Zagazig J. Agric. Res., Vol. 35 No. (1) 2008 123-143

DEVELOPMENT OF A SELF- PROPELLED SMALL ROTARY MOWER

El- Shal, M. S.[1], M. A. Hassen[1], W. M. Mikhail[2] and A S. Mahmoud[2]

[1]Agric. Eng. Dept., Fac. of Agric., Zagazig Univ., Zagazig, Egypt.
[2]Agric. Eng.Res. Instit., Agric Res. Center.

Accepted 21/10/2007

ABSTRACT: The need is felt towards an inexpensive and dependable mower to suit the local conditions. So that, this study was carried out to develop and evaluate a simple rotary mower as a mechanical device used in mowing clover crop and cutting cotton and corn stalks. The mower was tested with three shapes of cutter blades, four forward and rotary speeds. Evaluation parameters were actual field capacity, field efficiency, cutting efficiency, fuel consumption, energy required and cost. The results obtained from this study showed that circular saw 80 teeth gave Actual field capacity 0.125, 0.13 and 0.121 fed/h; field efficiency 88.6, 89.7 and 87.1 %; cutting efficiency 83.8, 95.4 and 87.8 %; fuel consumption 1.49, 1.71 and 2.35 L/h; energy required 39, 45.5 and 68.1 kW.h/fed; Cost 86.9, 85.9 and 98 L.E./fed. for mowing clover crop and cutting corn and cotton stalks respectively.

Key word: Mower, rotary mower, free cut, impact cut, knife geometry and cutting efficiency.

INTRODUCTION

More than 50% of the holdings in Egypt are less than five feddan. The small size of land holdings causes certain difficulties in using the big and medium size of agricultural machinery.

Van rest (1970) indicated that the equipment which could increase productivity with little or change in cultural practices could find ready acceptance in emerging nations.

Prased and Gupta (1975) found that the energy requirements for cutting maize stalks were observed to be minimum at about 23° bevel angle. In addition, they stated that a knife approach angle at 32° was observed to be optimum corresponding to minimum value of energy requirements for maize stalks.

El-Nakib (1985) used a rotary cutter shredder in cutting cotton stalks. The performance of the machine was investigated by changing the forward speed. The length of the cut stalks and the height of stubbles were measured for the evaluation. The results obtained from this investigation can be summarized as following: A low speed of 1.65 km/h gave clean cut with short Stubbles of 8.1 cm height. A high speed of 6.3 km/h on the other hand, gave a ruptured cut with longer Stubbles of 18.7 cm mean height. Lower speeds proved to give finer stock. Raising the speed from 1.65 to 6.3 km/h reduced the fineness from lengths of 2.5 to 17.5 cm.

Majumder and Datta (1983) studied kinematics of single rotary blade in rice harvesting. They found that the ratio between velocity of machine (V_m) and blade peripheral velocity (V_b) is as follow ($V_b/V_m \geq 2\pi r/nh$) {n= number of teeth in blade}. Thus, this ratio is useful parameter for ascertaining whether proper cutting is achieved. This is dependent on the blade specification like angular velocity of blade (ϖ), tooth depth (h) and radius of blade (R) thus, for certain blade specification there exists a minimum value of (V_m/V_b) below which the machine should not be operated.

Guzel and Zeren (1990) studied some properties of rotary cutters produced by some small agricultural machinery factories in the Cukurova region of Turkey. These machines work according to the free cutting principal. The rotary cutter is a blade system, which pivots horizontal on the vertical shaft and moves on the field. Because of this study, some basic engineering data were determined for rotary cutters. The cutting system consists of four blades with a clearance angle of 90^0. Peripheral velocity of the blade is changed between 60-80 m/s, and running speed is about 800-1000 r.p.m.

Awady *et al.*, (1986) investigated the performance of rotary harvester in cutting cotton stalks by changing the forward speeds and the cutter cover. The rotary harvester was tested with a cutting saw have 25 cm dia., from 600 to 1500 r.p.m. and 60 teeth. The height of stubbles and the number of remaining uncut stalks were registered for the evaluation.

They found that in general, rotary harvester proved to function satisfactorily in cotton stalks harvesting under the test condition. For the machine used, low speed of 0.75 km/h gave clean cut with high cutting efficiency of 93.3%. A high speed of 1.35 km/h, on the other hand, gave a ruptured cut with low cutting efficiency 83.35%. Forward speed of 1.15 km/h gave optimum rate of performance and field efficiency. The machine needed no cutter cover to enable watching the cotton stalks during cutting.

Imbabi (1992) designed and developed a rotary harvester to be suitable for the reaping of sesame in the Egyptian farmer circumstances. The designed rotary harvester was subjected to field experiments to set up a comparative analysis of the qualitative parameters. The designed and manufactured harvester was tested and evaluated with taking into consideration the following: Single and double cutter discs having 9, 12 and 16-inch diameter, different forward speeds and different rotary speeds. The results could be summarized as: height of plant stubble after cutting ranged from 9.1-11.9 cm, field capacity ranged from 0.1-0.2 fed/h, field efficiency ranged from 70-90%, the energy requirements ranged from 100-400 kW.h/fed and the cost was ranged from 15.81 to 59.58 L.E./fed.

McRandal and McNulty (1980) indicated that the typical velocities employed by rotary mowers were in the range of 71-84 m/s, where the way of cutting was by using an impact cutter with a single high-speed cutting element.

Cuplin (1975) stated that the chief advantages of rotary mower are ability to work at a high forward speed and the fact that the cutting mechanism is very free from blockages and leaves a high swath, which has not been chopped into short lengths.

Morad (1981) investigated the energy required to cut cotton and alfalfa using self propelled harvester and rotary mower in comparison with small hoe and sickle tools respectively. The cutting energy was found to be affected by moisture content, knife velocity, forward speed, and plant variety. Inertia force is affected by the square of knife velocity resulting in a sharp increase of cutting energy. Forward speed is directly proportional to the harvesting rate, expressed either as weight of harvest per unit time or as area per unite time.

The main objective of this study was to develop a proper rotary mower that would meet the needs of small farms under Egyptian condition.

MATERIALS AND METHODS

A sample rotary mower was fabricated to suit the Egyptian farmers. The mower consists of the following units the main assembly drawings and part details were presented in Fig.1 and Fig. 2.

Power Source

The machine was supplied its power from a hand tractor of (14 hp).

Transmission

To transmit the power from the real part of the hand tractor to the front part where the cutting unit was fixed, it was necessary to make some modifications. These modifications include designing and manufacturing three shafts, four pulleys, two helical gears and three super gears; as a result, the power was transmitted to the cutting unit through three stages.

The first stage

The power was transmitted from the source of power (p.t.o.) to the main shaft through pulley-belt drive system. The two pulleys have the same diameter of 90 mm. The main shaft is 1090 mm length and 31 mm diameter, it rotates horizontally through two units of (205) bearing house.

The second stage

The power was transmitted from the main shaft to the gearbox (two units) through pulley-belt drive system; the first pulley has a diameter of 300 mm, while the second one is 90 mm diameter to give increasing ratio of 1:3.3.

The third stage

The power passed through the gearbox, which consisted of two units. The first one, which was used to convey the power from the horizontal axial to the vertical axial, contained two helical gears; each of them has 15 teeth. The second unit contained three spur gears; each gear has 28 teeth. The central gear, which was 110 mm length, fixed at the end of the first unit shaft, while the two other gears, which were 30 mm length, fixed to the cutting shafts; each shaft was 420 mm length and 28 mm diameter. The two cutting shafts rotated through four units of (206) bearing house; they also could move up and down by sliding on the central gear to control the cutting length.

Cutting Unit

The cutting unite consisted of two cutter discs (200 mm diameter and 2 mm thickness) as a smooth edge, which pivoted to the lower end of the cutting shafts. The discs were replaced by two circular saws (20 mm diameter, 2 mm thickness and 45 teeth) and by two circular saws (20 mm diameter, 1.05 mm thickness and 80 teeth) as a serrated edge. The different shapes of cutter blades were shown in. Fig. 3.

During 2005-2006 seasons, field experiments were carried out at the Faculty of Agricultural Experimental Farm, Alexandria University, to evaluate the modified mower. The selected field crops for mowing trials were clover, corn and cotton stalks.

The clover crop was Meskawey variety {Giza 6} was planted in an area of two feddan. The field was divided into basins by borders and canals, basin area was 175 m^2. The average plant population in the study was about 800 plants per square meter. The average moisture content of the plants was 75%. The average stem length was 77 cm.

As to corn and cotton crop the experimental area was about four feddan. The field was formed in basins by borders and canals; basin area was 35 m^2, a sample of 100 plants was taken randomly to measure length, diameter and moisture content of stalks, the moisture content of stalk was determined by the standard oven methods. The samples were obtained by cutting the stems directly above the soil. The stems weighted and oven dried to a constant weight at 105 ^{0}C. Table 1 shows cotton, corn and clover characteristics.

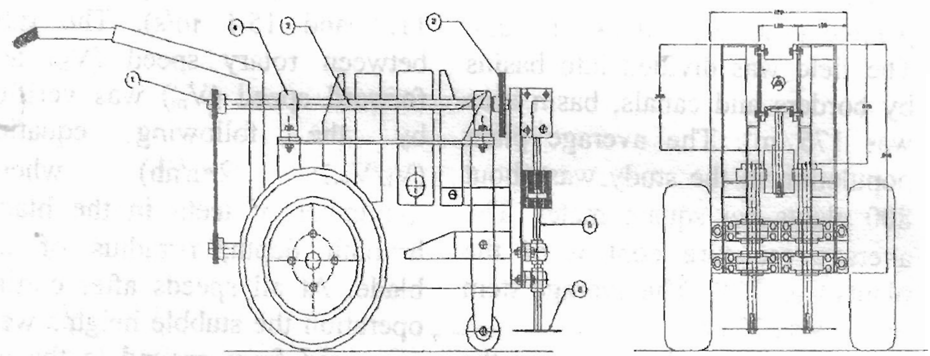
Four forward and rotary speeds were used; the forward speed was measured through traveling distance {30 meter} of machine for a period of time. Forward speeds were 0.7, 1.12, 1.54, and 1.96 km/h, while rotary speeds of cutter blades were 560, 840, 1120 and 1440 r.p.m.(5.9, 8.8, 11.7 and 15.1 m/s). The ratio between rotary speed (V_b) and forward speed (V_m) was verified by the following equation ($V_b/V_m \geq 2\pi r/nh$) where: n=number of teeth in the blade, h=tooth depth, r=radius of the blade. At all speeds after cutting operation the stubble heights were measured from ground to the cut surface. Table 2 shows the ratio between rotary speed and forward speed (1), where ($2\pi r/nh$) Was 1.7 for circular saw 80 teeth and 1.3 for circular saw 45 teeth

Table 1. Characteristics of cotton, corn and clover crops.

Crop	Cotton	Corn	Clover
Varity	Giza 70	Giza 2	Giza 6
Stalks height, m	1.15	1.98	0.77
Stalks diameter, cm	0.8	2.2	0.4
Intensity(per hill)	2	1	--
Distance between rows ,cm	70	70	--
Distance between plants, cm	20	25	--
Moisture content %	35.1	19	75

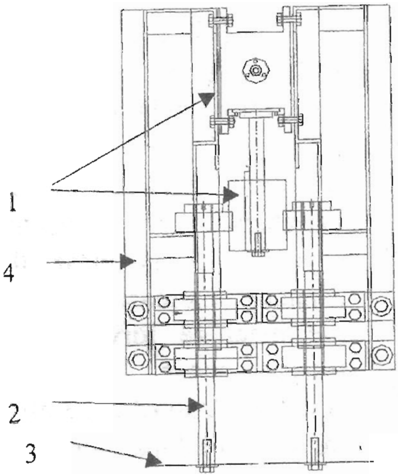
Table 2. The ratio between rotary speed (V_b) and forward speed (V_m).

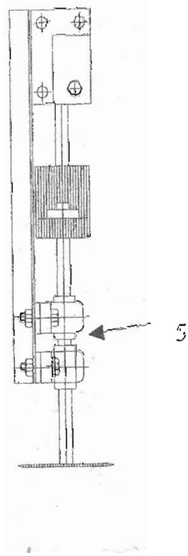
Rotary speed, r.p.m.	Forward speed, km/h.			
	0.7	1.12	1.54	1.96
	Kinematic parameter (λ)			
560	30.1	18.8	13.7	10.8
840	45.2	28.3	20.6	10.8
1120	60.3	37.7	27.4	21.5
1440	77.5	48.4	35.2	27.7



1 Drive pulley
2 Driven pulley
3 Main shaft
4 Ball bearing
5 Cutter shaft
6 Cutter blade
Dim/Scale :mm/1:8

Fig.1. The main assembly for the small rotary mower.





1 Gear box
2 Cutting shaft
3 Cutting blades
4 Frame (40*40)/5
5 Ball bearing (206)
Dim/S. mm./1:2

Fig. 2 The cutting unit details

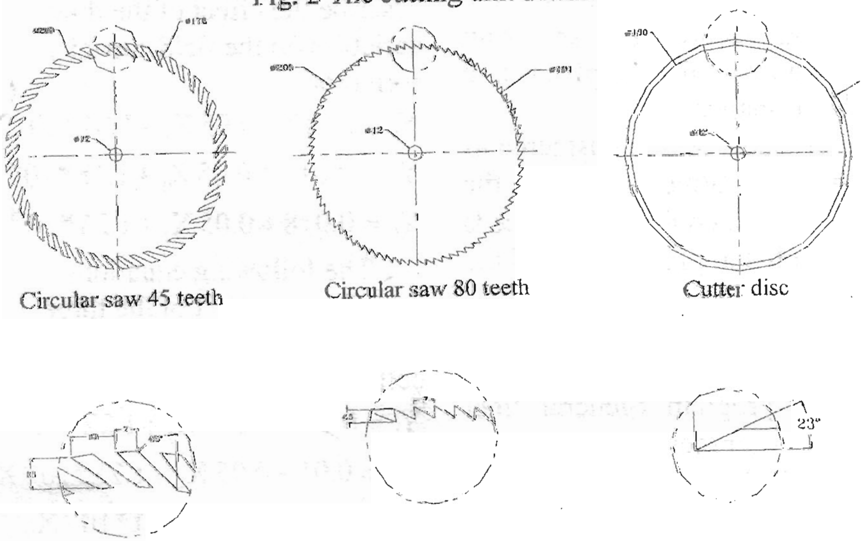


Fig. 3. The different shapes of cutter blades.

To evaluate the performance of the machine some parameters like actual field capacity, field efficiency, cutting efficiency, fuel consumption, energy required and cost were estimated.

The experimental design

The field experiments were carried out to study the effect of the following variables on the machine performance:

1. Machine forward speed (0.7, 1.12 1.54, and 1.96 km/h).
2. Rotary speed of cutter blades (560, 840, 1120 and 1440 r.p.m.).
3. Shapes of cutter blades (cutter disc, circular saw 45 teeth and circular saw 80 teeth).

The field experiments were carried out according to split-split plot design with three replicates, in which the shapes of cutter blades were considered as the main treatments while the subplot contained the rotary speeds and the sub-sub plots contained the forward speeds.

Data represented in this study were analyzed using SAS statistical program (general liner models procedure), the mathematical expressions were concluded using multiple regression

RESULTS AND DISCUSSION

Field Capacity as Affected by Different Variables

Fig. 5, 6 and 7 show the relation between the three variables and the machine field capacity. It is clear that field capacity increases with increase the machine forward speed and rotary speed. The following equations describe the effect of the three variables on the field capacity at clove crop.

$$Y_1 = 0.01 + 0.05\,X_1 + 1.2*10^{-5}X_2$$

$$Y_2 = 0.012 + 0.05\,X_1 + 1.34*10^{-5}\,X_2$$

$$Y_3 = 0.014 + 0.05\,X_1 + 1.42*10^{-5}X_2$$

The following equations describe the effect of the three variables on the field capacity at corn crop.

$$Y_1 = 0.012 + 0.05\,X_1 + 1.31*10^{-5}\,X_2$$

$$Y_2 = 0.017 + 0.05\,X_1 + 1.18*10^{-5}\,X_2$$

$$Y_3 = 0.018 + 0.05\,X_1 + 1.25*10^{-5}X_2$$

The following equations describe the effect of the three variables on the field capacity at cotton crop.

$$Y_1 = 0.01 + 0.044\,X_1 + 1.22*10^{-5}X_2$$

$$Y_2 = 0.01 + 0.05\,X_1 + 1.25*10^{-5}X_2$$

$$Y_3 = 0.02 + 0.05\,X_1 + 1*10^{-5}X_2$$

Where: Y_1, Y_2, and Y_3 values of field capacity (fed/h) at use of

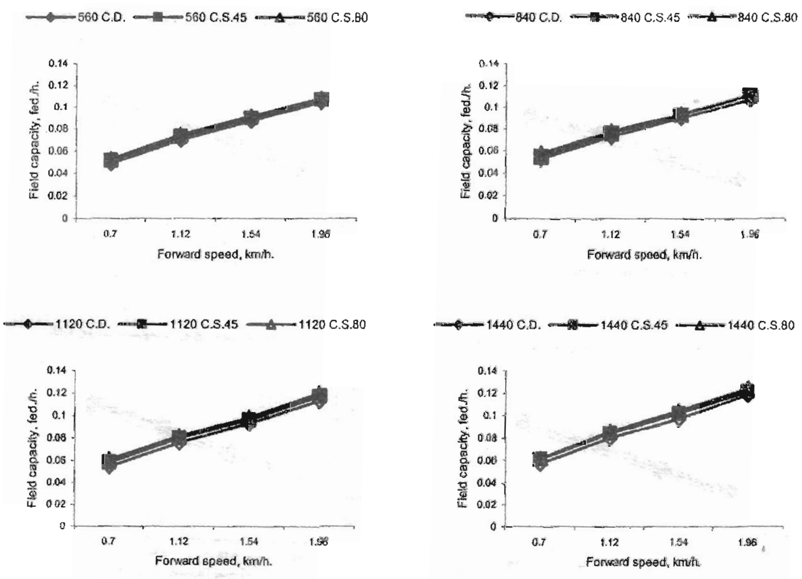


Fig. 5. The relation between forward and rotary speeds on the field capacity for shapes of cutter blades at clove crop.

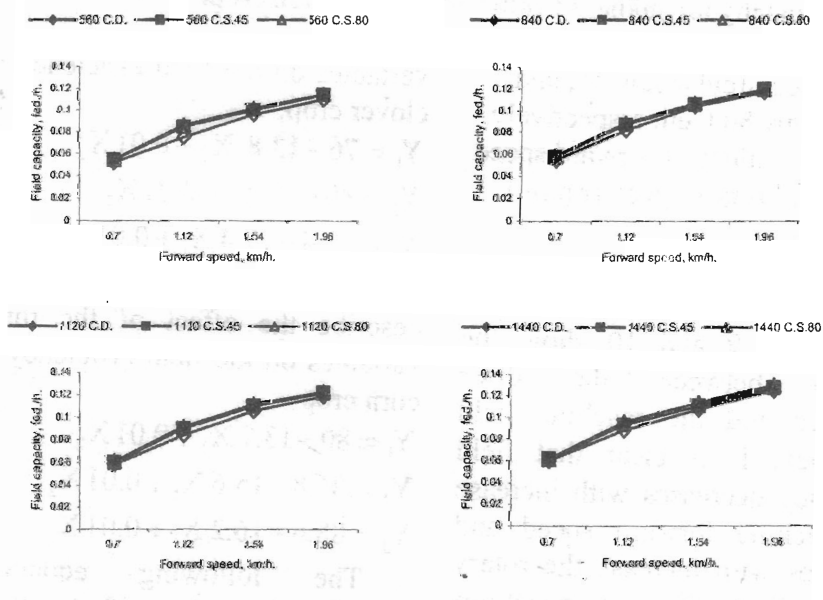


Fig. 6. The relation between forward and rotary speeds on the field capacity for shapes of cutter blades at corn crop.

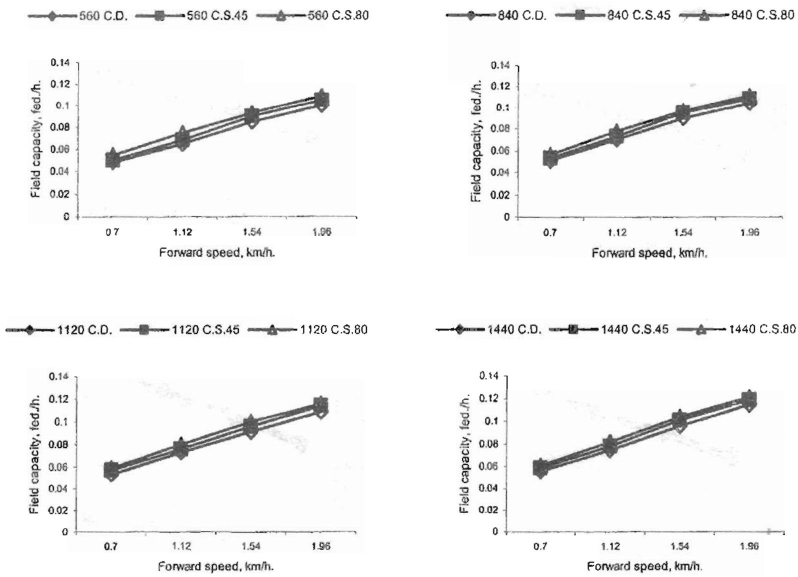


Fig. 7. The relation between forward and rotary speeds on the field capacity for shapes of cutter blades at cotton crop.

cutter disc, circular saw 45, and circular saw 80 teeth respectively. X_1 and X_2 values of forward speed (km/h) and rotary speed (r.p.m.) respectively.

Field Efficiency as Affected by Different Variables

Fig. 8, 9 and 10 show the relation between the three variables and the machine field efficiency. It is clear that field efficiency decreases with increase the machine forward speed and increases with increase the rotary speed. The following equations describe the effect of the three variables on the field efficiency at clover crop.

$$Y_1 = 76 - 13.8\ X_1 + 0.01\,X_2$$
$$Y_2 = 80 - 16\,X_1 + 0.01\,X_2$$
$$Y_3 = 83.4 - 17.4\,X_1 + 0.01\,X_2$$

The following equations describe the effect of the three variables on the field efficiency at corn crop

$$Y_1 = 80 - 13.7\,X_1 + 0.01\,X_2$$
$$Y_2 = 86.8 - 15.6\,X_1 + 0.01\,X_2$$
$$Y_3 = 88.6 - 16.2\,X_1 + 0.01\,X_2$$

The following equations describe the effect of the three variables on the field efficiency at cotton crop

$$Y = 72.5 - 13.3\,X_1 + 0.01\,X_2$$

$$Y = 76.4 - 14.2\,X_1 + 0.01X_2$$

$$Y = 85.3 - 16.8\,X_1 + 0.008\,X_2$$

Where: Y_1, Y_2, and Y_3 values of field efficiency (%) at use of cutter disc, circular saw 45, and circular saw 80 teeth respectively.

Cutting Efficiency as Affected by Different Variables

Fig. 11, 12 and 13 show the relation between the three variables and the machine cutting efficiency. It is clear that the cutting efficiency decreases with increase the machine forward speed, and increases with increase the rotary speed. The following equations describe the effect of the three variables on the cutting efficiency at clover crop

$$Y_1 = 81.1 - 2.3\,X_1 + 0.002\,X_2$$

$$Y_2 = 81.5 - 2.54\,X_1 + 0.003\,X_2$$

$$Y_3 = 82 - 2.5\,X_1 + 0.003\,X_2$$

The following equations describe the effect of the three variables on the cutting efficiency at corn crop

$$Y_1 = 92.4 - 2.02\,X_1 + 0.002\,X_2$$

$$Y_2 = 94 - 2.2\,X_1 + 0.002\,X_2$$

$$Y_3 = 94.2 - 2.1\,X_1 + 0.002\,X_2$$

The following equations describe the effect of the three variables on the cutting efficiency at cotton crop .

$$Y_1 = 84.1 - 2.95\,X_1 + 0.002\,X_2$$

$$Y_2 = 85.5 - 3.05\,X_1 + 0.0022\,X_2$$

$$Y_3 = 85.7 - 3.2\,X_1 + 0.003\,X_2$$

Where: Y_1, Y_2, and Y_3 values of cutting efficiency (%) at use of cutter disc, circular saw 45, and circular saw 80 teeth respectively.

Energy Required as Affected by Different Variables

Fig.14, 15 and 16 show the relation between the three variables and the energy required it is clear that energy required decreases with increase the machine forward speed and rotary speed. The following equations describe the effect of the three variables on the energy required at clover crop

$$Y_1 = 101.4 - 30.2\,X_1 - 0.003\,X_2$$

$$Y_2 = 96.2 - 28\,X_1 - 0.003\,X_2$$

$$Y_3 = 93.2 - 26.3\,X_1 - 0.004\,X_2$$

The following equations describe the effect of the three variables on the energy required at corn crop

$$Y_1 = 111.7 - 32.9\,X_1 - 0.004\,X_2$$

$$Y_2 = 104.3 - 30.6\,X_1 - 0.002\,X_2$$

$$Y_3 = 102.5 - 30\,X_1 - 0.002\,X_2$$

The following equations describe the effect of the three

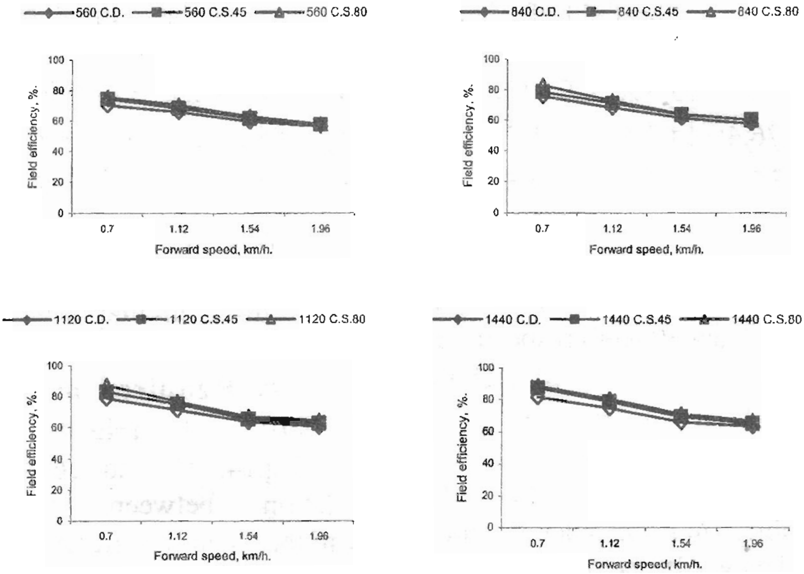


Fig. 8. The relation between forward and rotary speeds on the field efficiency for shapes of cutter blades at clover crop.

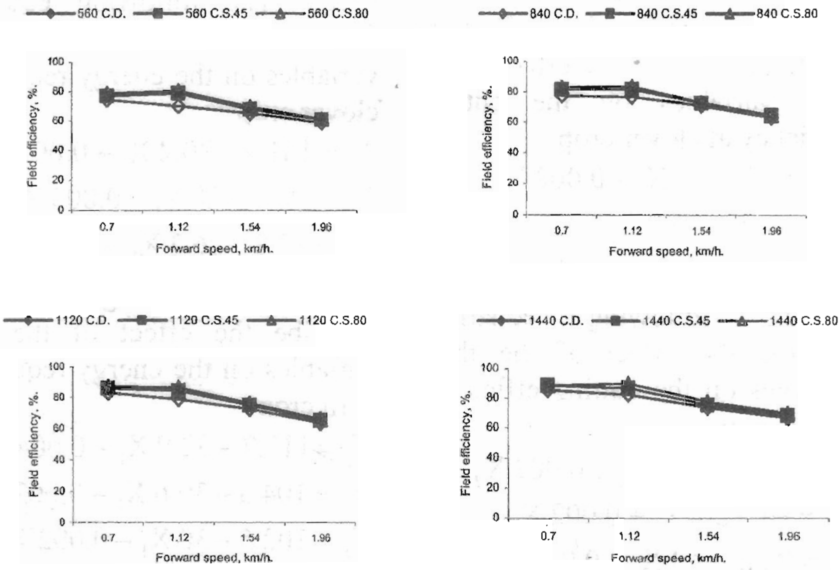


Fig. 9. The relation between forward and rotary speeds on the field efficiency for shapes of cutter blades at corn crop.

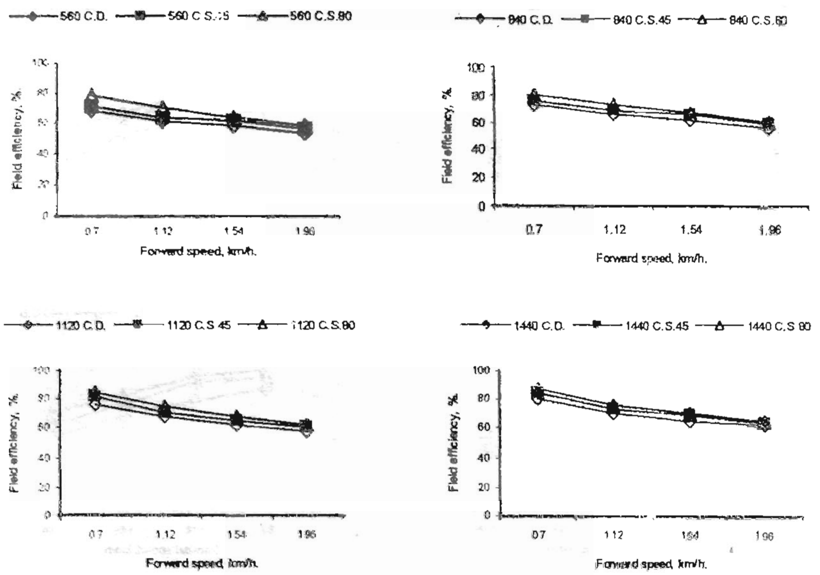


Fig. 10. The relation between forward and rotary speeds on the field efficiency for shapes of cutter blades at cotton crop.

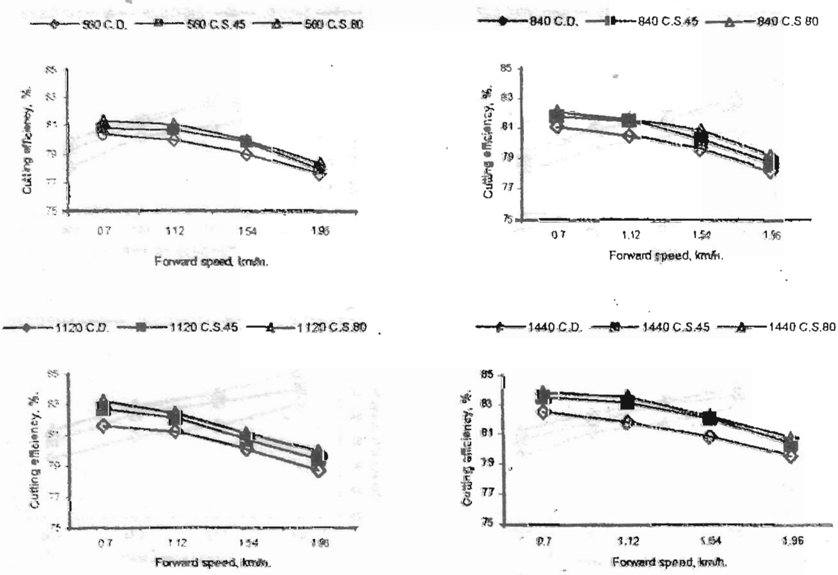


Fig. 11. The relation between forward and rotary speeds on the cutting efficiency for shapes of cutter blades at clover crop.

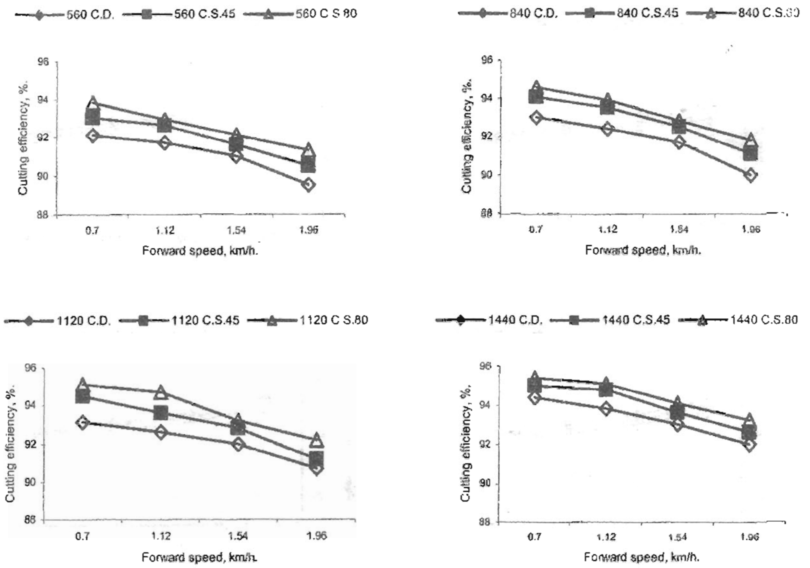


Fig. 12. The relation between forward and rotary speeds on the cutting efficiency for shapes of cutter blades at corn crop.

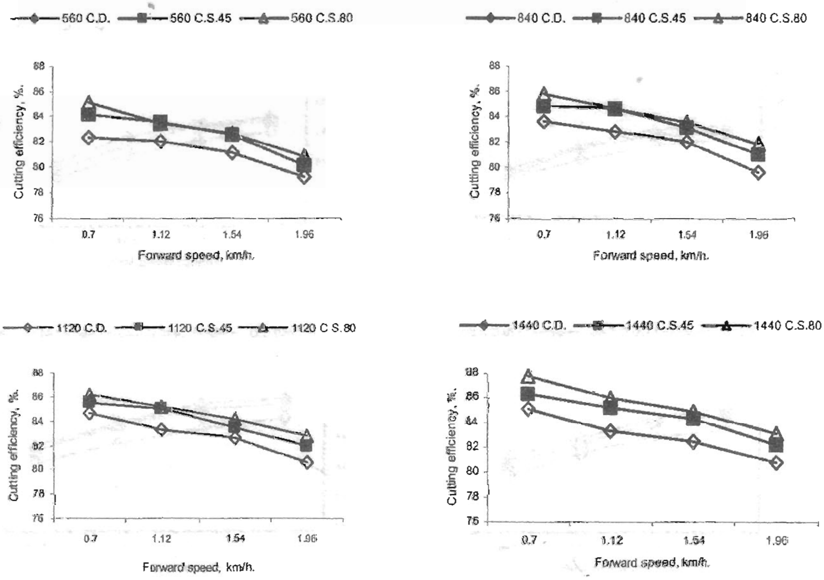


Fig. 13. The relation between forward and rotary speeds on the cutting efficiency for shapes of cutter blades at cotton crop.

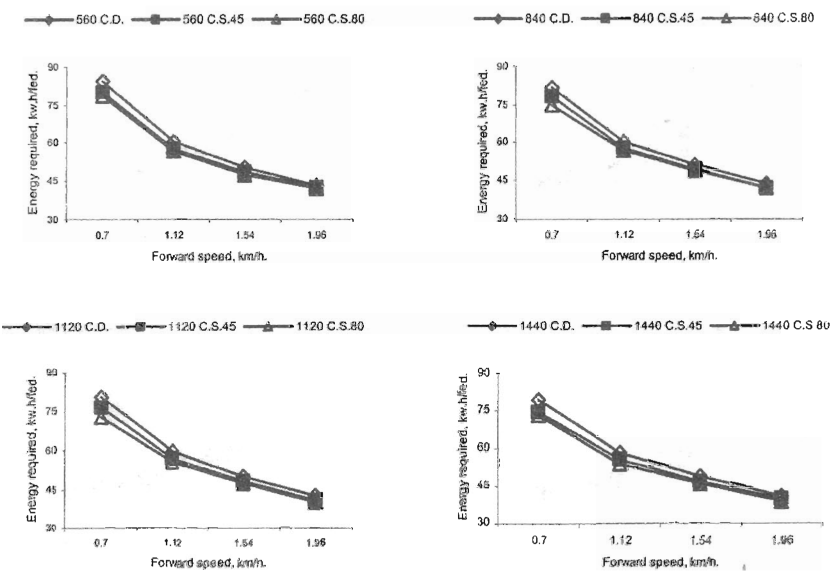


Fig. 14. The relation between forward and rotary speeds on the energy for shapes of cutter blades at clover crop.

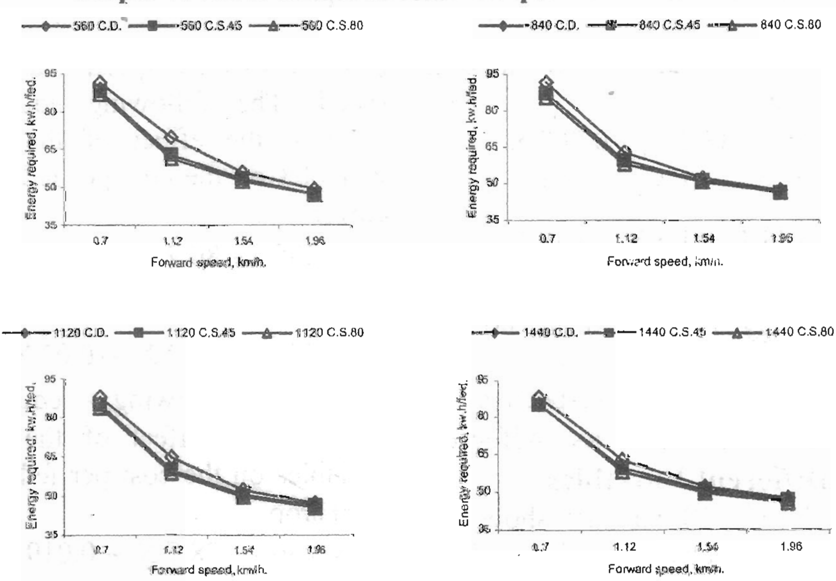


Fig. 15. The relation between forward and rotary speeds on the energy for shapes of cutter blades at corn crop.

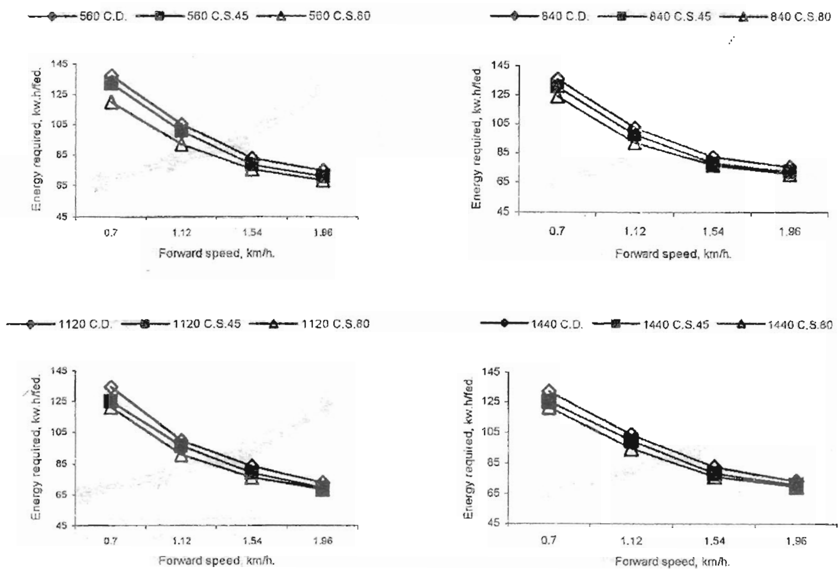


Fig. 16. The relation between forward and rotary speeds on the energy for shapes of cutter blades at cotton crop.

variables on the energy required at cotton crop

$$Y_1 = 165 - 48.2\,X_1 - 0.002\,X_2$$

$$Y_2 = 157.4 - 45.8\,X_1 - 0.002\,X_2$$

$$Y_3 = 143.1 - 41.3\,X_1 - 0.001\,X_2$$

Where: Y_1, Y_2, and Y_3 values of energy (kw.h/fed) at use of cutter disc, circular saw 45, and circular saw 80 teeth respectively.

Cost Evaluation as Affected by Different Variables

Fig.17, 18 and 19 show the relation between the three variables and the cost per feddan it is clear that cost per feddan decreases with increase the machine forward speed and rotary speed. The following equations describe the effect of the three variables on the cost per feddan at clover crop

$$Y_1 = 265.7 - 80.2\,X_1 - 0.02\,X_2$$

$$Y_2 = 252.4 - 74.1\,X_1 - 0.02\,X_2$$

$$Y_3 = 243.6 - 70.1\,X_1 - 0.02\,X_2$$

The following equations describe the effect of the three variables on the cost per feddan at corn crop

$$Y_1 = 256.1 - 78.7\,X_1 - 0.019\,X_2$$

$$Y_2 = 239.8 - 73.5\,X_1 - 0.015\,X_2$$

$$Y_3 = 235.4 - 72\,X_1 - 0.015\,X_2$$

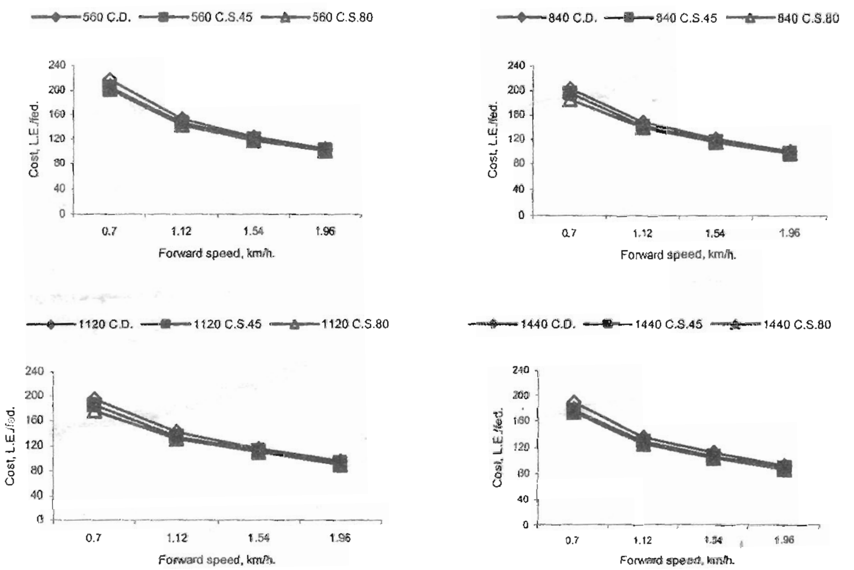


Fig. 17. The relation between forward and rotary speeds on the cost for shapes of cutter blades at clover crop.

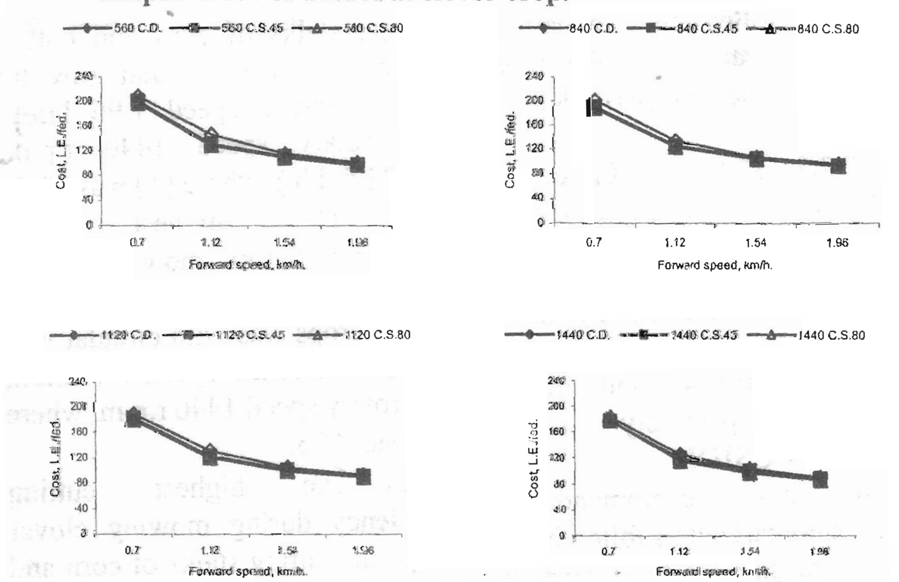


Fig. 18. The relation between forward and rotary speeds on the cost for shapes of cutter blades at corn crop.

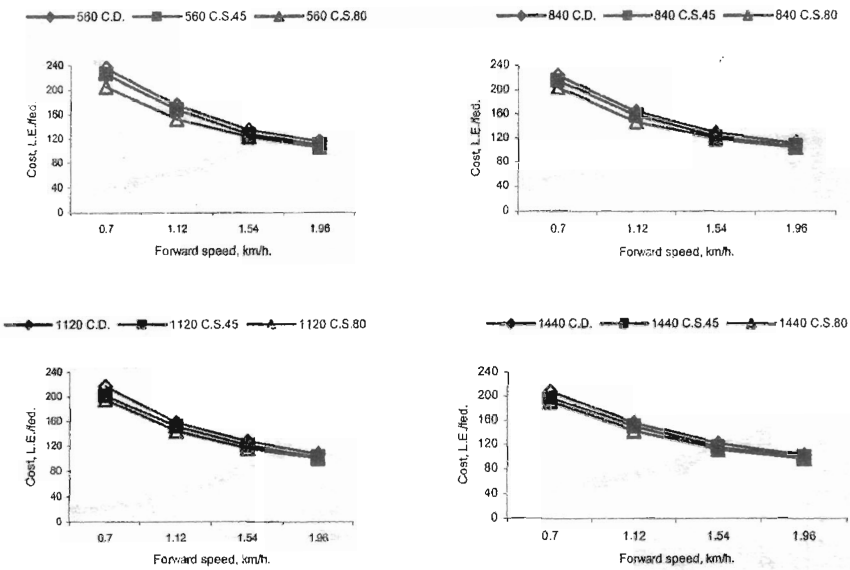


Fig. 19. The relation between forward and rotary speeds on the cost for shapes of cutter blades at cotton crop.

The following equations describe the effect of the three variables on the cost per feddan at cotton crop

$$Y_1 = 292.8 - 87.8\,X_1 - 0.02\,X_2$$

$$Y_2 = 279.2 - 83.2\,X_1 - 0.02\,X_2$$

$$Y_3 = 254.8 - 75.4\,X_1 - 0.01\,X_2$$

Where: Y_1, Y_2, and Y_3 values of cost (L.E./fed) at use of cutter disc, circular saw 45, and circular saw 80 teeth respectively

CONCLUSION

The main recommendation may be summarized as following:

1. The highest field capacity during mowing clover crop and cutting stalks of corn and cotton crops was with circular saw 80 teeth, forward speed 1.96 km/h, and rotary speed 1440 r.p.m. (0.092 fed/h.), where (1) was 27.7.
2. The highest field efficiency during mowing clover crop and cutting stalks of corn and cotton crops was with circular saw 80 teeth, forward speed 0.7 km/h, and rotary speed 1440 r.p.m, where (1) was 77.5.
3. The highest cutting efficiency during mowing clover crop and cutting stalks of corn and cotton crops was with circular saw 80 teeth, forward speed 0.7 km/h,

and rotary speed 1440 r.p.m., where (1) was 77.5.

4. The lowest energy required (kW.h/fed) during mowing clover crop was with circular saw 80 teeth, forward speed 1.96 km/h, and rotary speed 1440 r.p.m., where (1) was 27.7. While, the lowest energy required during cutting stalks of corn and cotton crops was with circular saw 80 teeth, forward speed 1.96 km/h, and rotary speed 1120 r.p.m., where (1) was 21.5.

5. The lowest cost per feddan during mowing clover crop and cutting stalks of corn and cotton crops was with circular saw 80 teeth, forward speed 1.96 km/h, and rotary speed 1440.p.m., where (1) was 27.7.

Generally, it is recommended to use the mower in small holding (less than one feddan), since it's cost is less than the cost of reciprocating mower which has less efficiency and high cost if it uses in small holding. In addition, it is essential to use this mower with circular saw 80 teeth at forward speed 1.96 km/h. and rotary speed 1440 r.p.m., to get the best performance.

REFERENCES

Awady, M. N.; S. Y. Ghoniem and E. A. Sahar, 1986. Evaluation of a rotary harvester in cutting cotton stalks. Misr J. Agric. Eng., 3(2): 59-68.

Cuplin, C., 1975. Farm Machinery, Crosby Lockwood Staples, 146-156. London.

El-Nakib, A. E 1985. Rotary cutter shredder performance in cotton-stalk cutting, Miser. J. Ag. Eng., 2(3): 29-39.

Guzel, E., and Zeren, Y., 1990. The Theory of free cutting and its application on cotton stalk. AMA, 21(1): 55-58.

Imbabi, A. T., 1992. Design and development of rotary harvester for harvesting sesame crop. Ph. D., the Agric. Eng. Dept., Fac. of Agric., Cairo Univ., Egypt: 211-212, 216-217.

Majumder, M., and Datta, R. K. 1983. Kinematics of single rotary blade in rice harvesting machine. AMA, 14(3): 49-51.

McRandal, D. M. and P. B. McNulty, 1980. Mechanical and physical properties of grasses. Trans ASAE, : 816-820.

Morad, M. M., 1981. A study on the energy requirements for the cutting operation of different kinds of plants. M.Sc. Th. Farm Mech. Dept., Fac. Of Ag., Zagazig U.

Prased, J. and. C. P. Gupta, 1975. Mechanical properties of maize stalks as related harvesting J. Agr. Eng. Research, 20: 79-87. London.

Van Rest, D. J., 1970. Harvest Aid for sugar cane, Agric. Eng. Vol. 51, No. 3: 134-134.

تطوير محشة دورا نية صغيرة الحجم ذاتية القدرة

محمد سعد الدين الشال[1]–محمود عبد العزيز حسن[1]

وجدي متري ميخائيل[2]–علاء صبحي محمود[2]

[1] قسم الهندسة الزراعية–كلية الزراعة–جامعة الزقازيق

[2] معهد بحوث الهندسة الزراعية–مركز البحوث الزراعية

الهدف من هذة الدراسة العمل علي إيجاد محشة دورا نية صغيرة لتلبية الاحتياجات اليومية من محاصيل الأعلاف الخضراء كالبرسيم ولقطع بقايا المحاصيل كالذرة والقطن في الحيازات الصغيرة. لذلك تم إجراء تجربة حقلية بالمزرعة التجريبية– كلية الزراعة– جامعة الإسكندرية خلال الموسم الزراعي ٢٠٠٥–٢٠٠٦ لاختبار وتقيم أداء المحشة المطورة، وقد تم ذلك باستخدام أربع سرعات أمامية هي ٠,٧، ١,١٢، ١,٥٤ و ١,٩٦ كم/ساعة وكذلك أربع سرعات دورا نية للمحشة هي ٥٦٠، ٨٤٠، ١١٢٠ و ١٤٤٠ لفة /دقيقة وكذلك باستعمال ثلاث أشكال مختلفة من أسلحة القطع لاختبار أدائها واختيار انسبها لعملية القطع، وكانت الأسلحة:قرص ذو حافة ملساء بقطر ٢٠٠ مم وسمك ١,٠٥ مم.قرص ذو حافة مشرشرة (٤٥ سن) بقطر ٢٠٠ مم وسمك ٢ مم.قرص ذو حافة مشرشرة(٨٠ سن) بقطر ٢٠٠ مم وسمك ٢ مم.

وقد تم دراسة تأثير أداء المحشة والسكاكين علي كلا من السعة الحقلية، الكفاءة الحقلية، كفاءة القطع، استهلاك الوقود، الطاقة والتكلفة وقد استخدمت المحشة والسكاكين المختلفة لحش محصول البرسيم وقطع سيقان كلا من الذرة الشامية والقطن وقد توصلت الدراسة إلي النتائج التالية:-

أعلي سعة حقلية في حش البرسيم و قطع سيقان الذرة و القطن كانت عند استعمال القرص ذي الحافة المشرشرة ٨٠ سن وسرعة أمامية ١,٩٦ كم/ ساعة وسرعة دورانية ١٤٤٠ لفة/ دقيقة.

أعلي كفاءة حقلية في حش البرسيم و قطع سيقان الذرة و القطن كانت عند استعمال القرص ذي الحافة المشرشرة ٨٠ سن و سرعة أمامية ٠.٧ كم/ ساعة وسرعة دورانية ١٤٤٠ لفة/ دقيقةأعلي كفاءة قطع في حش البرسيم و قطع سيقان الذرة و القطن كانت عند استعمال القرص ذي الحافة المشرشرة ٨٠ سن وسرعة أمامية ٠.٧ كم/ ساعة وسرعة دورانية ١٤٤٠ لفة/ دقيقة.

أقل استهلاك للطاقة كيلو وات ساعة/ فدان أثناء حش البرسيم كان عند استعمال القرص ذي الحافة المشرشرة ٨٠ سن وسرعة أمامية ١,٩٦ كم/ ساعة وسرعة دورانية ١٤٤٠ لفة/ دقيقة، بينما أقل استهلاك للطاقة أثناء قطع سيقان الذرة و القطن كان عند استعمال القرص ذي الحافة المشرشرة ٨٠ سن وسرعة أمامية ١,٩٦ كم/ ساعة وسرعة دورانية ١١٢٠ لفة/ دقيقة.

أقل تكلفة للفدان في حش البرسيم و قطع سيقان الذرة و القطن كانت عند استعمال القرص ذي الحافة المشرشرة ٨٠ سن وسرعة أمامية ١,٩٦ كم/ ساعة وسرعة دورانية ١٤٤٠ لفة/ دقيقة.

بناء علي ما سبق يوصي باستخدام المحشة المطورة في الحيازات الصغيرة (اقل من واحد فدان) وذلك لانخفاض تكاليف تشغيلها عن تكاليف المحشة الترددية وكذلك لانخفاض كفاءة المحشة الترددية في الحيازات الصغيرة. كذلك للحصول علي أفضل النتائج يفضل استخدام المحشة الدورانية مع القرص ذي الحافة المشرشرة ٨٠ سن عند سرعة أمامية ١,٩٦ كم/ ساعة وسرعة دورانية ١٤٤٠ لفة/ دقيقة.