



LETTERS TO EDITOR

Labour Saving and Cost Reduction Machinery for Sugarcane Cultivation

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Cultural operations for sugarcane production are very arduous especially planting, interculture, plant protection and harvesting. Modern sugarcane machinery and labour saving devices reduce the cost of sugarcane production, help in completion of operation timely reduce human drudgery and enable efficient utilization of resources with better quality work output. It helps in increasing overall production and productivity. Sugarcane planting requires about 350 man-hour and 30.6-bullock pair-hour / ha with the cost of operation of Rs 3987 in conventional system of planting, as against mechanical planting requires Rs 2200 / ha with the engagement of 20 man-hours. The cost involved in manual harvesting is about Rs. 9900 / ha (Rs 100 / tonne) with 990 man-hours as against Rs. 15700 per ha. with the labour engagement of 32 man-hours per ha. There is urgent need of introductions of modern sugarcane machinery, which are now available in the country like sugarcane cutter planters, interculture and weeding machinery, sprayers and imported chopper harvesters are getting acceptance. Although their initial cost is very high but advantages accrued in their use are much more. There is a need for the design, development and commercialization of mechanical harvesters suitable for Indian conditions. Custom hiring system on co-operative basis sugarcane harvesters should also be popularized.

KEY WORDS : Labour saving, cost reduction, machinery, sugarcane, cultivation

Sugarcane is one of the important cash crops in India. It is the main source of sugar, gur and khandasari in the country. It is cultivated in an area of about 4 million ha. with a production of 75 tonnes/ha (*The Hindu, Survey of Indian Agriculture 2000*). Total production of sugarcane has been increasing steadily from 230 million tonnes in 1993 – 94 to 300 million tonnes in 1999 – 2000. Sugar availability in the country has been about 18.5 million tonnes (*The Hindu, Survey of Indian Agriculture 2000*). The energy consumption in production of sugarcane is the highest as compare to many other crops such as potato, wheat, maize, paddy, sorghum etc. Sugarcane production is a labour intensive requiring about 3300 man- hrs for different operations (Yadav, RNS and D. Chaudhuri, 2000). Considering the present trend of availability of labour for sugarcane production, it has been experienced that use of modern machinery is inevitable. Use of machinery helps in labour savings ensures timeliness of operations, reduces drudgery, helps in improving quality of work, reduces cost of operation and ensures effective utilization of resources. In India considerable R & D work for design and development of agricultural

implements and machinery for few operations have been carried out for other crops. In case of sugarcane crop, although machinery has been developed. However the adoption of these implements and machinery have not been up to the desired level. Thus, there is a considerable mechanization gap, especially in the area of sugarcane planting, interculture, plant protection, harvesting and ratoon management. Therefore it is necessary that concentrated efforts be made for adoption, development and popularization of sugarcane machinery for various cultural operations.

LABOUR SAVING DEVICES AND MACHINERY FOR SUGARCANE PRODUCTION

Sugarcane machinery and other labour saving devices are described as under :

Land Preparation : Sugarcane crop requires well-prepared seedbed. In sugarcane production tillage is done with the help of mould board plough, disc plough, heavy disc harrow, duck foot tillers, rotavators, cultipackers / clod crushers, blade tracers, land planer, bund former, trencher, ridger, furrower and other local tillage tools. Various studies show that the cost involved in conventional methods is Rs. 8200 per ha including 331 man-hours, while in mechanized system it reduces

to Rs. 1500 per ha with the labour involvement of 7 man-hours/ha. Introduction of Tractor Operated Rotavators have been found quite effective in cane cultivations.

Treatment of Seed Cane : Sugarcane suffers from different types of seed born diseases like red rot, grassy shoot disease, ratoon **stunting** and mosaic etc. In order to control the disease, seed cane is treated at a temperature of 54° C for about 4 hours at a humidity level of about 90 percent or at 50° C for a period of about 2 hrs in case of moist hot air and hot water treatment plants respectively.

Sugarcane Sett Cutting : Sugarcane is a vegetatively propagated crop. It is planted in the form of cut setts of 2-3 buds. For preparing setts, manually operated hand tools and power operated sett-cutting machines are used. In conventional planting sugarcane sett cutting process is a pre planting practice, while in mechanized system (sugarcane cutter planter) sett cutting is done simultaneously by the planter. This ultimately reduces time, labour and moisture loss in setts of sugarcane seed and helps in higher germination percentage.

Planting : Different methods of planting are followed such as flat planting, trench planting, pit planting, staggered row planting and spaced transplanting. Most of the area in Northern India is flat planted. In the areas where sugarcane lodging takes place, trench planting is followed. Different row spacing are maintained at different places ranging from 60 – 70 to 90 – 150 cm. For flat planting of sugarcane efforts were made at Indian Institute of Sugarcane Research, Lucknow to develop bullock operated planter, tractor operated semi-automatic and automatic planter and cutter planter. Rotodrum planter was developed at Punjab Agricultural University, Ludhiana. Sugarcane planting involves 337.5 man-hours and 30.6 bullock pair hours with a cost of Rs. 3987/ ha land, while mechanical planting involves total cost Rs. 2200/ with the engagement of 20 man-hours. Thus to reduce drudgery and cost of planting and efficient utilization

of seed, chemical, fertilizer, use of planters is advocated.

For sugarcane production space transplanting technique is being followed in some parts of Maharashtra on large scale. Recently trend of single bud sugarcane transplanting for the production of cane in Maharashtra State requires attention for development of a sugarcane transplanter. Poly bag planting/ transplanting and mechanization of tissue culture seed production processes are new emerging areas.

Irrigation : Sugarcane is an intensively irrigated crop. However, under deficit water availability conditions, use of sprinklers, drip irrigation system and skip furrow method of irrigation & fertigation are practiced for economical and efficient use of water. Application efficiency is higher in case of drip, sprinkler irrigation than other methods.

Weeding and Interculture : Sugarcane requires number of interculture operations for weed control, moisture conservation, microbial action and creation of better environment for over all growth of the plant.. After emergence, weeding is done with the help of animal or tractor operated cultivators. Manual weeding with spade is a very common practice. However it is

Table - 1 : Comparative study of performance of two different make, models chopper harvesters and manual harvesting system

Machine Parameter	Machine A	Machine B
Field Capacity (ha/hr)	0.27	0.20
Field Efficiency (%)	41.89	52.86
Harvesting Speed (km/hr)	4.26	2.17
Loss of cane in harvesting*	2.02	3.82
Extraneous Matter (%), Net Cane basis	4.17	11.29
Harvesting Cost (Rs/tonne)	157	194
Net Cane Output (t/hr)	26.62	12.37

*Trials were conducted under different conditions

Table - 2 : Average man/bullock pair hours required per ha for sugarcane cultivation

Operation	Man-hr	Bullock-pair-hr	Cost of Operation (Rs)	Labour requirement in Mechanized cultivation	Cost of operation in Mechanized cultivation
Preparatory Tillage	331.5	245.0	8200	7	1500
Manuring	238	31.2	3004	238	3004*
Planting	337.5	30.6	3987	20	2200
Irrigation	392	64.4	5208	392	5208
Interculture and other Operation	816	27.4	8708	816	8708*
Harvesting and Stripping	990	-	9900	32	15700**
Total	3035	398.6	39007	1505	28408

*Conventional method; **For 100 t/ha yield @ 157 Rs./t

strenuous and affects the health adversely. Use of self-propelled rotary weeder and lightweight power tiller, tractor tiller with ridgers and discs are being followed for interculture and earthing of sugarcane. Multipurpose tractor operated equipment are also being used for this purpose. Cost of mechanical weeding and interculture is about 1/3rd to 1/4th as compared to manual weeding by traditional methods and tools.

Plant Protection : Sugarcane crop sometimes suffers heavily from insects, pests and rodents. For control of borers, insects and pests diseases, application of chemicals is done with help of sprayers at the initial stage. However, once the plants have grown taller, it becomes difficult to enter into field and spray the chemicals. In order to spray effectively and efficiently, use of wide swath spray boom is advocated. Wide swath spray boom may be operated by foot/hand/engine operated spray pumps. Self-propelled high clearance sprayers, tractor operated aero blast sprayers may also be used in a crop planted in a planned manner. Manual spraying is a very strenuous and labour intensive job while cost of spraying by improved system is less than 1/4th as compare to traditional method. Plant protection equipment may also be used for application of Urea solution and growth retardants and ripeners.

Propping : Propping of sugarcane is common under light soils. Therefore usually trench planting is done and heavy earthing of cane is done before the rainy season. Use of trenchers in planting is beneficial. In order to avoid lodging of tall sugarcane crop especially during rainy season due to wind, loose moist soil, propping is essentially done by tying up leaves of canes of side rows. Twine made of sun hemp locally available

or other biological materials are also used for tying tall bent canes. Modern adjustable height ladders, hand tools for tying ropes, wires may be used to avoid accidents.

Harvesting : In northern India harvesting of sugarcane in exchange of green tops is a common practice. Out of all the cultural operations harvesting requires maximum labour. It involves base cutting, detashing, detopping and bundle making followed by loading and transport. Different types of hand tools of various designs, sizes and shapes are used for cane harvesting. Sugarcane harvesting manually by traditional tools is a highly labour intensive and costly operation out of all sugarcane production practices. Sugarcane chopper harvesters such as CASE AUSTOFT & CLAAS 3000 are being introduced in the country. The cost involved in manual harvesting is about Rs. 9900 / ha (Rs. 100 per tonne) with 990 man-hours as against Rs. 15700 / ha with the labour engagement of 32 man-hours per ha. In terms of per tonne cost Rs 77.55 in mechanical harvesters (*Vachaparampil, Mathew M, 1999*), while considering the fixed and operating costs the cost of mechanical harvesting ranges from Rs 157 to 194 / tone (*Test report on sugarcane Chopper Harvester, 2001*).

Loading and Haulage of Sugarcane : After harvesting sugarcane bundles are piled up by head loading to the end points of the field and again loaded in the carts, tractors trailers, trucks by manual loading, which is common practice. Introduction of grab loaders, loaders and other devices can save lot of labour and drudgery. Although it may be costlier because of high initial cost of loaders. However keeping in view the

Table - 3 : Operation wise availability of sugarcane machinery

Operation	Traditional Equipment	Imported/Indigenous Equipment/Improved
Tillage	Bullock operated country plough, Harrow, Blade Terracer, planker, Bullock operated cultivator, ridger, furrower, manually operated spade	M.B. Plough, Disc Plough, harrow, Rotavators, Leveller, Clod Crusher, Trencher, Bund former, Tractor operated tiller, ridger, furrower, manually guided power tiller operated rototiller
Planting	Manually/animal operated furrow opening, sett cutting, planting, application of chemicals, placement of fertilizers, covering of setts.	Bullock drawn planter, Tractor Drawn Semi Automatic Planter, Tractor Drawn Cutter Planter.
Weeding and Inter culture	Bullock Operated weeder mulcher, cultivator	Tractor operated cultivator, tiller, rotary cultivator, Lightweight power tiller, Self-propelled weeder mulcher, furrower.
Plant Protection	Manually operated sprayer	Tractor operated mist blower, sprayer, wide swath boom, High clearance sprayer, Tractor operated boom type sprayer.
Irrigation	Furrow Irrigation/Flood Irrigation	Drip Irrigation, Sprinkler Irrigation, Skip Furrow Irrigation
Harvesting System	Manual Harvesting with locally available knives Base cutting, De topping, De trashing and bundle making.	Tractor operated whole stalk, Self propelled Whole stalk, Self propelled billet type
Loading and Haulage	Manual loading to Bullock cart, tractor trailer and trucks	Tractor operated articulated trailers along with harvesters, Grab type loaders and trucks
Ratoon Management	Manual operated knives for stubble shaving	Tractor Drawn Stubble shaver cum trash mulcher, Tractor Drawn Rotary trash collector.

comfort and safety and also scarcity of labour during harvesting it is very essential.

In case of chopper harvesters, harvested cane has to be transported to sugar mills immediately within 4 – 8 hrs of harvesting directly by trucks.

Ratoon Management : Ratooning is a common practice in sugarcane cultivation. Ratooning is more profitable as compared to plant crop as land preparation and planting operation are not required. About 50 percent of Sugarcane area is under ratoon crop. Use of Stubble Shaver, with attachment for off baring and placement of fertilizer has been found to be effective for ratoon culture. For ratoon culture, incorporation of trash is very important. Trash management technology is to be developed in case of manual as well as mechanical harvesting systems for different conditions. In case of mechanical harvesting sugarcane is harvested from the bottom portion. However precautions should be taken that clump is not uprooted and under cutting is not done. It will affect adversely ratoon crop. In case of manual sugarcane harvesting bottom portion of sugarcane is left in the soil. Cost of mechanical stubble shaving is about 1/3rd as compared to manual practices followed for ratoon cultivation.

CONCLUSIONS

Mechanization of sugarcane cultivation has yet to play its role in India. Traditional tools and equipment are still common in use for Sugarcane cultivation. Size of holding is one of the reasons for low level of mechanization. Sugarcane planting and harvesting are the important area, which require introduction of sugarcane machinery, its refinement and adoption based on location specific requirements. Prototypes already developed need to be tried at different locations and commercialized after carrying our necessary refinements. Introduction of costly machinery through custom hire can help the sugarcane growers to get the benefits of mechanization.

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