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CONSTRUCTING AND EVALUATION OF PROTOTYPE SHELLING MACHINE FOR SUGAR CANE LEAVES

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ABSTRACT

The objective of the present study is to construct and evaluate sugar cane shelling machine to be used in sugar cane juice shops. Shelling machine was fabricated on a private workshop in Dosuq city and experiments were carried out at Sakha Agriclture Research Center during summer season 2008 to state the effect of stalk moisture content, feeding and shelling speeds on shelling performance (shelling efficiency, machine productivity, specific energy and shelling cost).

Some physical and mechanical properties for sugar cane stalk variety Giza 54-9 were also measured. The obtained data helped in designing and manufacturing the proposed shelling machine.

Results showed that, the optimum operating conditions of the proposed prototype was at feeding speed of 500 r.p.m, shelling speed of 1200 r.p.m and stalk moisture content of 61.73%. Whereas it gave shelling efficiency of about 76.14% specific energy of 1.625 kW.h/ton and acceptable machine productivity of 0.670 ton/h. Also the cost calculations indicated that the manual shelling of sugar cane is about 4.51 times of mechanical shelling.

INTRODUCTION

Sugar cane (Saccharum officinarum) is one of the important sugar crops in the world. It ranks as the first of the world sugar cone crops. In Egypt sugar cane is planted in Upper Egypt in two seasons, autumn and spring. The growing area of sugar can is about 281,749 feddans with an average production of 49.2 ton/fed. (ESSE, 2002 in Arabic).

A sugar cane plant gas a leafy appearance because of the abundant tillers and the numerous nodes, each of which produces a leaf. The stalks are covered with a layer of wax that forms a band at the top of each internode. The leaf blade is green, sometimes with a purplish cast. The leaf sheath folds around the stem and serves as a protection to the bud. About 20 to 30% of total crop is leaves and tops (Martin *et al.,* 1976). The mechanical cleaning and gently shelling a fine and hardness rind surrounding the sugar cane stalk has not been used yet in Egypt for the post harvesting at the sugar cane juice shops.

The human system in sugar cane cleaning or detracting is vulnerable to extreme conditions in the physical environment. The environment can be alter a worker's ability to perform. Excessive heat over long period of time cause physiological changes that not only lead to seriously impaired performance, but also may results in injury or even death. The higher work strain gives indication of low productivity, the use of human work should be decreased and replaced with more mechanization, the sooner and the better.

Due to the greatest convergence between the leaf removal or detaching machine design and shelling of sugar cane machines deals with leaf removal and detachers can be considered of highly importance in designing and constructing sugar can machines.

Mornor *et al.,* (1983) reported that, the detaching device used for the removal of leaves from sweet sorghum can be used for sugar cane detaching. They used a device of rubber fingers to remove leaves from standing stalks.

Clark and Odshall (1988) describe the chemical composition of sugar cane as depicted in Table (1).

Table (1): Chemical composition of sugar cane stalk

Parameter	% in cane weight
Water	73-76
Solids	24-27
Souluble solids	10-16
Fiber (dry)	11-16

Srivastiva and Sinch (1990) stated that, in order to develop a power operated detracting unit for harvested sugar canes, the basic configuration of a machine consisting of a sugar cane conveying unit, a set of positive feeding spongy rollers. They added that the system was initially developed for low velocity, less than 1.5 m/s.

The ASAE (1994) provide sufficient technical data for the uniform physical application of belt drives to farm machines and mobile industrial equipment that contributes in designing of simple and economical derives. This standard establishes acceptable manufacturing tolerances, methods of measuring, and proper application for derives using V-belts and V-ribbed belts.

El-Nakib *et al.,* (1996) studied some physical and mechanical properties of sugar cane mainly: stalk dimensions, mass, number of buds, curvature, hardness and coefficient of friction and their relation to mechanization. They found that, the average length and diameter of the sugar cane stalk for the Egyptian variety were 178 cm and 2-3 cm respectively, the average stalk radius of curvature was 560 cm. The sugar cane stalk hardness was 755 centi-N, and the average coefficient of friction were 8.8, 7.6 and 8.9 degree for wood, rubber and steel, respectively.

Snich (1997) reported that the necessity of supporting a load in the presence of relative motion presents one of the most important of design problems. The motion may be either translatory or rotary and load may be radial, axial or both radial and axial. The machine part used for this purpose is known as a bearing. Thus a bearing may be defined as a machine member whose function is to support and retain a moving member. The part of the shaft in the sleeve is called the journal.

The objective of the present study is to construct and evaluate sugar cane stalk shelling machine.

MATERIALS AND METHODS

1. Materials:

The present study was devoted to construct and evaluate sugar cane stalk shelling machine. It was fabricated at private workshop in Dosuq city and experiments were carried out at Sakha Agriculture Research Center during summer season 2008. The machine consists of three main parts attached on the main frame by means of ball bearing and fixed by bolts. The specifications of shelling machine are indicated in Fig. 1 and Table 2.

Table 2: The specifications of shelling machine:

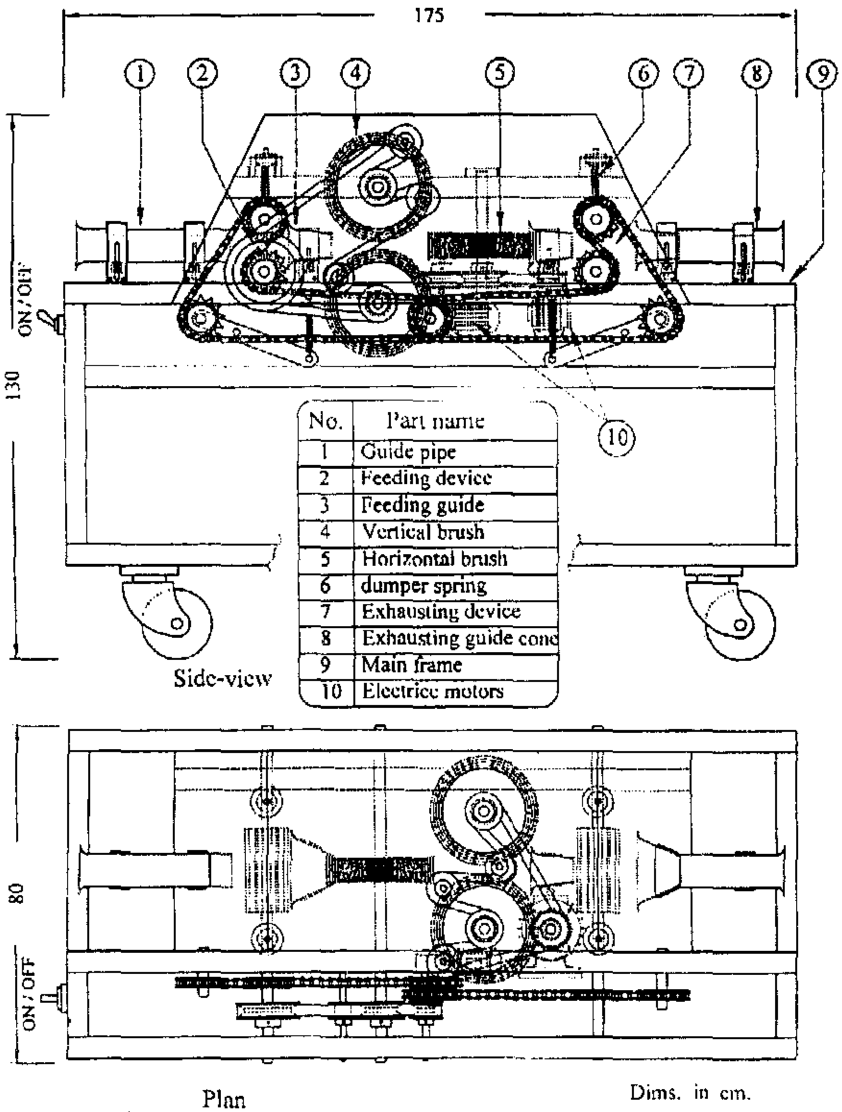
Items	Shelling machine
-Length, cm	175
-Width, cm	80
-Height, cm	130
-Mass, kg	225
-Source of power, kW	
Main motor	1.50
Auxiliary motor	0.40
-Diameter of feeding and exhausting rollers, cm	10
-Diameter of cleaning rollers, cm	20
-Length and diameter of feeding guide pipe, cm	35 and 8
-Length and diameter of exhausting guide cone, cm	35 and 20-8

a) Frame:

The frame was reinforced with four corners. It was manufactured from angle bars of 5 × 5 × 0.5 cm. This frame includes elements to fix hitching systems, feeding device, shelling device (vertical and horizontal rollers), exhausting device, power transmission system and the two electrical motors.

b) Feeding device:

The feeding device consists of plastic guide pipe with a dimension of 8 cm in diameter and 35 cm in length followed by two pulling rollers have a dimension of 10 cm in diameter and 20 cm in length. Hence the two rollers were covered with corrugated rubber cover according to (Mornor *et al.*, 1983) to facilitate the movement of cane stalks and to avoid the problems occurred from the variations in diameter for the same stalk. The two rollers rotate in opposite directions whereas the lower one is fixed and the upper one is movable against spring damper. The pulling rollers feeds the stalks through guide pipe which subsequently transfer them into the shelling device.



No.	Part name
1	Guide pipe
2	Feeding device
3	Feeding guide
4	Vertical brush
5	Horizontal brush
6	dumper spring
7	Exhausting device
8	Exhausting guide cone
9	Main frame
10	Electricc motors

Fig. 1: Side view and plan of sugar cane stalks shelling machine.

c) Shelling device:

The shelling device including two groups of rollers covered with metal brushes with 3 cm length. They were installed perpendicular to each other to allow high shelling efficiency of cane stalks. The two rollers of each group rotate in opposite direction.

d) Exhausting device:

The exhausting device consists of plastic guide pipe with conic shape and a dimension of 20 to 8 cm in diameter and 35 cm in length as mentioned in feeding device. It rotates with the same speed as the feeding device to allow sugar cane stalk to through outside the machine.

e) Power transmission device:

Two different size of electric motors were used to operate the shelling machine. The main one has a power of 1.5 kW and the auxiliary with 0.4 kW. The main motor drives the feeding and exhausting devices by the assortment of various sizes of sprockets and chains. However, the vertical shelling device was driven by using pulley and "V" belt takes its motion from the lower roller (fixed) of the feeding device. Also, the auxiliary motor drives the horizontal shelling device by means of pulleys and "V" belt.

The proposed prototype was used for shelling sugar cane stalks variety Giza 54-9 and its physical properties are shown in Table 3. Tests were carried out three different feeding speeds of 400, 500 and 600 r.p.m. and four various shelling speeds of 600, 800, 1000 and 1200 r.p.m for both vertical and horizontal shelling devices with three different levels of stalk moisture content of 61.73, 67.18 and 75.56% on wet basis.

Table 3: Average, maximum, minimum, standard deviation and coefficient of variance for cane stalks.

Parameter	Mass, kg	No. of nodes	Length, m	Diameter, mm		
				Bottom	Middle	Top
Max.	1.33*	21.00	1.98	31.20	28.17	24.62
Min.	0.77	13.00	1.46	20.75	18.64	15.00
Avg.	1.03	15.60	1.81	22.25	20.50	17.45
S.D.	0.25	3.59	11.38	3.69	4.99	3.84
C.V%	21.60	184.76	15.91	17.13	18.50	15.60

* Each reading indicated in the table is an average of ten samples.

2. Methods

a) Stalk curvature:

It was considered as an arc and the following equation can be used for calculating the stalk curvature according to Oberg *et al.*, (1982).

$$rc = \frac{(2c_1)^2 + 4(h_s)^2}{8h_s} \quad \text{---------------------------} \quad (1)$$

Where:

rc = radious of the most serious curvature on the sugar cane stalk, cm.

c_1 = the smallest dimension, (cm) from the position of h_s to any end of the stalk as indicated in Fig. 2.

h_s = the distance from the center of the stalk cross section at top of the curvature to the straight line that passes through the two ends of the sugar cane stalk, cm.

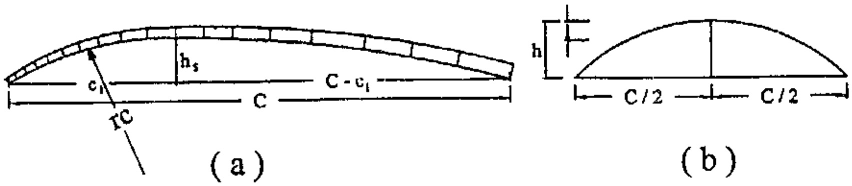


Fig. 2: Sugar cane stalks curvature (a) and stalk center of gravity (b).

b) Sugar cane stalk center of gravity:

The curved stalk was assumed to be an arc and the location of the center of gravity relative to the center of the stalk cross section could be calculated according to (Oberg et al., 1982), as indicated in equation 2.

$$I = \left(\frac{1}{3}\right) h \quad (2)$$

Where:

I = distance from the location of the center of gravity to the center of sugar cane stalk cross section, cm.

h = distance from the center of stalk cross section at the top of stalk curvature to the straight line passing through the two ends of the sugar cane stalk, cm.

c) Coefficient of friction:

Rolling angle was measured by using an inclined plan with three types of surfaces (steel, wood and rubber) and two positions. Position "a" at the long axis of sugar cane stalk was laid parallel to the direction of motion was laid vertical to the direction of motion. By placing the sugar cane stalk on the horizontal surface of the inclined plan one by one and gradually increasing the surface angle of inclination until the sugar cane stalk being to roll, the recorded angles for positions "a" and "b" are considered the rolling and sliding angles of sugar cane stalk, respectively. Hence the coefficient of static friction μ was determined by using the following equation according to Mohsenin (1968):

$$\mu = \tan \theta \quad (3)$$

Where:

θ = The angle that sugar cane stalk begins to slide on a specific surface.

d) Shelling efficiency:

Shelling efficiency was determined as the shelling area of cane stalk surface relative to the total surface area of the stalk in cm^2 using transparent sheet divided into square of 1 cm^2 area. Shelling efficiency was calculated by using the following equation:

$$m = (A_1/A) \times 100 \quad (4)$$

Where:

A_1 = sugar cane leaves shelled area in cm^2.
A = total leaves area in cm^2.

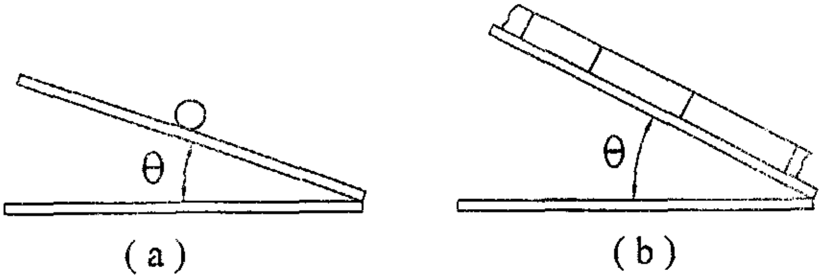


Fig. 3: The angle of friction rolling and sliding.

e) Stalk moisture content:

Five samples were taken for each storage day and the moisture content of stalk were determined according to the ASAE standard (1994) using oven method at 70 °C for 24 hours.

f) Power requirements:

An ammeter and voltameter were used for measuring current strength and potential difference, before and during experiments, respectively (Readings of ampere (I) and volt (V) were taken before and during each treatment). The power consumption (W) was calculated by using the following formula according to Draxler et al., (1987)

Power requirement (W) $= \sqrt{3}\ IV \cos\phi$ ---------------------------------- (5)

Where:

I = current strength, Amperes;
V = potential difference, Volt, and
$\cos\phi$ = power factor, decimal (being equal 0.71).

g) Specific energy requirements (kW.h/ton):

It was calculated by multiplying the consumed power (kW) by the time (h) and then dividing by the machine productivity (ton).

h) Machine operation costs:

The machine operation costs were calculated according to (Younis, 1997) as follows:

Fixed costs:

- Depreciation = (original cost- salvage value)/mechanical life. LE/year Salvage value is 10% of original cost.
- Interest = Interest rate × (original + salvage value)/2, L.E/year. Shelter, taxes insurance = 4% of original cost.

$$\text{Total fixed cost} = \left[\frac{\text{Depreciation + Interest + Shelter taxes and insurance}}{\text{Hours of use per year}}\right], \text{L.E/h} \text{ ------ } (6)$$

Variable costs:

-Repairs and maintenance = 5.77% of original cost / hours of use per year, L.E/h as mentioned by (Bowers, 1987).

-Electricity cost =Maximum power consumed, (kW/h) × electricity price, L E. /h.
-Greasing = 2 × 0.25 / No. of hours per day, L.E./h.
-Labor cost =2 L.E./h
-Total Variable costs =(Repair + Electricity + Greasing + Labor), L.E./h.
The cost of production (CP) was calculated by using the following formula:
(P = Total coals/Machine productivity. L.E./ton. -------------------------------- (7)

RESULTS AND DISCUSSION

1. Physical and mechanical properties of sugar cane stalks:
a. Sugar cane stalk dimensions:

The sugar cane stalk length and diameter represents the most important factors that affect the construction of shelling machine. Table (3) summarizes the average length and diameter of the sugar cane stalks. The average stalk length was found to be 1.81 m with standard deviation of 11.38 and coefficient of variations of 15.91%. Also, the stalk diameter was measured to estimate the clearance between the feeding rollers, shelling and exhausting devices. Also the average diameter of sugar cane stalk were 22.25, 20.5 and 17.45 mm for bottom, middle and top of sugar cane stalks, respectively with standard deviation of 3.69, 4.99 and 3.84 obtained at the same mentioned above positions. They had coefficient of variation of 17.13, 18.50 and 15.60 for the same positions.

b. Stalk mass:

The mass of sugar cane stalk was measured and the data are presented in Table (3). The average of mass stalk was 1.03 kg with standard deviation of 0.25 and coefficient of variation of 21.60.

c. Stalk curvature:

Table (4) shows the average of sugar cane stalk curvature. It was expected to be an effective factor on the machine performance if the radious of the curvature is small. So, the larger the stalk radious of curvature the smaller the distance between feeding, shelling and exhausting devices. Hence the average stalk curvature was 377.8 cm.

Table 4: Sugar cane stalk curvature and center of gravity

Rep. Np.	L_s (cm)	L_b (cm)	d (cm)	c_1 (cm)	h_s (cm)	Curvature r_c (cm)	Center of gravity l, cm
1	188	85	2.5	75	8	347	2.67
2	195	96	2.2	61	5	369	1.67
3	191	87	2.4	62	4	478	0.8
4	186	83	2.6	76	3	230	1
5	175	82	2.3	75	6	465	2
Avg.	187	86.6	2.4	69.8	5.2	377.8	1.628
Min.	175	82	2.2	61	3	230	0.8
Max.	195	96	2.6	76	8	478	2.67

L_s : Length of stalk.
L_b : Location of center of gravity from the bottom and the location of the center of circular cross section of the stalk.

d. Sugar cane stalk center of gravity:

The curved sugar cane stalk was assumed to be arc and the location of the center of gravity to the center of the sugar cane stalk cross section was calculated and indicated in Table 4. The location of the stalk center of gravity from the bottom end of the stalk L_b recorded 86.6 cm for the tested variety. This means that, the center of gravity is 6.9 cm from the middle of the stalk toward the bottom of the stalk. The location of the center of gravity of the curved stalk from its transverse circular cross section I was 1.63 cm toward the inner side of the curvature.

e. Coefficient of friction:

Coefficient of friction for rolling and sliding were calculated and indicated in Table (5) for rubber, wood and steel surfaces. The average values of coefficient of friction (μ) were 0.135, 0.151 and 0.154 for rolling tests, while they were 0.453, 0.339 and 0.391 for sliding tests respectively for the three above mentioned surfaces.

Table 5: The rolling and sliding of 30 cm sugar cane sets on the surfaces of rubber, wood and steel

Material	Rolling angle (degrees)			Sliding angle (degrees)		
	Mean	SD	μ*	Mean	SD	μ*
Rubber	7.71	3.055	0.135	24.37	4.987	0.453
Wood	8.59	2.762	0.151	18.74	3.128	0.339
Steel	8.76	4.210	0.154	21.35	4.381	0.391

* Coefficient of friction between sugar cane and the studied surfaces ($\mu = \tan\theta$).

2. Shelling efficiency:

Figure 4 shows the effect of sugar cane stalk moisture content, feeding and shelling speeds on shelling efficiency. It was found that, the increase of feeding speed from 400 to 600 r.p.m decreases the shelling efficiency from 80.75 to 75.46, 75.40 to 70.81 and 65.50 to 63.67% at shelling speed of about 1200 r.p.m with stalk moisture contents of 61.73, 67.18 and 75.56%, respectively. This reduction in shelling efficiency may be due to the increase in feeding rate with the higher feeding speeds. However, the same increase in feeding speeds decrease the shelling efficiency at all shelling speeds and the lowest value of shelling efficiency was 5.60% with speed ratio for feeding and shelling of about (1:1) and stalk moisture content of 75.56%.

In the same manner, increasing the shelling speeds from 600 to 1200 r.p.m increases the shelling efficiency by 7.37, 9.04 and 6.87% with feeding speed of about 400 r.p.m and stalk moisture contents of 61.73, 67.18 and 75.56%, respectively. Also, the same increase in shelling at all feeding speeds and stalk moisture contents.

On the other hand, the increase of stalk moisture content from 61.73 to 75.56% tends to decrease the shelling efficiency from 75.21 to 61.29, 77.04 to 62.15, 79.23 to 63.98 and 80.75 to 65.50 with feeding speed of 400 r.p.m and shelling speeds of about 600, 800, 1000 and 1200 r.p.m, respectively. The same trend was obtained with the other feeding speeds. Results also ahowed that, the highest value of shelling efficiency of 80.75% was obtained with stalk moisture content of 61.73% feedind speeds of 400 r.p.m and shelling speed of 1200 r.p.m.

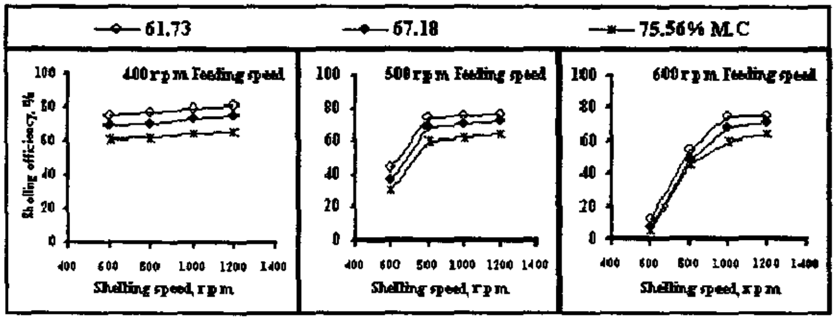


Fig. 4: Effect of shelling, feeding speeds and stalk moisture content on shelling efficiency.

3. Machine productivity:

Data presented in Fig. 5 illustrates the effect of sugar cane stalks moisture content, feeding and shelling speeds on machine productivity. It is conceivable that, the machne productivity was increased by increasing feeding speed, shelling speed and the stalk moisture content. Whereas, the increase of feeding speed from 400 to 600 r.p.m tends to increase the machine productivity by 26.23% with shelling speed of 600 r.p.m and sugar cane stalk moisture content of 75.56%, respectively. The same increase in feeding speeds tends to increase the machine productivity with all shelling speeds and sugar cane stalks moisture contents.

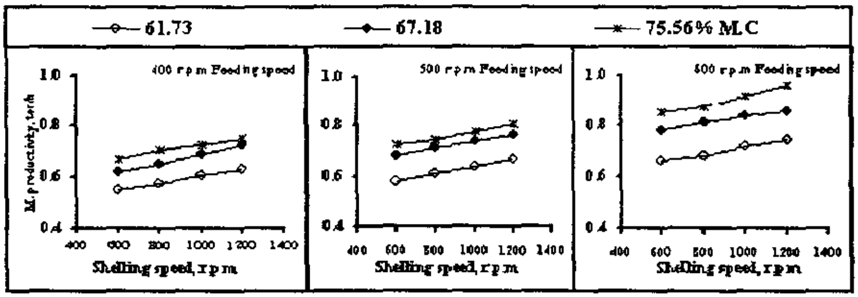


Fig. 5: Effect of shelling, feeding speeds and stalk moisture content on machine productivity.

The obtained results showed that, the increase of shelling speed from 600 to 1200 r.p.m tends to increase the machine productivity from 0.550 to 0.632, 0.581 to 0.670 and 0.660 to 0.745 ton/h with stalk moisture content of 61.73% and feeding speed of 400, 500 and 600 r.p.m, respectively. The same trend was noticeable with the other stalk moisture contents and feeding speeds.

However, the increase of stalk moisture content from 61.73 to 75.56% leads to increase the machine productivity from 0.550 to 0.671 ton/h with feeding speed of 400 r.p.m and shelling speed of about 600 r.p.m the same trend was obtained with the other feeding and shelling speeds.

4. Specific energy:

The obtained results in Fig. 6 indicated that the effect of sugar cane stalks moisture content, feeding and shelling speeds on specific energy. It can be stated that, the increase of feeding speed from 400 to 600 r.p.m tends to increase the specific energy from 1.485 to 1.796, 1.523 to 1.829 and 1.617 to 1.852 kW.h/ton with shelling speed of 600 r.p.m and stalk moisture contents of about 61.73, 67.18 and 75.56%, respectively.The same results were obtained with other shelling speeds and stalks moisture contents.

Moreover, the increase of stalk moisture contents from 61.73 to 75.56% increas the specific energy by 8.89, 2.22 and 3.12% with shelling speed of 600 r.p.m and feeding speed of 400, 500 and 600 r.p.m, respectively. Hence, the same tendency was obtained with other feeding speeds.

Meanwhile, the increase of shelling speed from 600 to 1200 r.p.m decreases the specific energy from 1.485 to 1.462, 1.758 to 1.625 and 1.796 to 1.695 kW.h/ton with stalk moisture content of 61.73% and feeding speeds of 400, 500 and 600 r.p.m, respectively. This trend may be due to the increase of machine productivity at moisture content. The other shelling speeds gave the same above mentioned trend.

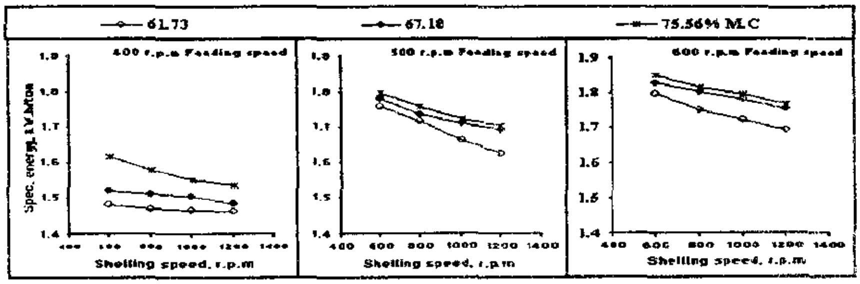


Fig. 6: Effect of shelling, feeding speeds and stalk moisture content on specific energy.

Table 6: Effect of feeding and shelling speeds on shelling efficiency, machine productivity, specific energy and shelling costs with sugar cane stalk moisture content of 61.73%

Stalks moisture content, %	Feeding speed, r.p.m	Shelling speed, r.p.m	Shelling efficiency, %	Machine productivity, ton/h	Specific energy, kW.h/ton	Shelling Cost, L.E/ton	
						Mechanical	Manual
61.73	400	1200	80.75	0.632	1.462	7.91	35.75
	500	1200	76.14	0.670	1.625	7.46	
	600	1200	75.46	0.745	1.695	6.71	

5. Shelling cost:

The resuls in Table 6 showed that, the increase of feeding speed from 400 to 600 r.p.m increases both the specific energy from 1.462 to 1.695 kW.h/ton and the machine productivity from 0.632 to 0.745 ton/h. Also, the shelling efficiency decreases from 80.75 to 75.46% at the same mentioned above conditions, respectively. Moreover mechanical shelling resulted a drastic reduction of about 77.87% in comparison with manual shelling.

CONCLUUSION

From the above results, it can be concluded that:

1. The highest value of shelling efficiency of 80.75% was obtained at feeding and shelling speeds 400 and 1200 r.p.m respectively and stalks moisture content 61.73%. Meanwhile, the lowest value of specific energy of 1.462 kW.h/ton was noticeable under the above mentioned condition.
2. Machine productivity of 0.745 ton/h seems to be acceptable under the optimum operating conditions.
3. Manual shelling costs is about 4.52 times of mechanical shelling.
4. The optimum operating conditions of the shelling machine were between feeding speeds of about 500 r.p.m, shelling speed of 1200 r.p.m and stalk moisture content of 61.73%.

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الجمعية المصرية لمصدرى قصب السكر "ESSE" (٢٠٠٢). المجلس المركزى للمحاصيل السكرية – وزارة الزراعة.
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تصنيع وتقييم نموذج أولى لتقشير أوراق قصب السكر

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معهد بحوث الهندسة الزراعية – مركز البحوث الزراعية – الجيزة – مصر.

يعتبر محصول قصب السكر من أهم المحاصيل السكرية فى مصر، حيث يستهلك الشعب المصري حوالي ٦,١٪ من إجمالى المساحة المنزرعة والمقدرة بحوالي ٢٨١٧٤٦ فدان كعصير مثلج. ومن ناحية أخرى فإن ميكنة تقشير القصب تسهم إلى حد كبير فى رفع الجهد عن العمالة اليدوية والتى قد تتعرض للإصابة بجروح خطيرة أثناء عملية التقشير. كما تساهم الميكنة فى الحفاظ على المنتج نظيفاً خالياً من التلوث والإصابات الفطرية والميكروبية على حد سواء.

ولتحقيق هذا الهدف فقد تم تصنيع وتقييم ماكينة تقشير قصب السكر لاستخدامها فى محلات العصير والتى تتكون من وحدتي التغذية والطرد ووحدة التقشير. وقد قيمت الآلة من خلال العوامل التالية:–

١. ثلاثة سرعات دورانية لبكرات التغذية هى ٤٠٠ ، ٥٠٠ ، ٦٠٠ لفة/دقيقة.
٢. أربعة سرعات دورانية لإسطوانات التنظيف وهى ٦٠٠ ، ٨٠٠ ، ١٠٠٠ ، ١٢٠٠ لفة/دقيقة.
٣. ثلاثة مستويات لرطوبة سيقان القصب وهى ٦١,٧٣ ، ٦٧,١٨ ، ٧٥,٥٦٪ على أساس رطب.

وقد تم دراسة تأثير العوامل السابقة على المتغيرات التالية:–

– كفاءة التقشير. – إنتاجية الآلة. – الطاقة المستهلكة فى التشغيل. – تكاليف التشغيل.

ويمكن تلخيص النتائج المتحصل عليها كما يلى:

١. أعلى قيمة لكفاءة التقشير ٨٠,٧٥٪ عند سرعة بكرات التغذية ٤٠٠ لفة/دقيقة وسرعة اسطوانات التنظيف ١٢٠٠ لفة/دقيقة ومحتوى رطوبى لسيقان القصب ٦١,٧٣٪. بينما كانت أقل طاقة مستهلكة ١,٤٦٢ كيلو وات ساعة/طن عند نفس ظروف التشغيل السابقة.
٢. بلغت إنتاجية الآلة إلى ٠,٧٤٥ طن/ساعة من خلال ظروف التشغيل المثلى السابق ذكرها.
٣. انخفضت التكاليف اللازمة لتقشير طن القصب بالآلة إلى ٨ جنيهات بالمقارنة بالعمالة اليدوية والتى وقدرة بـــ ٣٥,٧٥ جنيهاً للطن.

وبناءاً على ما سبق يمكن التوصية باستخدام الآلة فى عملية تقشير القصب عند سرعة بكرات التغذية ٥٠٠ لفة/دقية وسرعة اسطوانات التنظيف ١٢٠٠ لفة/دقيقة ومحتوى رطوبى لسيقان القصب ٦١,٧٣٪ حيث أعطت أفضل كفاءة تقشير بأقل طاقة مستهلكة.