

Evaluation of Portable Cotton Picker

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Abstract – Participatory ergonomic evaluation of cotton harvesting in rainfed and irrigated cotton of central India during 2012 found present contract manual harvesting is 30% more efficient than battery powered portable cotton picker. Higher load on contract labourer’s heart was noticed with higher output of seed cotton regardless of methods of harvesting. Portable cotton pickers are high speed, precise and no need of defoliation but adequate training and willingness to adopt the machine is must. Adequately trained female and male pickers can pick 80 and 41% more seed cotton and 44% more cotton area was picked with Portable cotton picker. Portable cotton picker are more suitable for family labour of rainfed cotton harvesting with lower moisture percentage. Higher moisture content in irrigated cotton may be a hindrance for machine picking with frequent slippage. Trash content can be similar to hand harvesting (1-2%). Present Portable cotton picker were frequently trouble shooting with improper cable connections, entry of burs and leaves with obstruction of over grown braches.

Keywords – Drudgery Reduction, Machine Picking, Portable Cotton Picker, Small Farm Mechanization.

I. INTRODUCTION

Large scale adoption of Bt hybrid cotton during 2005-2007 with synchronized maturity and higher boll retention brought lot of changes in cotton harvesting in rural India by limited availability of harvesting women labourers and rise in cost of seed cotton harvesting US \$ 0.03-0.13 /kilo gram [2][8]. Cotton harvesting manually involves a low to moderate drudgery due to posture, load of picked cotton and abrasion of fingers due to sharp points of dried bracts [3][5][9]. Hand harvesting operation requires 450-500 women-hr ha⁻¹ which costs US \$ 79-248 ha⁻¹ [4][5][6]. Bt hybrid cotton dried boll beaks were sharp and abrasive to forearms and fingers of female cotton pickers. Cotton harvesting machines suitable for small farms were developed and used in China to reduce drudgery on cotton harvesting of migrated labourers which could pick at US\$ 0.05/kg-1 [7]. BPPCHM were bulk imported and sold @ US \$ 40-80/unit with a limited success due to lack of training and operational difficulties [11] [12]. North Indian irrigated cotton had reduced drudgery by BPPCHM [6]. Present research was concentrated on adoptability of BPPCHMs by small farm contract cotton women harvesters of central India for mild winters to moderate summer cotton harvesting season in participatory mode.

II. METHODOLOGY

2.1 Weather conditions:

Central Institute for Cotton Research, Nagpur is in central India, which is the hub of rainfed cotton production in Vertisols. Weather conditions during the harvesting season were mild winters to moderate summers [Fig.1.] i.e. November to January months during which temperatures can drop below 10 °C.

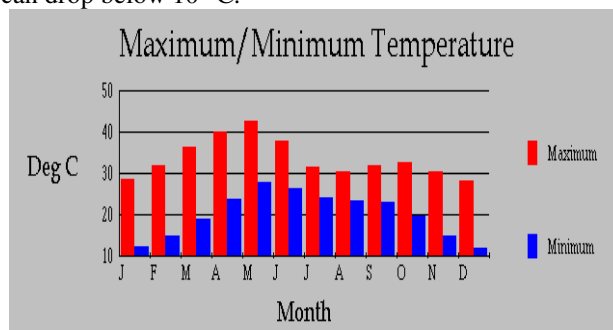


Fig.1. Weather conditions at Nagpur during cotton harvesting.

2.2 Cotton fields:

Preliminary harvesting studies were conducted at Central Institute for Cotton Research, Nagpur on Bt hybrid cotton under rainfed conditions. Results were validated under drip and flood irrigated conditions with labour shortages. Irrigated Bt hybrid cotton fields were selected for harvesting with the prevailing contract manual harvesting system in Vertisols of central India. Similarly, irrigated and rainfed cotton fields were selected and cotton was picked from 1st, 4th harvesting to study adoptability and suitability across age groups and genders.

2.3 Cotton harvesting machine:

Battery powered chain and peg type chinese cotton pickers [Fig.3.] were compared with traditional system of a piece of cloth tied around waist of a female laborer besides this old petticoat and male full sleeves shirt were used for protecting limbs and forearms from bruising/abrasion which is a popular practice followed in central India [Fig.2]. Cotton harvesting machine weighed by 0.7 kg is continuous serrated chain/peg type operated by 12 V battery[2.0 kg weight], works for 6-8 hrs with a front loaded pouch type harvesting bag [0.12 kg weight] for down loading cotton directly from the machine with a conveyor or cotton pipe [6].



Fig.2. Manual cotton harvesting

2.4 Cotton harvesting:

BPPCHM doesn't need any defoliation. Very high speed rotating serrated chain/ drum picks cotton. This needs to be directed towards the boll which clinches the opened boll [Fig.3].



Fig.3. BPPCHM

Cotton can be doffed off into the front loaded cotton harvesting bag tied to the waist of cotton harvester through a wider cotton pipe type conveyor. Battery along with power cables are also tied to the waist of cotton harvester by a belt. Unless adequate care is not taken in directing the machine for a small fraction of time every possibility of entering cotton dried bur/ leaves into the machine, which needs to be reversed to take them out. There is no special advantage as the machine targets a single boll for harvesting similar to manual harvesting and advantage is speed and precision, if trained properly can reduce physical injuries to fingers, drudgery and trash content. As the machine needs a weight of 2.0 kg battery and front loaded bag also obstructs movement of cotton harvesting labour in the field.

2.5 Selection and training of subjects:

Farm women were selected from Nagpur district, Maharashtra state, India, who are harvesting cotton on custom basis paid per kilo gram cotton picked on weight basis. They were with normal health/ blood pressure and body temperature. Knowledge, skills for using these cotton harvesting machine was imparted and allowed them

to use for dummy harvesting. Heart rate machine was tied to wrist, stethoscope and digital weighing machine was used for measuring data.

III. RESULTS AND DISCUSSION

3.1 Social acceptability of cotton harvesting machine:

BPPCHM was new to the conventional contract female cotton labour/ pickers of central India, who were shy in accepting the new machine. As a common feeling any machine displays the laborers they feel it is a threat to their livelihoods. It requires a lot of time for convince them that it is a harvesting aid to reduce work load on them. However, farm owners and male pickers regardless of age welcomed and accepted the machine, picked cotton 41% more efficiently compared to professional contract manual harvesters [Table 3]. Extra weight of 0.7 kg on hands and 2.0 kg battery weight on waist with a front loaded bag on picker, felt machine is more suitable for males, which is not acceptable to female professional contract cotton pickers.

3.2 Machine performance:

The data of station trials [Table1] clearly indicates that the training and practice offered was inadequate and insufficient besides higher moisture content with frequent slippages, interruptions due to machine failures in drip/ flood irrigated Bt hybrid cotton. Over all conventional hand harvesting out weighed 30% more output in both station and farmers fields respectively under rainfed and supplementary irrigated conditions.

Table 1. Performance of BPPCHM.

Location	Out put kg/hr		Out put kg/day		Machine efficiency
	Manual	Machine	Manual	Machine	
CICR	4.02	2.88	32.2	23.4	73
CICR	3.8	2.5	30.4	20	66
Belapipla	4.3	3.1	34.4	24.8	72
Mohazilpi	4.0	2.6	32	20.8	65
Mohazilpi	4.3	3.14	34.4	25.1	73
Average	4.08	2.84	32.7	22.8	70
Probability	6.9 x 10 ⁻⁶		Sig		

Onfarm trials best performing female Janno [Table 2] with Bt hybrid cotton Mallika 207 drip irrigated could understand the mechanism properly and 80% more seed cotton was picked besides covering 44% more area of the cotton hour⁻¹ over conventional contract manual harvesting but exerted significantly higher load on the heart rate. However, Female cotton harvester Mangru faced difficulties with over grown branches of irrigated cotton which were obstructing cotton harvesting job by BPPCHM compared to manual system [Table 2]. of contract cotton harvesting significantly exerted more load on heart rate with 9% more seed cotton was harvested with 41% more area was covered. It is clear increasing output is putting more exertion on pickers with regardless of methods. Further, Shakeela got even scared and felt it was embracing and interfering with their routine contract livelihood as paid output of seed cotton [Table 2]. These results were in agreement under irrigated north Indian conditions [6].

Table 2: Machine picking by females in drip irrigated Bt hybrid cotton

Female Pickers	Heart Rate*		Probability	Out put kg/hr		Out put M ² /hr		Moisture content%	
	Machine	Manual		Machine	Manual	Machine	Manual	Machine	Manual
Mangru	100.2	107.8	3.41x10 ⁻⁷	6.67	7.27	200	282	3.87	4.31
Janno*	102.4	94.2	0.0018	7.20	4.00	360	250	3.03	6.25
Shakeela**				1.5	6.53	300	365	5.27	6.25

*HRM Heart rate machine data *Scared with machine

Table 3: Machine picking by male females in flood irrigated Bt hybrid cotton.

Cotton pickers	Age	Method	Out put kg hr ⁻¹	Area covered M ² hr ⁻¹	Kg/ delta heart beat
Vimal	46	Manual	3.5		
Yemobai	47	Manual	2.6	771	0.202
Sumanbai	50	Manual	2.5	771	0.291
Average			2.9	771	0.246
Vishal	28	Machine	4.0	1700	0.133
Bhaorao	30	Machine	3.8	1700	0.188
Raju	30	Machine	5.5		
Vimal	45	Machine	2.0		
Average			4.4	1700	0.146
Probability			0.14	Sig	

3.3. Trash content:

Trash content was significantly higher in defoliated machine picked cotton [Table 4] compared to manual harvesting as the pickers were not professionals and adequate training was not received, therefore more dried leaves entered the machine compared to hand harvesting. However, despite significant differences the trash content in un defoliated cotton at farmers fields had very low trash content and within acceptable limits and comparable to that of hand picking. This clearly indicates clear understanding adequate training and practice were pre requisite for machine harvesting in small farms. They are more suitable for family labourers rather hired labourers on contract.

Table 4: Trash percentage of defoliated cotton

Location	Trash Percentage	
	Manual	Machine
CICR, Nagpur	4.5	9
CICR, Nagpur	3.4	10.70
CICR, Nagpur	2.3	10.29
Trash percentage	3.4	9.99
Probability	0.000636	Sig

Table 5: Trash percentage of undefoliated cotton

Location	Trash Percentage	
	Manual	Machine
Belapipla	0.67	1.0
Moha zilpi	1.01	1.69
Moha zilpi	1.68	3.44
Trash percentage	1.12	2.04
Probability	0.15	Sig

IV. CONCLUSION

4.1 Portable cotton picker can improve cotton harvesting efficiency without defoliation. They were more suitable for family labour in rainfed cotton harvesting with lower trash content.

ACKNOWLEDGEMENT

Authors were great full to SMS (Home Science), Farm Science Centre / Director, Central Institute for Cotton Research, Nagpur.

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was born in Chalvai village, Warangal district, Andhra Pradesh state, India on 16th August.1962. Graduated and Post graduated in Agronomy discipline in 1983, 1985 from College of Agriculture, Nagpur. He served for one year at ANC, Warora(M.S) as lecturer in Crop Science. He has passed ARS in 1986 and joined service in 1989 at Central Institute for Cotton Research, Indian Council of Agriculture and Research, Nagpur after completion of his Ph. D from Post Graduate Institute, Dr. *Punjab Rao Deshmukh* Agriculture University, Akola(M.S) India. He has an extensive Research and Extension experience 25 years in Cotton production. His research interests include Rain water conservation, harvesting and recycling in farm ponds through drip/ fertigation, Plant population and yield plateau, Biological nitrogen fixation(BNF), P solubilisation/ mobilization by fungal, bacterial and *mycorrhizal* associations, Micro and Secondary nutrition of soybean-Bt and non Bt hybrid cotton, Strip and intercropping, mechanization of small farms, herbicide tolerant weeds and their management in sole, inter and rotational crops. He is the author of Seven books and 25 journal papers.

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