compared to other mechanical cotton picking machine. Because, the developed modal required dwarf cotton varieties and

special planting system i.e. High Density Planting System (*HDPS*) for its field operation. Hence, the selected dwarf cotton varieties were cultivated with modified agronomic practices to obtain the short plant height and high plant population required for cotton stripper. To extract the seed-cotton from the stripped/harvested material, a boll crusher cum cotton extractor, presently operational at Bathinda, Punjab was considered due to its higher efficiency and capacity.

MATERIAL AND METHODS

A brief description of design and development of indigenous cotton stripper and other related processes are given under this section.

Design and development of self propelled walk behind finger type cotton stripper. A conceptual design of finger type cotton stripper was generated by keeping in view the local cotton varieties grown in small/marginal farm. Machine should be of simple design, lower capital cost, lower repairing and maintenance cost and lesser moving components. The physical prototype of finger type cotton stripper was designed to pick/harvest the local high density and dwarf cotton varieties mechanically. The idea of physical development of self propelled cotton stripper was derived from the study conducted by Tupper G R in 1966 [7]. An experimental cotton stripper was designed and built by the Arkansas Agricultural Experiment Station for harvesting either broadcast or narrow row cotton. Burr cotton was stripped from the plant with a series of stationery teeth approximately 66 cm in length and spaced approximately 1.6 cm between teeth. In operating position, the stripper teeth were inclined approximately 15 degrees in respect to the ground, with the angle of inclination being changeable with hydraulic controls.

A self propelled walk behind finger type cotton stripper was developed by mounting the designed cotton stripper header on the self propelled power tiller having an engine of 3.6 kW. Cotton stripper header was developed by selecting the suitable specifications of stripping fingers, kicker/paddle, belt-pulley arrangement and material collecting tank. In this self propelled finger type cotton stripper, the stripping fingers of 70 cm length were welded to the front part of engine frame at an angle of 21°. The width of the developed header was 64 cm. A rotating paddle/kicker, having a speed in the range of 120 - 250 min^{-1}, was designed to push the stripped materials (cotton bolls i.e. opened and closed along with sticks and burs) in to the collecting tank. A collecting drum/tank, having capacity 15-20 kg, was attached behind the cotton stripper header for collecting stripped cotton materials. Fig. 1 shows the line diagrams of top and side views of cotton stripper and Table 1 shows the brief specifications of developed prototype of self propelled cotton stripper.

The designed cotton stripper works on the principle that when the cotton stripper will move through the cotton field due to its forward motion, inclined fingers will strip the cotton bolls with burs including green bolls, sticks and leaves from the plants and rest of the plant will remain in its position in the field. Cotton bolls with shells/burs will be stripped from the plants with the help of a series of stationery inclined fingers having a narrow gap among the fingers. The stripped materials will be moved upward to the inclined fingers with the force of next group of plants being stripped. A kicker/paddle mounted at the rear-side of the fingers will help to convey the stripped materials to the

collecting tank. Fig. 2 shows the operational view of self propelled cotton stripper in the field before and after the harvesting.

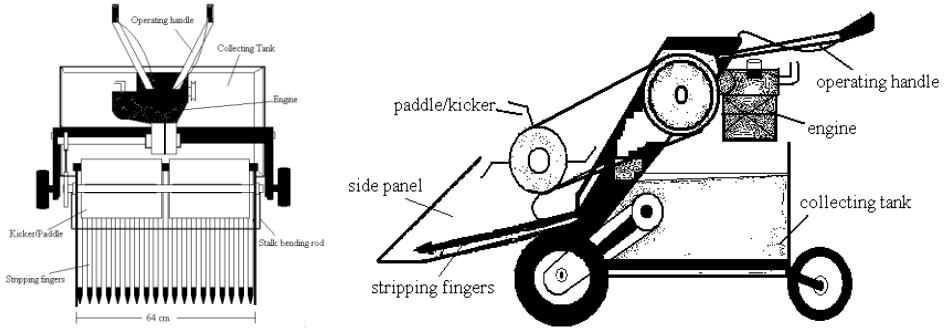

Figure 1. Top and side view of self propelled finger type cotton stripper

Table 1. Technical specifications of stripper

No	*Attribute*	*Range*
1	*Engine power (kW)*	*3.6*
2	*Forward speed range (km·hr^{-1})*	*2.0 - 4.5*
3	*Engine speed (min^{-1})*	*1500*
4	*Width of stripper head (cm)*	*65*
5	*Number of stripping fingers*	*19*
6	*Length of stripping fingers (cm)*	*70*
7	*Thickness of stripping fingers (cm)*	*1.8*
8	*Gap between two fingers (cm)*	*1.5*
9	*Slope angle (with horizontal) of stripper head*	*21^0*
10	*Paddle/kicker speed (min^{-1})*	*120-250*
11	*Capacity of collecting tank (kg)*	*15-20*

Figure 2. Operational view of cotton stripper in the field before and after harvesting of crop

Boll crusher cum seed-cotton extractor. The harvested material having leaves, sticks, and cotton with outer shells (bur) need to be removed and separated to obtain

seed-cotton. To remove the outer shells from cotton bolls, a boll crusher/seed-cotton extractor (Millennium Model), developed by a local manufacturer and operational at Bathinda, Punjab, was used. Fig. 3 shows the self explanatory line diagram of boll crusher currently available in Punjab. The stripped material was fed manually to the boll crusher with the help of air suction unit. The air suction blower created suction to convey the feeding material to serrated drum/cylinder. The working principle of boll crusher cum seed-cotton extractor is when cotton bolls come into the contact with cylinder (drum) and concave assembly than the cotton burs are removed with the rubbing action between the cylinder and concave and cotton fibre sticks to the drum of having the serrated surface. The seed-cotton wrapped on the drum was removed with the help of brush roller rotating in the opposite direction to the serrated drum with the speed of 1440 min^{-1}. The seed-cotton separated from the shells and other foreign material was collected from the rear side of the machine known as seed-cotton outlet. The foreign material includes burs/shells, leaves, sticks, dust particles etc. was removed with the help of screw conveyor called trash outlet. Fig. 3 and Tab. 2 show the line diagram and operational view of boll crusher/seed-cotton extractor and its technical specifications.

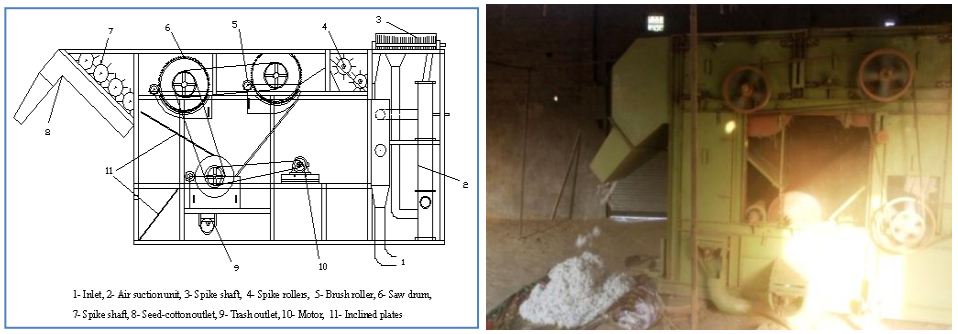

Figure 3. Line diagram and operational view of boll crusher/seed cotton extractor

Table 2. Technical specifications of boll crusher/seed-cotton extractor

S. No.	*Attributes*		*Observations*
1	*Total power requirement for boll crusher*		*11.2 kW*
2	*Blower power*		*3.7 kW*
3	*Blower (min^{-1})*		*1440*
4	*Drum type*		*Serrated (saw) drum*
5	*Speed of rotating drums (min^{-1})*	*Drum 1*	*360*
		Drum 2	*360*
		Drum 3	*160*
6	*Speed of small/brush roller (min^{-1})*		*1440*
7	*Speed of rotating spikes (min^{-1})*		*600*

The power requirement for the operation of boll crusher is 11.2 kW. Two electrical motors of 3.7 kW each and an air-suction blower operated with 3.7 kW motor are used for the boll crusher operations. The saw drums (large drums) operated with installed motors rotates with 360 min^{-1} (upper drums) and 160 min^{-1} (lower drum) respectively.

The parameters like lint turnout and trash content can be calculated during the cotton extracting operation.

Agronomic practices. Special crop geometry and suitable agronomic practices are required for growing the cotton varieties so that the developed cotton stripper could be performed well in the field experiments. The field experiments for evaluation of cotton stripper were conducted at Research Farms of Punjab Agricultural University (*PAU*), Ludhiana and Regional Research Station (*RRS*), Bathinda. Cotton varieties i.e. F-2383 and RCH-773 were identified for experiments due to its suitable characteristics like short height, less canopy and less vegetation. The crop was sown by adopting a new planting system i.e. High Density Planting System (*HDPS*) at 45x30 and 67.5x30 cm spacing instead of 67.5x60.0 cm recommended by the university for selected cotton varieties. The crop was harvested about 188-198 days after sowing. Figure 4 shows the standing view of F-2383 and RCH-773 cotton varieties in the field.

Figure 4. Crop view of F-2383 and RCH-773 cotton varieties

Defoliants are chemicals or methods of treatment that cause only the leaves of a plant to abscise, or fall off. Defoliants are applied to cotton to improve and facilitate mechanical harvest [6]. Defoliant was sprayed before 20 days of harvesting to improve the harvesting efficiency of cotton harvester. It helps to shed the leaves of plants and to make the green bolls mature early so that the harvesting operation could be made easy and effective. In present experiment, 2-*Chloroethyl-phosphonic acid* (Ethrel) defoliant was used to fall off the leaves of cotton plant to improve and facilitate mechanical harvest. The defoliant was sprayed with the help of knapsack sprayer and self propelled electrostatic sprayer.

Measurement of trash content in seed-cotton. Cotton stripper strips the cotton crop which includes opened/closed bolls, leaves, sticks and other trash contents. Materials like burs, sticks were removed with the help of boll crusher cum seed-cotton extractor during the cotton extracting operation. To remove the trash entangled with seed-cotton extracted from the boll crusher, a commercially available Texaco trash analyzer Make (Texaco Engineering, Model: Texaco) was used. Trash like entangled leaves with cotton, dust particles mixed with cotton fibre were removed with the help of trash analyzer. Trash analyzer consists of the serrated drum, air-vacuum pump, heavy trash chamber,

lint collector, macro and micro dust plates. For measuring the trash content in the seed-cotton, the lint was separated from the seed. Then the weighted (known) sample was fed into the trash analyzer having articulated feeding claws and the weight of lint turnout and trash content were measured separately to obtain the percentage of trash content from the sample during the machine operation.

RESULTS AND DISCUSSION

Crop geometry and characteristics. Tab. 3 shows the cotton crop characteristics for F-2383 and RCH-773 cotton varieties, sown at different plant spacing and its statistical analysis using Completely Randomised Design (*CRD*). Plant height of variety F-2383 sown at closer row to row spacing of 45 cm was significantly shorter than plant height at row to row spacing of 67.5 cm at same location. Plant height of F-2383 sown at Bathinda was significantly shorter as compared to plant height of same variety sown at Ludhiana with same plant spacing. The change in plant height was due to soil and climatic difference at different locations. Plant height of RCH-773 was significantly longer i.e. 92 cm than the height of F-2383 i.e. 83 cm sown at same location. The plant width (canopy) across row of F-2383 was significantly lesser i.e. 56.6 cm sown at row to row spacing of 45 cm than the plant canopy of same variety i.e. 68.4 cm sown at 67.5 row to row spacing. Plant canopy for variety F-2383 sown at Ludhiana was significantly higher i.e. 68.4 as compared to plant canopy i.e. 54.2 cm of same variety, but sown at different location. Similarly, the plant canopy of RCH-773 was significantly more i.e. 70.2 cm as compared to plant canopy i.e. 54.2 cm of F-2383 sown at same spacing.

Table 3. Crop characteristics data

S.N.	*Attribute*	*Average values of observed data*				*CD*
1	*Field location*	*PAU, Ludhiana*		*RRS, Bathinda*		*(5%)*
2	*Cotton variety*	*F-2383*	*F-2383*	*F-2383*	*RCH-773*	-
3	*Plant spacing (cm)*	*45x30*	*67.5x30*	*67.5x30*	*67.5x30*	-
4	*Plant height (cm)*	75.6^{a}	91.8^{b}	83.0^{c}	92.0^{b}	*6.00*
5	*Plant canopy across row (cm)*	56.6^{a}	68.4^{b}	54.2^{a}	70.2^{b}	*4.30*
6	*Height of lower boll (cm)*	28.2^{a}	27.6^{a}	19.2^{b}	23.4^{c}	*3.82*
7	*Height of upper boll (cm)*	68.6^{a}	68.0^{a}	77.0^{b}	83.0^{c}	*4.70*
8	*No. of opened bolls*	22.0^{a}	21.0^{a}	27.0^{b}	30.0^{c}	*2.50*
9	*No. of green/unopened bolls*	3.0^{*}	3.0^{*}	2.0^{*}	2.0^{*}	*NS*
10	*Crop yield ($kg \cdot ha^{-1}$)*	595.0^{a}	690.0^{b}	715.0^{c}	1395.0^{d}	*16.00*

From Tab. 3, it was found that the height of lower and upper boll of F-2383 sown at same location but at different spacing showed no significant difference with each other. The height of lower boll was significantly more for RCH-773 than F-2383 sown at same location. Similarly, the height of upper boll of variety RCH-773 was significantly more than F-2383 sown at same spacing and same location. The change in height of upper and lower boll of RCH-773 was due to overall height of plants. Number of opened bolls was significantly more i.e. 30 for RCH-773 as compared to F-2383, having 27 opened bolls at the same location for same plant spacing. The number of opened bolls for F-2383 at same location but at different spacing was not significantly different with each other.

There was no significant different for the green/unopened bolls for both the varieties. Crop yield of variety F-2383 sown at 67.5x30 was significantly more than crop yield of same variety sown at 45x30 cm spacing at same location. Crop yield of RCH-773 was significantly higher i.e. 1395 kg·ha^{-1} as compared to crop yield i.e. 715 kg·ha^{-1} of F-2383 sown at same spacing and same location. The difference in yield may be due to big size results in more weight of cotton bolls.

Field performance of self-propelled cotton stripper. Tab. 4 show field performance data of the developed cotton stripper. The picking efficiency of cotton stripper was observed to be non significant for F-2383, sown at different spacing at PAU Farm. The picking efficiency for RCH-773 was observed to be non significant with F-2383, sown at same location. The average value of picking efficiency was observed to be 78.45 percent. The observed values of stalk and ground losses for F-2383 were not significantly different with each other. There was no significant difference in ground losses between RCH-773 and F-2383 sown at same spacing and same location. The average value of losses was observed to be 21.55 percent. The main reason behind the stalk loss was the height of the cotton bolls attached to the lower part of the plants at the average height of less than 25 cm which did not come in to the contact of the stripping fingers which were mounted at the front part of engine with ground clearance more than 25 cm. The reason of the ground loss may be due to vibration of the engine and positioning of the collecting tank. Fig. 5 shows the graphical representation of the stalk and ground losses observed during the performance of the cotton stripper. In the conducted experiments for picking capacity of cotton stripper, the observed value of picking capacity for F-2383 was significantly lower i.e. 135.3 kg·h^{-1}, as compared to picking capacity i.e. 157.8 kg·h^{-1}, for same variety, sown at 67.5 and 45 cm row spacing. Picking capacity for RCH-773 was found to be significantly higher i.e. 325 kg·h^{-1} as compared to capacity i.e. 156.3 for F-2383 sown at same spacing and same location. There was no significant difference among the values of field capacity for both varieties with an average value of 0.118 ha·h^{-1}.

Table 4. Field evaluation of self propelled walk behind type cotton stripper

S.N.	*Attribute*	*Observations and performance data of cotton stripper*				*CD (5%)*
1	*Field location*	*PAU, Ludhiana*		*RRS, Bathinda*		
2	*Cotton variety*	*F-2383*	*F-2383*	*F-2383*	*RCH-773*	-
3	*Plant spacing (cm)*	*45x30*	*67.5x30*	*67.5x30*	*67.5x30*	-
4	*Material harvested (kg·ha^{-1})*	*1140.0*	*1318.5*	*1366.6*	*2750.0*	-
5	*Picking efficiency (%)*	*78.8*	*79.8*	*76.4*	*78.8*	*NS (78.45)*
6	*Losses (stalk and ground) (%)*	*21.2*	*20.2*	*23.6*	*21.2*	*NS (21.55)*
7	*Picking capacity (kg·ha^{-1})*	*135.3^{a}*	*157.8^{b}*	*156.3^{b}*	*325.0^{c}*	*7.34*
8	*Field capacity (kg·ha^{-1})*	*0.12*	*0.12*	*0.11*	*0.12*	*NS (0.118)*

Performance of boll crusher/seed-cotton extractor. The material stripped by the cotton stripper was conveyed to the boll crusher. The seed-cotton output though boll crusher for material stripped by cotton stripper is shown in Tab. 5. In the experiments conducted for F-2383, stripped material with an average weight of 9.3 kg was fed to boll crusher to obtain the seed-cotton and material waste (burs, leaves, sticks etc.). The average weight of seed-cotton output was observed to be 7.23 shared the 77.4 percent of

total fed material. The average weight of material waste was found to be 2.11 kg shared 22.6 percent of the total material. Similarly, in the experiments for RCH-773, with an average 7.98 kg weight of stripped material was fed to boll crusher to obtain the seed-cotton and material waste (burs, leaves, sticks etc.). The average weight of seed-cotton output was observed to be 6.00 kg shared 75.75 percent of total fed material. The average weight of material waste was found to be 1.94 kg shared 24.25 percent of the total stripped material.

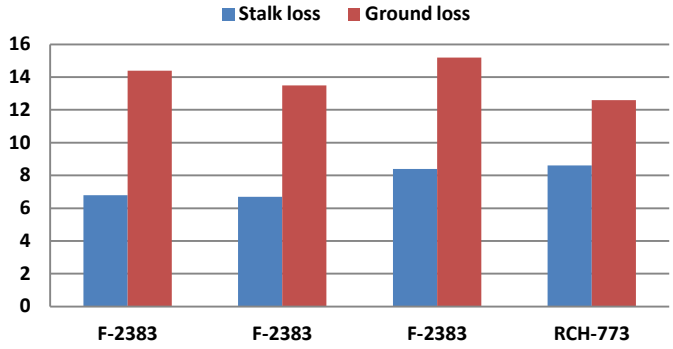

Figure 5. Graphical representation of stalk and ground losses at different locations

Table 5. Seed-cotton output though boll crusher for material stripped by cotton stripper

Cotton variety	*Stripped material weight*	*Seed-cotton weight*		*Material waste (burs, leaves, sticks etc.)*	
	(kg)	*(kg)*	*(%)*	*(kg)*	*(%)*
F-2383 (PAU, Ldh)	*11.000*	*8.60*	*78.2*	*2.40*	*21.8*
	9.000	*6.84*	*76.0*	*2.16*	*24.0*
	8.000	*6.24*	*78.0*	*1.76*	*22.0*
	9.300	*7.23*	*77.4*	*2.11*	*22.6*
RCH-773 (RRS, Bathinda)	*8.100*	*5.93*	*73.2*	*2.17*	*26.8*
	7.850	*6.15*	*78.3*	*1.70*	*21.7*
	7.980	*6.00*	*75.7*	*1.94*	*24.2*

Table 6. Trash analysis of harvested cotton

Picking type	*S.N.*	*Sample weight (g)*	*Gin/lint turnout (g)*	*Seed weight (g)*	*Trash content (g)*	*Trash content (%)*
Cotton stripper	*1*	*100*	*31.5*	*40.0*	*28.5*	*28.5*
	2	*100*	*29.6*	*42.6*	*27.8*	*27.8*
	3	*100*	*28.7*	*42.1*	*29.2*	*29.2*
	Avg.	*100*	*29.9*	*41.5*	*28.5*	*28.5*
Manual	*4*	*100*	*33.5*	*41.0*	*7.5*	*7.4*

Trash content. It was observed that the trash content in cotton picking with stripper was higher i.e. in the range of 27-30 % as compared to the manual picking i.e. 7.5

percent, respectively. Fig. 6 and Tab. 6 show the cotton sample before and after experiments with trash analyzer and observed data during the experiments.

Figure 6. Cotton sample before and after trash analyzing operation

Quantitative observations of harvested seed-cotton. Tab. 7 shows the calculated percentage values of the seed-cotton obtain from the harvested material and gin turnout of both cotton varieties. For F-2383 variety, the observed value of seed-cotton was found to be 77.4 % containing foreign material (trash) in the form of leaves, small sticks, dust particle etc. The measured value of seed-cotton with trash was 75.8% for RCH-773. The percentage of clean seed cotton for F-2383 was observed to be 55.1% and 53.9% for RCH-773 variety. The values of gin turnout for both varieties were observed to be 25.0 and 31.6%, respectively.

Table 7. Percentage Values of Seed-Cotton and Gin Turnout for F-2383 and RCH-773

S.N.	Parameters	Observations of seed-cotton			
		F-2383		RCH-773	
		($kg \cdot ha^{-1}$)	(%)	($kg \cdot ha^{-1}$)	(%)
1	Material stripped by cotton stripper	1275.0	100.0	2750.0	100.0
2	Seed-cotton + trash content after boll crushing	986.9	77.4	2084.5	75.8
3	Cleaned seed-cotton	702.7	55.1	1484.2	53.9
4	Gin turnout	175.7	25.0	469.0	31.6

Labour requirement. The main cause of adopting the mechanical cotton harvester was to reduce the labor requirement (man-$h \cdot ha^{-1}$) of cotton picking. During the field operation of cotton stripper, It was found that the labor requirement for picking the cotton bolls with stripper was measured to be 08-10 man-h/ha, lesser as compared to the labor requirement for manual picking of cotton bolls with burs i.e. 100-120 man-$h \cdot ha^{-1}$. Labor requirement for combine operation of machine picking of cotton bolls and boll crusher was also lesser i.e. 15-20 man-$h \cdot ha^{-1}$ as compared to the labor requirement for combine operation of manual picking of cotton bolls and boll crusher i.e. 125-130 man-$h \cdot ha^{-1}$ for extracting the seed-cotton. Labor requirement for manual picking of seed-

cotton was measured in the range of 400-450 man-h·ha^{-1}. Labor requirement of cotton picking was lesser i.e. 90.9% in the case of machine picking of cotton bolls as compared to the manual picking of cotton bolls with burs. Similarly, the saving of labor in manual picking and machine picking of boll/boll crusher for seed-cotton extraction was 70.1 and 96.0%, respectively as compared to manual picking of seed-cotton (Tab. 8).

Table 8. Comparison of labor requirement

S. N.	*Cotton picking methods*	*Labour requirement (man-h·ha^{-1})*	*Saving (%)*
1	*Manual picking of seed-cotton*	*400 - 450*	*-*
2	*Manual picking of cotton bolls along with burs*	*100 - 120*	*-*
3	*Machine picking of cotton bolls along with burs*	*8 - 10*	*90.9*
4	*Manual picking of bolls along with burs + using boll crusher for seed-cotton extraction*	*125 - 130*	*70.1*
5	*Machine picking of bolls along with burs + using boll crusher for seed-cotton extraction*	*15 - 20*	*96.0*

CONCLUSIONS

The field performance of developed stripper was done on F-2383 and RCH-773 cotton varieties to observe the picking efficiency and picking capacity. From the conducted experiments, it was concluded that:

- Plant height of variety F-2383 sown at closer row to row spacing of 45 cm was significantly shorter than plant height at row to row spacing of 67.5 cm at same location and plant height of RCH-773 was significantly longer i.e. 92 cm than the height of F-2383 i.e. 83 cm sown at same location.
- Plant canopy of RCH-773 was significantly more i.e. 70.2 cm as compared to plant canopy i.e. 54.2 cm of F-2383 sown at same spacing.
- Crop yield of RCH-773 was significantly higher i.e. 1395 kg·ha^{-1} as compared to crop yield i.e. 715 kg·ha^{-1} of F-2383 sown at same spacing and same location. The difference in yield was due to big size and more weight of cotton bolls.
- Picking efficiency of developed cotton stripper was observed in the range of 75-80%
- Picking capacity of cotton stripper was observed in the range of 135 to 325 kg·ha^{-1}.
- Seed- cotton output through the boll crusher cum seed-cotton extractor was found to be 74 to 79%.
- Trash content in cotton picking with stripper was higher i.e. in the range of 25-30 % as compared to the manual picking i.e. 7.5 percent, respectively.
- Labor requirement during cotton picking by stripper was in the range of 8.30-8.75 man-h·ha^{-1} and saving of labor in mechanical cotton picking was 90.9% as compared to the manual picking.

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KONSTRUKCIJA I RAZVOJ BERAČA PAMUKA SA RUČNIM POGONOM

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***Sažetak*:** U Indiji se još uvek pamuk bere ručno. Nedostatak radne snage dovodi do odloženog branja i gubitaka u proizvodnji. Berači koji su dostupni na tržištu su probani sa indijskim sortama, ali bilo je problema. Poznajući uslove na farmama u Indiji, razvijen je berač sa prstima na ručni pogon za branje domaćih sorti pamuka. Kod ove konstrukcije prsti dužine 70 cm su zavareni na prednji deo rama mašine pod uglom od 21º. Širina glave je 64 cm. Rotacione pedale rotiraju sa 120-250 min^{-1} i guraju ubranu masu (čaure sa peteljkama) u sabirni sanduk kapaciteta 15-20 kg. Sanduk je postavljen odmah iza glave berača. Ovaj prototip je testiran na sortama F-2383 i RCH-773. Srednja efikasnost i kapacitet branja iznosili su 76-80% i 135-325 $kg \cdot hr^{-1}$, redom. Istresanje semena je iznosilo 74-80% primenom drobilice čaura.

***Ključne reči*:** *usev pamuka, berač pamuka, osobine useva, karakteristike mašine, drobilica čaura, izlaz semena*

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