RESEARCH PAPER | International Journal of Agricultural Engineering | Volume 8 | Issue 1 | April, 2015 | 92–96
e ISSN–0976–7223 ■ Visit us : *www.researchjournal.co.in* ■ DOI: 10.15740/HAS/IJAE/8.1/92-96

Effect of mechanization on cost of rainfed cotton cultivation in Vidarbha

■ AVINASH V. GAJAKOS, SAGAR R. PATIL AND ISHAN A. DOBADE

Received : 17.11.2014; **Revised :** 03.03.2015; **Accepted :** 14.03.2015

See end of the Paper for authors' affiliation

Correspondence to :

SAGAR R. PATIL
Department of Farm Power and Machinery, College of Agricultural Engineering and Technology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, AKOLA (M.S.) INDIA
Email : srpatil120@gmail.com

■ **ABSTRACT :** Nowadays, agricultural mechanization is getting popular but still in some region traditional practices are followed. The present investigation was conducted to study the effect of mechanization on cost of cotton cultivation. The investigation was carried out for rain fed cotton cultivation in Akola district of Vidarbha region. In this study, costs of cotton cultivation of rain fed cotton cultivated by both traditional and mechanized practices were computed. The cost of cotton cultivation in improve mechanize practices (13231 Rs./ha) was less than traditional practices (17897 Rs./ha), by improve mechanized practices quality and rate of work was also found to be improved over traditional practices.

■ **KEY WORDS :** Mechanization, Agricultural, Cotton, Rain fed, Traditional, Vidarbha

■ **HOW TO CITE THIS PAPER :** Gajakos, Avinash V., Patil, Sagar R. and Dobade, Ishan A. (2015). Effect of mechanization on cost of rainfed cotton cultivation in Vidarbha. *Internat. J. Agric. Engg.*, **8**(1) : 92-96.

In Vidarbha region, cotton is the most important cash crop grown on an area of 13.00 lakh ha with production of 27 lakh bales of cotton (2008-09). Most of the farmers in the Vidarbha are still using the traditional practice of cultivation of cotton crop, which is leading to considerably low productivity while in Punjab and Haryana farmers are using mechanize practices of cultivation. One of the main reasons for the low productivity of cotton in Vidarbha is its dependence on the monsoon rain and about 95 to 98 per cent area is under rain-fed cultivation. Farmers have now started using seeds of high yielding varieties, which are very costly and cannot be sown by traditional way of sowing *i.e.* seed drilling otherwise cost of production will increase. Mechanical interventions can be made through mechanization of tillage, planting, intercultural and plant protection operations for efficient utilization of costly inputs. Agricultural mechanization implies the use of various power sources and improved farm tools and equipment, with a view to reduce the drudgery of the human beings and draught animals, enhance the cropping intensity, precision and timeliness of efficiency of utilization of various crop inputs and reduce the losses at different stages of crop production. The end objective of farm mechanization is to enhance the overall productivity and production with the lowering down cost of production (AICRP on cotton, Akola).

The objectives of the study were as follows :

- To compare the cost of cotton cultivation by mechanize and traditional practices.
- To study on quality parameters of field operation by mechanized and traditional practices.

■ METHODOLOGY

To meet with the objectives of present study, the cost of different field operations carried out for cotton cultivation such as land preparation, sowing, intercultural operation, spraying, cotton picking, uprooting etc. by

traditional and mechanized practices have been computed. For above purpose parameters such as the variety of crop, depth of operation, soil moisture, travelling speed, width of operation, effective field capacity, field efficiency, fuel consumption, plant spacing, row spacing, weeding efficiency, labour requirement, area covered, type of implement, seed rate for planter, weeding efficiency for weeder, soil pulverization for rotavator and cultivator, cotton picking efficiency for cotton picker, spraying efficiency and application rate for sprayer etc. have taken.

Parameters which are taken for consideration :

For cotton, picker readings were taken by using the prototype of cotton picker and all parameters of other implement were taken from field trials carried out at Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. For traditional, weeding cost of operation (*i.e.* by animal drawn hoe) was taken on rent basis.

Cost of implement :

Average of recent market price of implement of different companies is considered.

Moisture content of soil :

The soil moisture content affects draft of implement. If soil has more moisture content then it increases draft resulting in more slip. If soil has less moisture content then it also increases draft (Daji, 1968).

Variety of crop :

Reading for rotary weeder, was taken on Suraj and readings for other operations were obtained from previous data for different varieties such as Ankur 651 BT-Cotton, PKV-Rajat etc.

Depth of operation :

It is considered for ploughing, harrowing, sowing, weeding by rotary weeder, uprooter etc. For rotary weeder depths of different locations were measure by removing disturbed soil from furrow.

Width of operation :

It is considered for the M.B. plough, rotavator, cultivator, pneumatic planter, sprayer, cotton picker, uprooter and V-blade. It was measured by measuring meter tape.

Plant height :

It was measured at different locations in the field for rotary weeder and average value was considered. It was measured by measuring meter tape.

Travelling speed :

It was computed with the help of stopwatch. It is the distance covered by the tractor or implement in given time. It was calculated by formula :

$$\text{Speed (km./hr.)} = \frac{\text{Distance covered (km.)}}{\text{Time taken (hr.)}}$$

Theoretical field capacity :

It is the field coverage of the implement based on 100 per cent of time at the rated speed and covering 100 per cent of its rated width :

$$\text{Theoretical field capacity (ha/hr)} = \frac{\text{Width (m)} \times \text{Speed (km./hr.)}}{10000}$$

Table A : Implements and their cost

Sr. No.	Implements	Cost Rs.	Life	Ann. working hrs.
1.	Tractor 50 hp	670000	10	1000
2.	Tractor drawn two bottom m b plough	45000	15	500
3.	Tractor operated rotavator	88000	15	500
4.	Tractor drawn blade harrow	12000	15	500
5.	Tractor operated pneumatic planter	70000	8	300
6.	Tractor operated rotary weeder	130000	10	500
7.	Tractor operated air sleeve boom sprayer	190000	8	300
8.	Knapsack power sprayer	6000	10	500
9.	Self operated cotton picker	4000000*	15	400
10.	Tractor drawn uprooter	15000	15	300
11.	Tractor drawn V-blade	16000	15	300

*Approximate cost(Kepner R. A.)

Effective field capacity :

It is actual area covered by the implement based on total time consumed.

Field efficiency :

It is the ratio of effective field capacity to the theoretical field capacity. It is expressed in percentage (%).

$$\text{Field efficiency (\%)} = \frac{\text{Effective field capacity}}{\text{Theoretical field capacity}} \times 100$$

Fuel consumption :

It is the fuel consumed by the tractor (in litre) to cover one hectare area. Fuel consumption was measured by measuring the fuel in the tank before the operation and after the operation and calculated the area covered.

Cost of operation :

The process of calculation of cost of operation is given below and it is taken from the book "Elements of agricultural engineering" by Jagdishwarsahay (1971).

$$\text{Depreciation cost} = \frac{C - S}{L \times H}$$

Interest :

It was assumed 10 per cent of capital cost per year and it is given by :

$$\text{Interest} = \frac{(C + S) \times i}{L \times H}$$

where,

C=Capital cost.

S= Resale price.

i= Interest 10 per cent of capital cost per year.

Table 1 : Results for cotton cultivation by traditional and improved mechanize practices

Sr. No.	Parameters		Primary tillage	Secondary tillage		Sowing		Interculture		Spraying		Cotton picking		Uprooting	
1.	Name of implement		Trad. and Imp.	Imp.	Trad.	Imp.	Trad.	Imp.	Trad.	Imp.	Trad.	Imp.	Trad.	Imp.	Trad.
			A	B	C	D	E	F	G	H	I	J	K	L	M
2.	Cost of	Rs./hr	401	490	409	607	112	540	26	829	242	3356	1109	530	529
	operation	Rs./ha	3316	1441	1023	1103	900	693	1000	217	484	4248	8878	2211	2301
3.	Field capacity, ha/hr		0.121	0.34	0.4	0.55	0.125	0.78	0.052	3.8	0.5	0.79	0.125	0.24	0.23
4.	Labour requirement		1	1	1	1	6	1	1	1	2	1	45	1	1
5.	Fuel consumption, l/ha		18.3	9.05	7.42	8.05	-	4.44	-	5.7	1	29	-	16.5	17.4
6.	Pulverization, cm		-	1.53	2.28	-	-	-	-	-	-	-	-	-	-
7.	Degree of burring (%)		-	65	25	-	-	-	-	-	-	-	-	-	-
8.	Working width, cm		60	142	210	-	90	-	90	865	175	-	-	120	180
9.	Working depth, cm		-	8	-	4	3-4	3-6	3-4	-	-	-	-	15	26
10.	Efficiency, %		-	-	-	-	-	94	89	90.7	80	-	-	-	-

Imp. –Improve mechanize. Trad.– Traditional; A - Tractor drawn two bottom M.B. plough. B - Tractor operated rotavator. C - Tractor drawn blade harrow. D - Tractor operated pneumatic planter. E - Manual dibbling. F - Tractor operated rotary weeder. G – Blade hoe. H - Tractor operated air sleeve boom sprayer. I - Knapsack power sprayer. J - Self operated cotton picker. K - Manual picking. L - Tractor drawn under root cutter. M - Tractor drawn V-blade

Table 2 : Comparison between net profits obtained in traditional and mechanized practices of rain fed cotton cultivation

Sr. No.	Parameters	Rain fed	
		Traditional	Mechanize
1.	Cost of cultivation, Rs./ha	17897	13231
2.	Cost of seed, Rs./ha	4550	4550
3.	Cost of fertilizer, Rs./ha	3575	3575
4.	Cost of pesticides, Rs./ha	4000	4000
5.	Yield obtained, kg/ha	1000	1000
6.	Seed cotton rate, Rs./kg*	46	46
7.	Gross output, Rs./ha	46000	46000
8.	Net profit, Rs./ha	15978	20643

*Based on market price

H=Annual working hours.

L= Life of implement.

Repair and maintenance cost :

It was 10 per cent of initial capital per year.

Housing, taxes, insurance cost: It was assumed 3 per cent of initial cost per year.

Fuel cost :

It is the cost of the fuel, which was consumed during operation. Cost of one lt. fuel was 60 Rs.

Lubricants :

It was assumed to be 30 per cent of fuel cost.

Wages :

Vary as per the operations (Sahay, 1971). Implements and their cost is given in Table A.

RESULTS AND DISCUSSION

Total cost of cultivation by traditional practice was 17897 Rs./ha and by improved mechanize practice was 13231 Rs./ha.

As per Table 1 the total input for cotton cultivation approximately in the rain fed season by traditional practice was 30022 Rs./ha and net profit obtained was 15978 Rs./ha and by mechanize practice total input was 25356 Rs./ha and net profit obtained was 20643 Rs./ha. So by using improved mechanize practices for cotton cultivation farmers can increase their income approximately by 4665 Rs./hr.

Conclusion :

- In current practices tractor drawn M B plough is generally used so considering it for both traditional and mechanize practice. Cost of operation for primary tillage is 401.3 Rs./hr and 3316.03 Rs./ha.
- For secondary tillage it is observed that cost of operation in mechanized practice was greater than traditional and the pulverization (*i.e.* mean clod size diameter in cm) in mechanized practice was less than traditional. For obtaining the same quality of work of rotavator, blade harrow needs two or three rounds on the same field.
- For sowing it is observed that cost of operation in mechanized practice was greater than traditional, also field capacity was very less in traditional and labour requirement was very high.
- For weeding it is observed that cost of operation in mechanized practice was less than traditional, also the field capacity and weeding efficiency was less in traditional.
- For spraying it is observed that cost of operation in mechanize practice was less than traditional practice and field capacity was very less in traditional with high labour requirement.
- For cotton picking it is observed that cost of operation in mechanize practice was less than traditional practice and field capacity was very less in traditional with high labour requirement.
- For uprooting it is observed that cost of operation and working depth in mechanize practice were less than traditional practice but under root cutting efficiency was more in improved mechanize than traditional.
- Cost of cultivation and labour requirement in improved mechanize practice was less than traditional practice. In mechanize quality of work was superior. Net profit obtained by mechanize practice was greater than traditional. Availability of labour is major problem in Vidarbha region, therefore, improve mechanize practice is well suited for cotton cultivation than traditional practice.

Authors' affiliations:

AVINASH V. GAJAKOS AND ISHAN A. DOBADE, Department of Farm Power and Machinery, College of Agricultural Engineering and Technology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, AKOLA (M.S.) INDIA

REFERENCES

AICRP (All India co-operated project) on cotton, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Blog.

Anonymous (1977). Research scheme on testing: Final report of ICAR and evaluation of machines for mechanization of cotton cultivation. Report no. 7 Department of Agricultural Engineering, C.C.S. Haryana Agricultural University, Hissar (HARYANA) INDIA.

Anonymous (2009). All Indian area, production and productivity of vegetable. Indian horticulture data base.

Daji, J.A. (1968). *A text book of soil science*. Modern promoters Publishers Pvt. Ltd., Bombay (M.S.) INDIA.

Erdal, O.Z. and Tezer Karayol (2000). 1635 harvesting performance of a tractor mounted mechanical cotton picker. 1-9pp.

Godfrey, Mahofa (2007). *Economic analysis of factors affecting cotton production*. 24-40pp.

Jaiswal, B.N. and Patil, A.B. (2007). Performance evaluation of spindle type cotton picker. *J. Agric. Engg.*, **44** (1) : 38-42.

Kepner, R.A. *Principles of farm machinery* (3rd Ed.). (Life of implements is taken from this book.). 23-45pp.

Lubbe, P.A., Archer, A.C. and Whitehead, E.N.C. (2012). Guide to machinery costs 2012/13 Department of Agriculture, *Forestry & Fisheries*, 1-8pp.

Nalavade, Parish P., Salokhe, Vilas M., Jayasuriya, H.P.W. and Hiroshi, Nakashima (2000). Development of a tractor mounted wide spray boom for increased efficiency. *J. Food, Agric. & Environ.*, **6**(2) : 164-169.

Narkhede, N.N. Deogirikar (2002). *Tractor mounted rotavator*. 1-8pp.

Neog, A.K. (2007). *Cost of cultivation of principal crops in India*. 262-263pp.

NSS 54th Round January 1998 – June 1998. *Cultivation practices in India*.

Parajulee, Megha N. (2012). Cotton entomology programme research activity annual report 2012. 1-20pp.

PetrVozka (2007). *Comparison of alternative tillage systems.* 1-20pp.

Potekar, J.M. and Tekale, D.D. (2001). Comparative performance of tractor drawn implements tillage system with rotavator tillage system. *Karnataka J.Agric.Sci.*, **17**(1) : 4098-1100.

Prasad, J., Kapur, Tarun, Sandhar, N.S., Majumdar, G., Patil, P.G., Shukla, S.K., Jaiswal, B.N. and Patil, A.B. (2007). Performance evaluation of spindle type cotton picker. *Karnataka J. Agric. Sci.*, **25**(3) : 363-365.

Sahay, Jagdishwar (1971). *Elements of agricultural engineering*. 225-297pp.

Shinde, Gopal U., Potekar, J.M., Shinde, R.V. and Kajale, S.R. (2011). Design analysis of rotary tillage tool components by CAD-tool. 1-5pp.

Singh, V.V. and Yadav, B.G. (2004). CIAE design and development of tractor mounted rotavator.

Subbulakshmi, S., Saravanan, N. and Subbian, P. (2009). Conventional tillage vs conservation tillage - a review. 76-87pp.

Surjit, V. Foundation for agrarian studies (2011). *Evolution of the study of cost of cultivation in India*. 128-129pp.

Tiwari, R.K. (2012). Energy and cost audit of bullock farming system in wheat crop production– A case study in Sikkim. *Agric. Engg. Today*, **37**(3) : 12-15.

■ WEBLOGRAPHY

Majumdar, EG (2012). CICR technical bulletin - Mechanisation of cotton production in India. Nagpur: Central Institute for Cotton Research (CICR). Available: *http://www.cicr.org.in/pdf/mechnaisation?_cotton.pdf*. Accessed 11 October 2013.