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A review on sugarcane harvesting technology

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ABSTRACT

Sugar is an important strategic commodity for all countries of the world. Sugar after wheat is of strategic importance in Europe, Africa, the Americas, and Australia, while sugar is second only to rice for Asian countries. It was, therefore, necessary to pay full attention to sugary crops, especially sugar cane, to increase productivity and to bridge the gap between production and consumption by increasing the productivity of sugarcane. The main problem of sugarcane plantations is the harvesting process, this research includes most of the systems used to harvest sugar cane around the world to identify the advantages and disadvantages of operating in the systems. This research aims to survey most of the systems used in sugarcane harvesting around the world.

1. Literature review

Sugar cane harvesting systems

Braithwaite (2013); Tweddle (2013); Yinggang et al. (2013) reported that the classifications of the sugar cane harvesting systems are shown in Fig. 1.

1.1. Manual harvesting systems

In most sugarcane-producing countries the traditional method to harvest the crop is by hand. In green sugar cane, the stalks are topped, and the trash is removed, or the tops are removed only when the sugar cane is burnt by using a wide range of knives and detrashing devices (Meyer, 1997).

Meyer and Fenwick (2003) mentioned that there are two basic systems are used to harvest the sugar cane manually:

- Cut and stack green or burnt sugar cane as shown in Fig. 2.
- Cut and windrow green or burnt sugar cane for subsequent mechanical loading as shown in Fig. 2.

1.2. Mechanical Harvesting

The Agricultural Engineering Department of SASEX researched two main aspects of mechanized harvesting and harvesting systems:

1) Partial mechanization (semi-mechanization) in burnt and green sugar cane, primarily to ease the burden of manual harvesting and reduce the cost of harvesting operations.
2) Total mechanization (full mechanization). (Meyer, 1996)

Meyer and Fenwick (2003) summarized the average sugar cane cutter performance for various harvesting systems as in Table 1.

1.2.1. Fully mechanized harvesting systems

There are two main types of sugar cane harvesters researched in China as shown in Figs. 3 and 4.

1) Whole stalk harvester.
2) Chopper harvester, Fig. 3 shows the main components of these two main types of sugar cane harvester. (Yinggang et al., 2013).

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1.2.1.1. Self-propelled whole stalk harvester

Debeer (1974) reported that cane harvested as whole stalks has the inherent advantages of easy stock-piling on any reasonable surface and fairly extended storage capability without serious quality deterioration. An example of whole-stalk harvesters is the so-called "soldier-type" machine developed in Louisiana (Fig. 5). This harvester tops and base cuts cane while it is held tightly between sets of chains. These chains subsequently convey the cut cane to the back of the machine whereas many as six rows can be put into one windrow with the stalks at right angles to the direction of the rows.

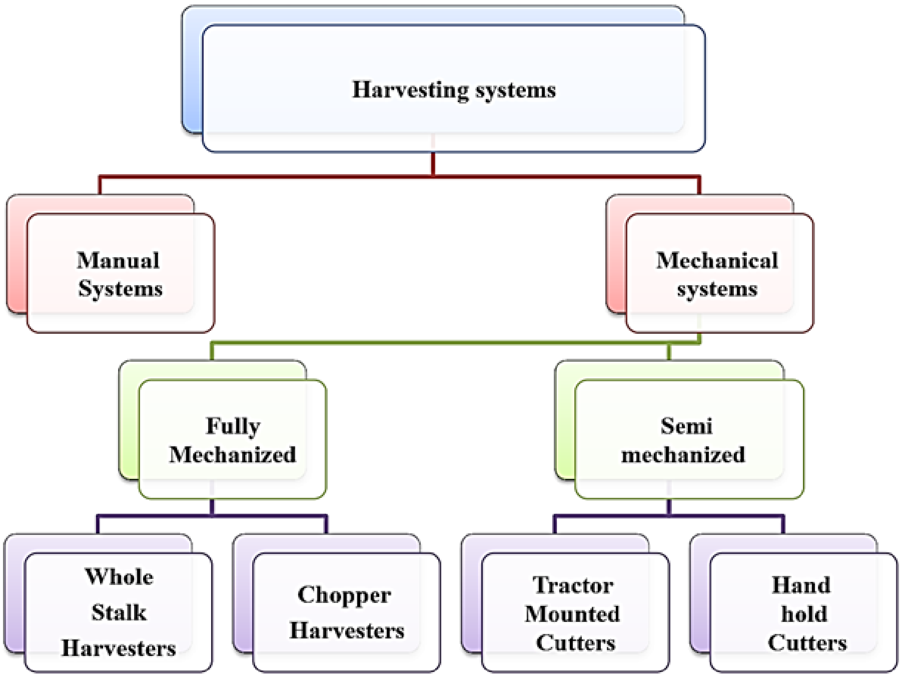
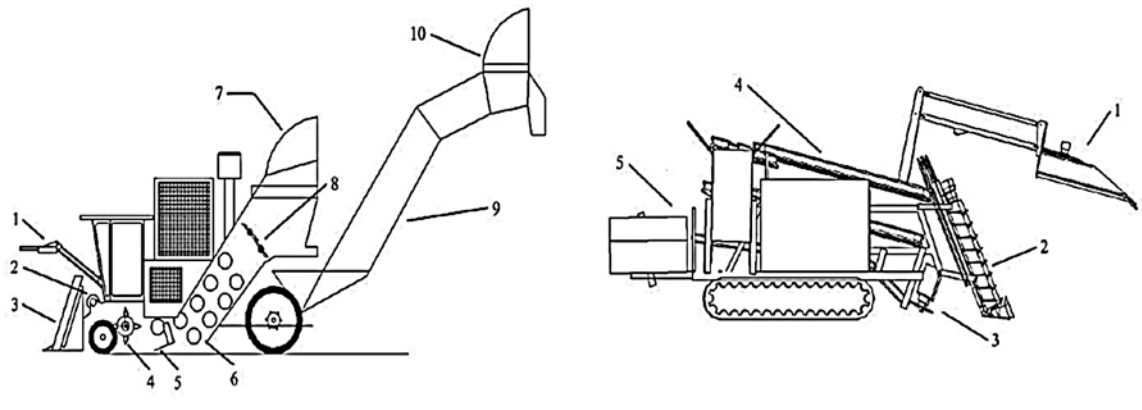


Fig. 1. Infield sugar cane harvesting systems (Braithwaite, 2013; Tweddle, 2013; Yinggang et al., 2013).

Fig. 2. Manual harvesting of green and burnt sugarcane (Chatterton and Braith, 1985).

Table 1.
Average sugar cane cutter performance for various harvesting systems (Meyer and Fenwick, 2003).

Harvesting system	Average cane yield (t\Fed)	Cutter output (t\day)	No. of cutter per 1000 tons
Cut and stack (green)	30.46	3.45	1.79
Cut and stack (burnt)	29.24	4.20	1.44
Cut and bundle (green)	31.07	5.58	1.07
Cut and bundle (burnt)	29.38	6.56	1.08
Cut and windrow (green)	39.02	8.01	0.99



1. Topper; 2. Knockdown roller; 3. Crop divider; 4. Fin roller; 5. Base cutter; 6. Feed roller; 7. Primary extractor; 8. Choppers; 9. Elevator; 10. Secondary extractor.

1. Topper; 2. Crop divider and lifter; 3. Base cutter; 4. Conveying devices; 5. Collector.

Fig. 3. Main components of sugar cane harvesters (Yinggang et al., 2013).

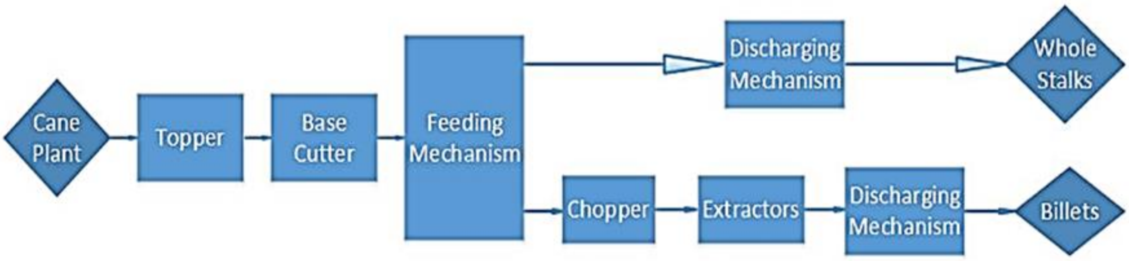
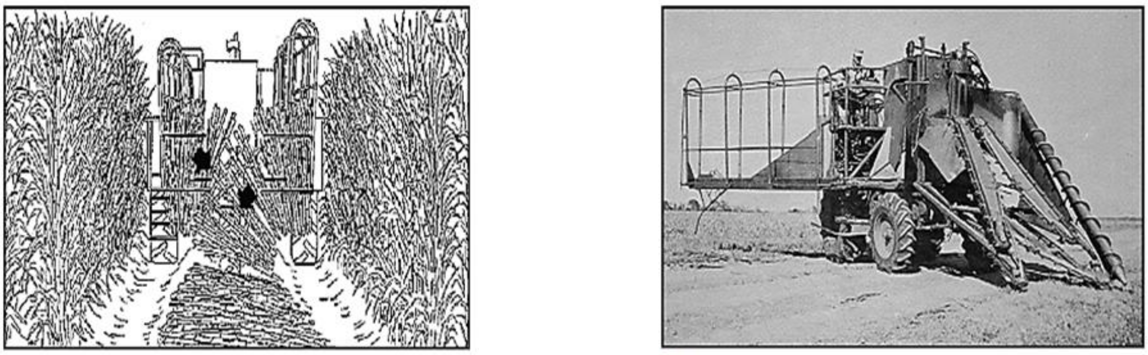


Fig. 4. Sugar cane flow in typical sugar cane whole stalk harvester and chopper harvester (Ma et al., 2014).



(a) (b)

Fig. 5. Harvesters that use the soldier harvesting principle (Louisiana). (a): Two-row; (b): One-row (Braunbeck and Paulo, 2014).

Scott (1986) investigated the necessary elements of a whole stalk harvester are:

a. Dividers gather the cane in the row being cut and separate it from the cane in adjoining rows.

b. Base-cutters to sever the cane at ground level.

c. A feeding device to take the cane from the base cutters and convey it through the machine.

d. A cleaning device to remove tops and discard trash.

e. A bin to accumulate cane and discharge it in neat piles, far enough from the cane face to allow passage of the machine on its next pass and onto the ground which has been cleared of trash.

Meyer (1997) and Rohit et al. (2015) reported the advantages and disadvantages for whole stalk harvester.

Advantages

- Generally, whole stalk harvesting machinery is cheaper to purchase.
- Whole cane stalks deteriorate more slowly than chopped cane and can be stockpiled for considerably longer at trans-loading sites or in mill yards.
- Where field and crop conditions are suitable whole stalk harvesting systems will result in less cane loss and better-quality cane compared with chopper harvesting. However, in badly lodged cane the situation could be reversed.
- Because the cutting and loading operations are conducted separately, there is more flexibility when breakdowns occur.
- In most instances, whole stalk cutters are simple machines that are easy to operate and require relatively unsophisticated maintenance staff and facilities.
- In South Africa, these harvesting systems permit the continued use of whole stalk loading, mill receiving equipment, vehicles, and facilities.

Disadvantages

- Whole stalk harvesters are not always able to handle the crop. Lodged and recumbent crops present extreme difficulties for this type of machine, as do yields over 120 t/ha.

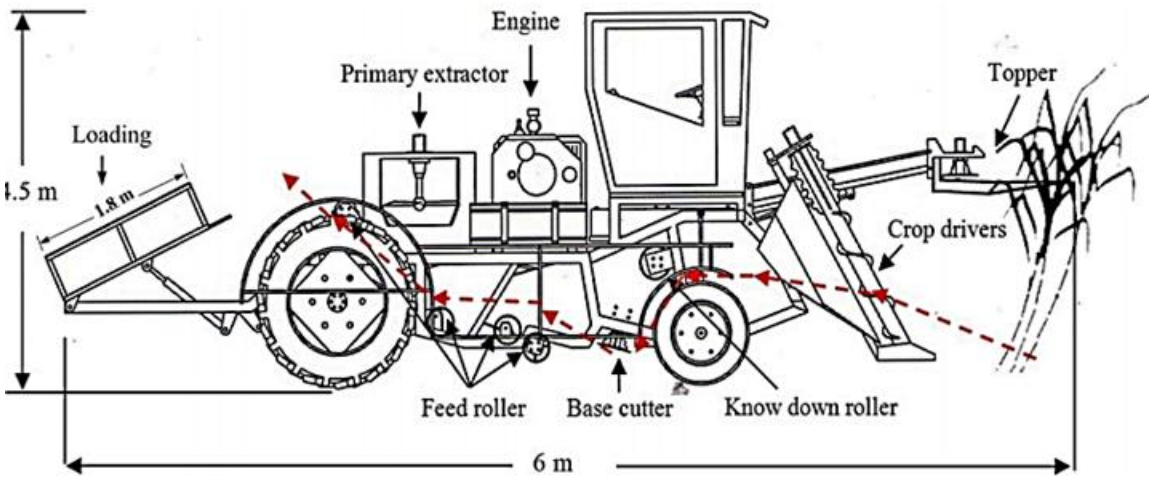


Fig. 6. Side view of the sugar cane harvester. (Yinggang et al., 2013)

- Separate infield loading equipment is required.
- Mechanical loading of whole stalk cane could increase soil content in the cane sample.
- Some whole stick machines (soldier harvesters) have a high center of gravity, making them unsuitable where slopes exceed10%. Most other whole stalk machines cannot operate on slopes greater than 15-20%.
- Transport load densities are usually lower for the whole stalk than for chopped cane.

Moontree et al. (2012) developed a sugar cane harvester using a small engine in Northeast Thailand as shown in Fig. 6. the sugar cane harvester using a small engine can perform at an average speed of 0.26 Fed/h with fuel consumption of 20.03 l/h and a mobile speed of 0.25 km/h. The percentage of sugar cane-cut stalks is 100% since this engine is installed with double blades with a speed of 1,090.5 rpm; a speed of leaf-cutting blades is at 669 rpm with the breakeven point of 122,572.8 kg/year and the payback period of 2 years.

1.2.1.2. *Chopper harvester (sugar cane combine)*

Rohit et al. (2015) stated that chopper Harvester's cut the sugar cane at the base and then it is Fed into the harvester where the cane is cut again into shorter pieces called billets with a size 20-40 cm. Mayer (1997) and Boast (1977) reported advantages and disadvantages of combine chopper harvesters:

Advantages

- Chopper harvesters are complete combines and do not require separate infield loading equipment.
- Modern combine harvesters can handle both green and burnt cane in a wide range of weather and crop conditions, from erect to badly lodged cane.
- In pollution, sensitive areas choppers harvesters have distinct advantages because of their ability to handle green cane.
- The delay between harvest and crushing is minimal, resulting in higher sugar recoveries.
- Chopped cane feeds into the mill more easily and consistently.
- Chopped cane spillage enroute to mills is usually lower than the whole stalk.

- Labor requirement is reduced.

Disadvantages

- The high capital outlay makes this system appropriate only for large-scale growers and contracting groups.
- Harvesting, transport, and milling operations are linked, which means that communication and transport scheduling is vital to obtain optimum harvester utilization.
- Receiving facilities at mills that usually handle whole stalks would have to be adapted.
- Cane losses are generally higher compared with whole stick harvesting systems.
- Chopped cane deteriorates more quickly than whole stalks and ideally, should be crushed within 12-14hours after harvesting. This may increase transport costs.
- High levels of managerial/operator skill and technical support are required.

1.2.2. Equipment of semi-mechanization sugar cane harvesting

1.2.2.1. Tractor mounted cutters

1) McConnel sugar cane harvester of Barbados

The McConnel harvester was a new concept in sugar cane harvesting, it was tested in commercial fields under a wide range of conditions, and it has recently been developed in (BSPA) Barbados by the Sugar Producers Association and F. W. McConnel Ltd., England. The stage (I) McConnel harvester is mounted on a standard 75 hp agricultural tractor. As shown in Fig. 7.

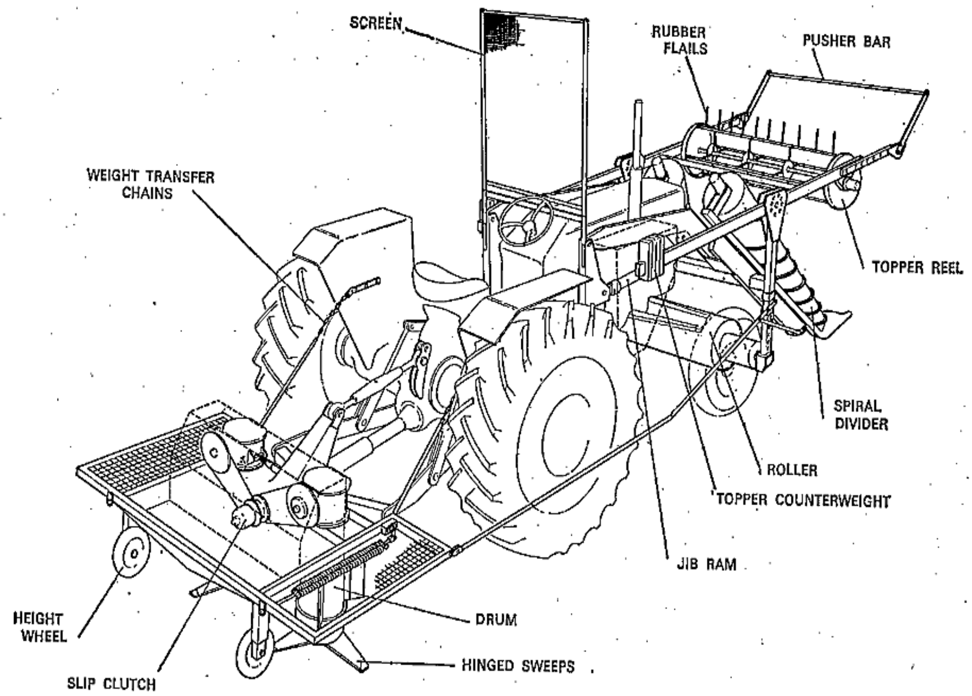


Fig. 7. General layout of McConnel (Hudson, 1974).

The mechanical problems of this machine were:

The prime mover and engine cooling, air cleaner, hydraulic system, and PTO. Power transmission systems can easily be solved by fabricating a prime mover to fit the field conditions and harvesting components (Alliso, 1974).

Hudson (1974) reported that the purpose of this machine is to reduce a standing crop of cane to an orderly swath of cut band topped stalks, freed from adhering trash. The more important demands which it must satisfy are that it must be:

- Able to cut unburned cane of up to 100 tons per hectare.
- Tolerant of rough-and-ready field preparation.
- Able to cut cane from furrows, ridges, tied furrows, or flat planting.
- Able to work in stony conditions.
- Competent to cut cane from any slope which can be negotiated by a wheeled tractor for other operations.
- Tolerant of variable row spacing and wide ratoon stools.

- Able to negotiate difficult headlands, in-field ditches, etc.
- Rugged in construction and undemanding in operator skill, maintenance, and local backup capacity.
- Priced within the capability of a 100-hectare farm.

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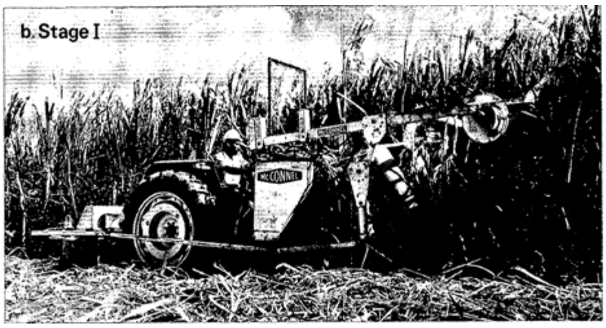
- Rugged in construction and undemanding in operator skill, maintenance, and local backup capacity.
- Priced within the capability of a 100-hectare farm.

Scott and Hudson (1980); Hudson (1977) report the main changes made to the BSPA/McConnel machines since they were described at the XVIth ISSCT Congress. In particular, the Stage (I) machine has been equipped with sharpened base cutter blades and mounted on a reversed tractor. Stage (II) now cleans trash and, tops on the bottom "fan" only with significant performance improvements. The cane is lifted to the conveyor from the gathering sweeps of a powered roller, instead of a stationary ramp, allowing work in more wet conditions. The "Loadster" has been simplified by eliminating the telescopic extension. Stage I and II are shown in Fig. 8.



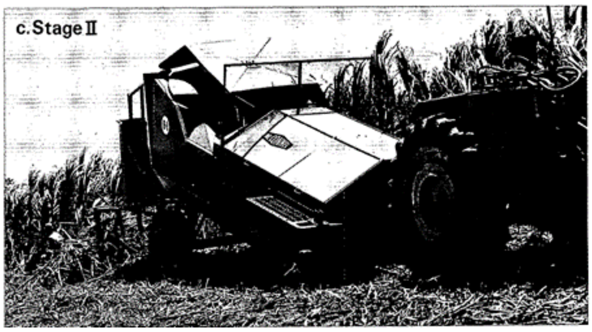


Fig. 8. The first and second stages of BSPA/McConnel machines (Hudson et al., 1976).

2) SASABY sugar cane harvester of South Africa

Boast (1985) and De Beer et al. (1983) reported that SASABY was developed in South Africa for green cane harvesting (Fig. 9) from January 1978 to December 1979.

The SASABY whole stalk green cane harvester was designed, built, and tested. A second SASABY was subsequently built to correct the shortcomings of the first. The SASABY (II) cut a single row of cane and fedd it into a bin. A crane with a grab mounted on the harvester loaded the cane directly from the 5in into trailers traveling alongside the harvester. This machine could harvest 30 t h^{-1} at which rate the extraneous matter content was 8% and losses were less than 5%. The experience gained from SASABY I and II was used to build a third prototype which is a smaller machine built onto a Ford 6600 tractor. It is a single-row harvester that delivered cleaned cane into a bin at the rear. Up to 200 kg of cane is collected before it is dumped in bundles on the ground.

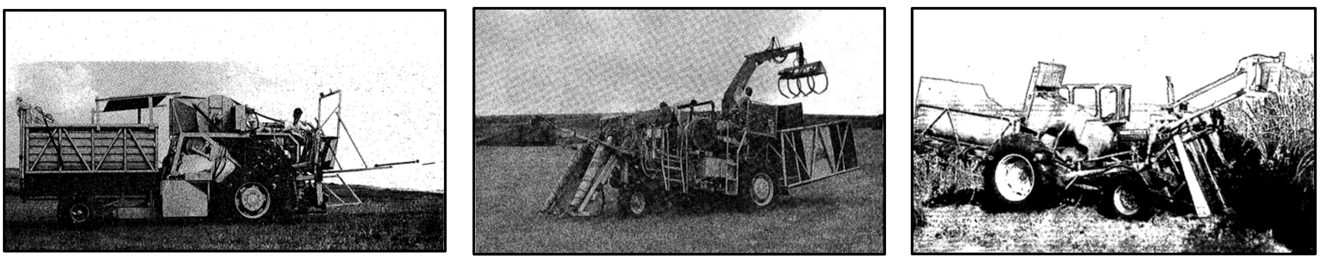


Fig. 9. First, second and third stages of SASABY harvester (De Beer et al., 1983).

3) Sasex sugar cane cutter

Pilcher and Merwe (1976) discussed the evolution of the Sasex cutter for the whole stalk sugar cane. The original concept was a very simple machine known as the "Cane Sny" (Fig. 10). From this was developed an economical cane cutter able to operate under a wide range of conditions. It is claimed that the Sasex can significantly reduce harvesting costs and labor requirements. The concept of the Sasex Cane Cutters originated from a machine known as the "Cane Sny". This machine was designed by Mr. Frans Snyman of Nkwaleni and further developed on the rivers bend Sugar and Citrus Estates. When the Cane Sny was first inspected in mid-1974 it was extremely simple. The machine was mounted on the three-point linkage of a tractor, with the base cutter set out beyond the right-hand rear tractor wheel. The mainframe of the machine comprised a random selection of channels and angles and the cane gathering frame was of tubular steel, being lifted for transport by a hydraulic ram. The base cutter was a 61 cm diameter scalloped harrow disc mounted on a 51 mm shaft which was carried in Plummer block bearings and driven by 4 Beta Vee belts through a Massey Ferguson PTO-driven belt-pulley gearbox.

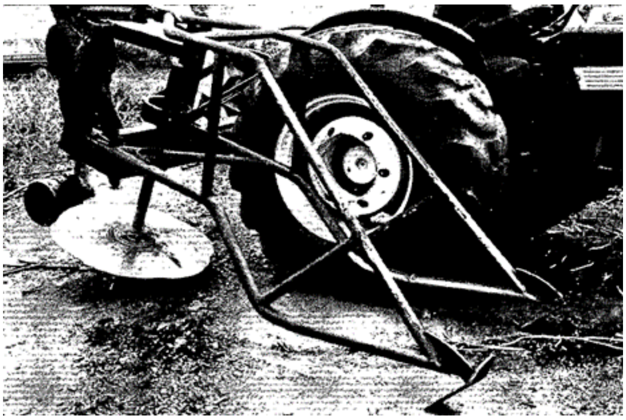


Fig. 10. Cane Sny Cutter after fitting depth wheel (Pilcher and Merwe, 1976).

Sasex (I) had a mainframe made of 152 x 76 mm RS channels welded toe to toe to form a 152 x 152 box section. This was hinged behind the right-hand tractor wheel so that the whole machine could fold up behind the tractor for transport. The considerable overall width of side-mounted machines had caused trouble on narrow farm roads and even when traveling on national roads. Hinging the beam overcame this problem as shown in Fig. 11.

It was found that, when the base cutter jammed, the belts would slip and, because they were horizontal, they would sometimes jump off and the crop lifters were not effective in heavy, lodged cane and the small diameter, particularly at the bottom, encouraged weeds and trash to build up around them, which usually resulted in jamming. They were also underpowered.

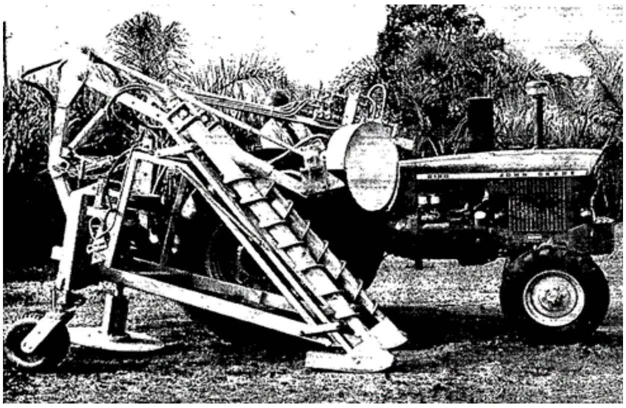


Fig. 11. SASEX (I) Cane cutter (Pilcher and Merwe, 1976).

Sasex (II) was built by using a 127 x 127 mm beam made up of channels welded toe to toe. A mistake was made here in putting the joint in the vertical plane instead of the horizontal. To save weight the left-hand end of the beam was used as part of the oil tank, by which approximately 26 extra liters of capacity were gained, together with a good increase in surface area. However, the beam cracked, which resulted in oil leaks, partly because of its wrong orientation and partly because insufficient attention had been paid to the welding preparation: In addition, a small oil tank was used to save weight but there were no signs of overheating of the oil until a later stage when a different pump was fitted to serve extra motors as shown in Fig. 12.

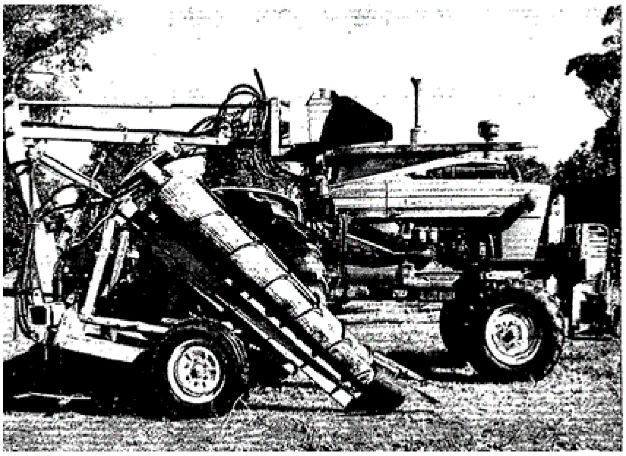


Fig. 12. SASEX (II) cane cutter with sausage shifter (Pilcher and Merwe, 1976).

Van der Merwe et al. (1978) showed the disadvantages of Sasex sugar cane cutter: It can be understood that if each row of cut cane is left on the ground, as the tractor moves to the right to cut subsequent rows, unless the row spacing is exactly right, there is a possibility of the tractor wheels, to a lesser or greater extent, running over cane already cut. This effect is accentuated when operating on hillsides where the sausage tends to slide out of position. The other big disadvantage to the side-mounting was the drag imposed when attempting to cut recumbent cane. This would slew the tractor and steering was made difficult and sometimes impossible.

4) Edgecombe cane cutter

Merwe et al. (1978) reported that the Edgecombe cane cutter (Fig. 13) was born to overcome the disadvantages of the side-mounted Sasex and build an in-line machine using the same components of the Sasex machine. An attractive feature of the Sasex was the ease with which it could be attached and removed from a tractor. An attempt was made with the Edgecombe cutter to retain this feature and the cutting part of the machine was mounted on a quickly detachable frame. The machine was mounted on a John Deere 2120 2-wheel drive tractor. It had crop lifters, a topper, and base cutters from the Sasex but was mounted on a new frame. The machine was intended to cut single rows more than 1.3 m apart and double rows at lesser spacing. The base cutters, toppers, and crop lifters were all driven hydraulically, and the oil tanks and pumps were mounted on a frame carried on the three-point linkage, to counterbalance, to a degree, the weight of the machine on the front wheels.

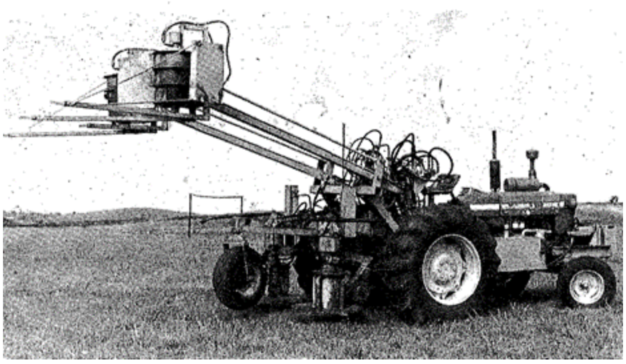


Fig. 13. Edgecombe cane cutter, general view (DE Beer, 1980).

Disadvantages

- An important problem was the loss of base cutter blades in stony fields. The best solution so far has been to weld the blades onto the base cutter disc in addition to bolting them on. The quality of base cutting was good in light and heavy soils with no discernible stool damage.
- Ridges were more of a problem than an advantage, especially in lodged cane where the base cutters were unable to retrieve recumbent stalks lying right next to the ridge. Ridged fields were also a distinct impediment to across-the-row mechanical loading and more cane was left behind by the loader in ridged fields than in fields with a flat culture.

5) Midway sugar cane cutter

Debeer (1980) and Meyer (1984) stated that the design of the Midway cutter was the result of experiences gained in operating the Sasex and Edgecombe cane cutters. It was felt that an improved cutter could be developed by retaining the simplicity of the Sasex and eliminating the problems caused by mounting it on the side of a tractor or by rear mounting an Edgecombe cutter. The location of the base cutter and the operator's poor visibility made it difficult to maintain proper base cutting height with both the Sasex and Edgecombe cutters. An advantage of the Midway cutter is that the cane tops are collected which makes it possible to load the cane mechanically directly after it has been cut. The machine was tested and developed at the Experiment Station's La Mercy farm from 1978 to 1982 as shown in Fig. 14.

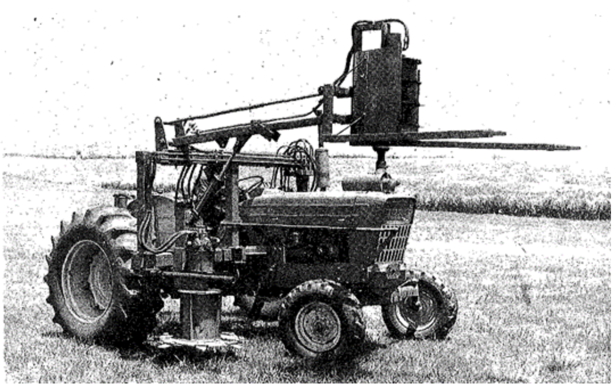


Fig. 14. General view of the first prototype of the midway cane cutter (Debeer, 1980).

The Midway cutter can top, and base cut a single row of burnt or green cane. The cane stalks are left in a single 'sausage' windrow parallel to and between two cane rows. The tops may be collected in a bin if so required. The prime mover is a Ford 5000 tractor which is fitted with a county reduction gearbox to give a wider range of forwarding speeds. Power steering and 305 mm rear wheel spacers are used. The wheels are spaced for maximum stability and to assist the operator in controlling the cutting height of the mid-mounted base cutter. Wheel spacing is such that the cut cane lying on the ground is not trampled. The only other modification to the tractor is that the cooling fan is reversed but none of the tractor controls are altered.

6) Bell (cut + stacks)

Boast (1986) and Merwe et al. (1978) described the modifications that were required to convert a standard, high-capacity Bell loader to a cane cutter and the use of this machine in various harvesting systems. Base cutter assemblies that had been previously tested were mounted in the best position for this machine (Fig. 15). Two rows of cane were cut simultaneously which enabled the machine to open a field at any convenient point and cut any chosen face of the field in any direction without damaging the cane which was still standing or had already been cut into a 'sausage' windrow. Time studies were done to establish the output of the machine when used as a cane cutter fitted with Sasex-type toppers. The results were compared with the output of the machine when the cane was cut without topping and the tops were removed with a sickle bar topper during the loading operations. The weaknesses and disadvantages of the system were identified, and the necessary modifications were either carried out or they were recorded for future reference. The cutting operation had a high forward speed which necessitated the development of 'ground following base cutters, which automatically follow the ground profile. The mechanization standards for cane harvesting as in Table 2.

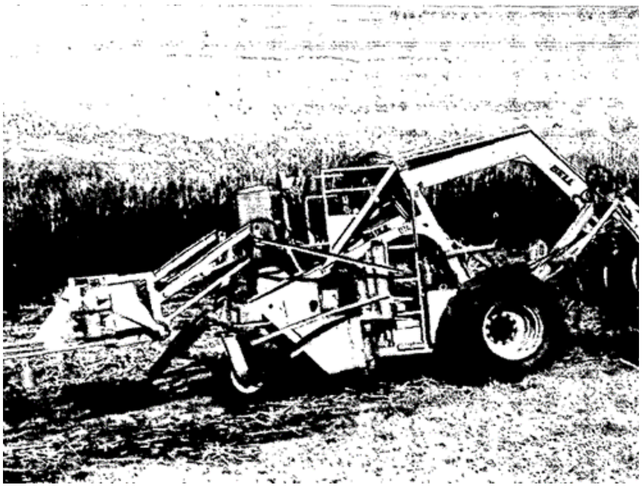


Fig. 15. Bell cutter with attachments. (Bosat, 1986).

Table 2
Mechanization standards for cane harvesting (Debeer and Fourie, 1984).

Operation	Tons\field hours	Fuel consumption, l\h.kW	Topping efficiency, %
Edgecombe	25	0.26	49
Midway	20	0.29	44
Sasex	14	0.37	50
Bell (cut + stack)	7	0.62	43

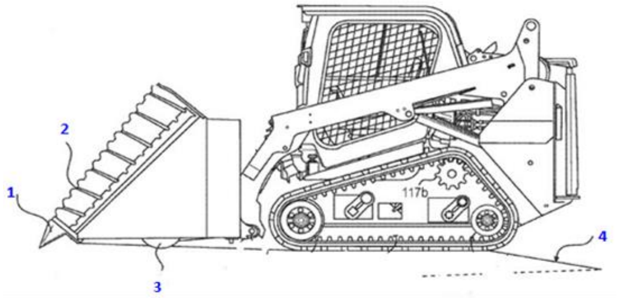
7) Other tractor-mounted sugar cane harvesters

Al Sharief et al. (2006) design and manufactured a sugar cane harvester. The sugar cane harvester consists of two main units, namely, the tractor front-mounted crop divider and topping unit, and the rear-mounted base cutter unit. The crop divider and topping unit as mounted on the tractor front are shown in Fig. 16. The crop divider system consists of two rotary dividers made of 2 mm thick metal sheets which were cut, folded, and welded into conical pipes with the ends closed using flat discs. Each divider has a spiral rod welded in windings to the body to form a conveying system. A driveshaft runs through each divider and is integrated into it by welding at the ends of the pipe. Each divider is mounted vertically with the lower end shaft running in a bearing enclosed by the base shoe. The upper-end shaft runs through a bearing carried in a housing that is mounted vertically on a square pipe, into a hydraulic motor, which is powered by a hydraulic system held in position on the tool frame.

Results of the tests showed that the effective field capacity ranged from 0.4 to 0.5 ha/h and decreased with an increase in crop density and extent of stem lodging. In the high crop density fields, the field efficiency averaged 65.82 %. It, however, increased with a decrease in crop density and stem lodging. The material capacity increased from 7.75 to 21.04 t/h as the crop yield increased from 15.48 to 53.28 t/ha. The topping unit efficiency was significantly affected by crop density and extent of stem lodging, while the base cutter efficiency was not significantly affected.

Fig.16. Sugar cane harvester attached to the tractor (Al Sharief et al., 2006).

Parker and Speichinger (2014) designed and fabricated a sugar cane harvester machine. In one aspect, the disclosure provides a removable sugar cane harvester attachment including a coupler configured to couple the removable sugar cane harvester attachment to a machine. The removable sugar cane attachment includes at least one pair of counter-rotating row dividers; and at least one pair of counter-rotating base cutters located intermediate of the coupler and the at least one pair of counter-rotating row dividers (Fig. 17).



(1) Pointed conical tip; (2) Pair of row dividers; (3) Guide wheels; (4) Surface ground.

Fig.17. Sugar cane harvester attached to the tractor (Al Sharief et al., 2006).

Ranveer and Tambuskar (2015) designed a cutting front attachment and rear conveying attachment to be appended to a tractor (Mahindra Yuvraj 215) which will cut the sugar cane and convey it to a trolley that will follow the tractor. This attachment will work as a sugar cane harvester which can be used for a smaller area of farms especially in India where the area of farms is smaller, unlike the developed countries where huge price & cost cane harvesters are affordable to the farmers. Also, to design a smaller sugar cane harvester at a lower price so that it can be affordable to the farmers or group of farmers of India.

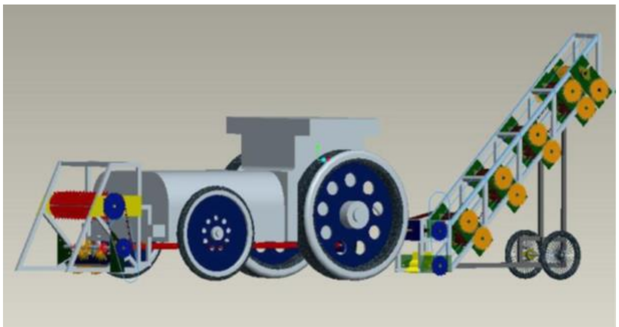


Fig.18. Assembly of sugar cane harvester (Ranveer and Tambuskar, 2015).

***1.2.2.2. Walking*-man steering sugar cane cutters:**

Meyer et al. (2011) stated that the sugar cane thumper can be used in both burnt and green cane, with the cane being windrowed or stacked by hand, as in the manual cutting system as shown in Fig. 19.

Adarsh et al. (2013) were Designed a small-scale sugar cane harvesting machine as shown in Fig. 20. Different parts of a machine will be mounted on strong chassis. The wheels will be attached to this chassis so that it can be moved on the farm. The petrol engine is mounted on the chassis which provides the power to the wheels to move using a gear and chain mechanism and it also provides the power to the cutter. The shaft of the gearbox and the shaft which is connected to the wheels are interconnected using gear and chain mechanism to provide variable speed. The pulley is connected to the output shaft of the engine which intern connected to the front pulley which is mounted on the shaft by using a belt then by using bevel gear the power is transmitted to the cutter shaft.

Fig.19. Walking-man steering sugar cane cutters (Meyer et al., 2011).

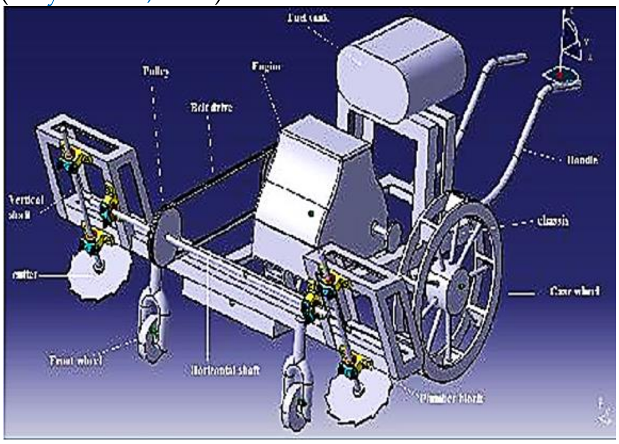


Fig. 20. 3D Model of Sugar cane Harvesting Machine. (Adarsh et al., 2013).

Pachkhande et al. (2015) designed and fabricated a small semiautomatic sugar cane cutter as shown in Fig. 21. Different parts of a machine will be mounted on strong chassis. The wheels will be attached to this chassis so that it can be moved on the farm. The machine is pushed through the field manually to perform cutting action. The guides/ram is provided in front of the machine to lift abruptly grown sugar cane. Ergonomics is given importance as it involves pushing action. The cutter is driven with the help of a belt and pulley arrangement. The pulley is mounted on the shaft of the motor which drives another pulley and shaft arrangement to which cutter is attached. V-belt is used to avoid slip factors.

Siddaling and Ravaikiran (2015) Designed and fabricated a small-scale sugar cane harvesting machine as shown in Fig. 22. The Fuel from the tank is supplied to the Engine and the power is generated to the shaft inside the engine. The driver sprocket which is attached to the engine shaft rotates the driven sprocket through a chain drive mechanism. The driven sprocket that is connected to the longer shaft will transmit the power to either side of the bevel gears through the shaft. The longer shafts will be mounted between the two plumber blocks which provide support to the shaft. The rotating bevel gears are in turn connected to the cutters through vertical rods which rotates the cutters. In this way, the small-scale sugar cane harvesting machine works. The operations involved are simple and easy to operate.

Fig.21. Conceptual CAD model (Pachkhande et al., 2015).

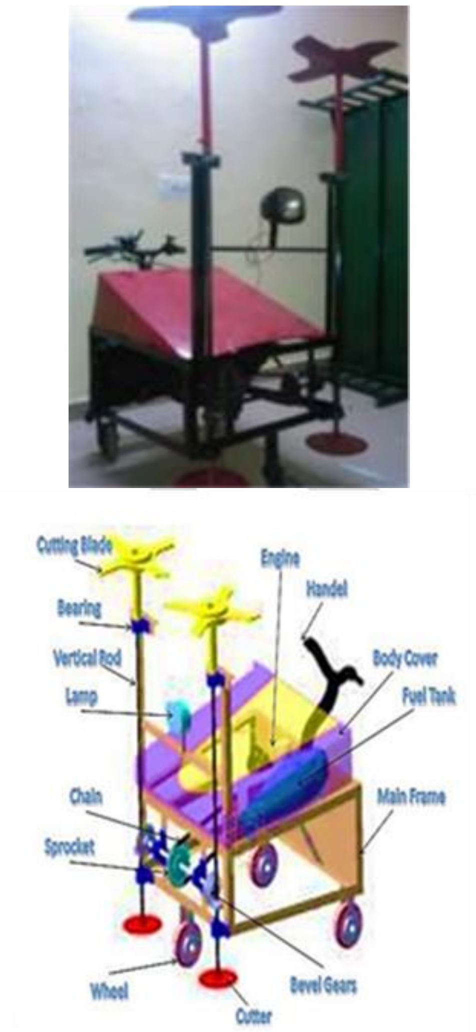


Fig. 22. Sugar cane harvesting machine, (Siddaling and Ravaikiran, 2015)

2. Conclusions

Harvesting is a crucial component of the sugarcane production system. In this paper, we conducted a literature review on sugarcane harvesting technologies in the context of both sugar and biofuel production. This review paper is a small work towards analyzing sugarcane harvester machine aspects for economical harvesting which will help to minimize the working fatigue and to reduce labor costs.

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دراسة مرجعية لتكنولوجيا حصاد قصب السكر

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الملخص العربي

يعتبر السكر سلعة استراتيجية مهمة لجميع دول العالم. حيث يأتي السكر في المرتبة الثانية بعد القمح لما له أهمية استراتيجية في أوروبا وإفريقيا والأمريكتين وأستراليا، بينما يحتل السكر المرتبة الثانية بعد الأرز بالنسبة للدول الآسيوية. لذلك كان من الضروري إيلاء الاهتمام الكامل للمحاصيل السكرية، وخاصة قصب السكر، لزيادة الإنتاجية وسد الفجوة بين الإنتاج والاستهلاك من خلال زيادة إنتاجية قصب السكر. المشكلة الرئيسية لمزرعة قصب السكر هي عملية الحصاد، هذا البحث يتضمن أغلب الأنظمة التي تستخدم في حصاد قصب السكر حول العالم للتعرف على مزايا وعيوب التشغيل في الأنظمة. يهدف هذا البحث إلى عمل حصر لأغلب الأنظمة المستخدمة في حصاد قصب السكر حول العالم.