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DEVELOPMENT AND EVALUATION OF A COTTON STALKS PULLER

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ABSTRACT

This researcph was carried out during 2008/2009 season to develop and evaluate a cotton stalks puller prototype. Primary field experiments were conducted, to gather characteristics of cotton field and stalks and to determine proper values for tilt angle (ϕ) of 20, 45 and 65 degree, rotating speed (S) of 47.14, 31.5 and 18.9 m/s, with soft or rough contact surface throughout this study. Field evaluation was investigated on the effect of machine efficiency. The experimental design was split-split plot design. Field evaluation experiments were conducted at soil moisture contents of 26, 19 and 11 % (d.b.), with soil bulk density of 1.29, 1.17 and 1.12 g/cm^3, respectively. Stalks moisture content were 60, 38 and 22 % under the mentioned soil moisture, respectively. Tilt angles of 45^0 with rotating speed of 18.9 m/s under moisture content of 19 % were appropriate treatments factors of the puller performance. Rough contact surface and stalks moisture content of 38 % showed the best results in all treatments. Overall, these technical parameters and specifications can be used to manufacture this machine with multiunit in case of mechanical planting to increase the machine field capacity.

INTRODUCTION

Egyptian cotton area declined from 2,000,000 feddans in 1980s to 300,000 feddans in 2009. This area is concentrated in Delta and the rest is in the other parts of country. Many obstacles face cotton cultivation such as low price as a result of international economic crisis, high labors, yield reduction per feddan and picking with uprooting. These problems must be solved to enrich cotton cultivation. Farmers should uproot the cotton stalks and eradicate it completely to reduce pests, diseases and hindrance to next crop and also roots decompose very slowly and thus create problem in intercultural and tillage operations of the next crop. Nearly 2.2 to 2.35 tons fed^{-1} of cotton stalk waste refers to the residue left unused in the field after cotton is harvested, is reported to be generated during cotton production each year Curtis *et al.* (2003); Gilbert and Huhnke, (2003). Manual pulling is slow and intensive labor and requires about 50 to 65 man-h/ha. Some farmers use cutting blades (sickles/scythe) to cut the stalk and bury it in soil but this method leaves cotton plant to re-grow and stop the next crop to grow. In another way, they were removed using deep tillage and roots were gone under the topsoil during forward movement of tractor. By passing winter, decomposition roots and remains were mixed with soil. Disadvantages of conventional methods are spending more money and time to perform deep tillage, remove useful soil insects and evaporation from topsoil because of soil mixing, Borchard (2001).

Summer *et al.* (2003) evaluated a counter rotating wheel plant puller as a method to harvest cotton stubble from the soil. Power required to rotate the pulling wheels in the laboratory increase with a decrease in tire pressure and an increase in force between the wheels. The pulling wheels were effective in pulling 97 % of the cotton stubble. They operated efficiently at tire pressures between 69 and 124 kPa with 2.7-3.6 kN of force between the pulling wheels while travelling at velocities up to 8 km/h. Manian *et al.* (2004) carried out an investigation to mechanize the cotton stalk pulling. The developed unit consists of a gearbox for power transmission and a set of counter rotating pulling wheels. The pulling efficiency was maximum at 1.2 kph forward speed of operation followed by mixed results at 1.6 and 2 kph forward speed of operations. The maximum pulling efficiency of 86.63 % was obtained at 140 rpm wheel rotational speed, 1.2 kph forward speed of operation and 30^0 wheel tilt angle combination. Minimum breakage of cotton stalk (7.74 %) was observed at 180 rpm wheel rotational speed, 1.2 kph forward speed of operation and 30^0 wheel tilt angle followed by 220 and 140 rpm wheel rotational speeds. Stalk removal with the cotton stalk puller resulted in 3.85 and 94.39 % saving in cost and time, respectively, compared to the manual method of cotton stalk removal. Sarkari and Minaee (2008) evaluated cotton stalks performance. The selected method for stalk pulling was two cleated disks which were placed on a main chassis. The results revealed that the tilt angle treatment in level of 30 degree with 95.4 %, the rake angle treatment in level of 17 degree with 94.9 % and finally disk covering treatment in one step of 25 mm with 94.1 were appropriate treatment's factors of the machine performance while maximum percentage of stalks were harvested. After involving roots with disks, regarding to rotation of disks and given rake angle to mechanism, roots were pulled up and so stalks were come out of soil Lubetzky and Svavolsky (1988). Moreover, Kemp and Matthew (1982) reported that work rate of stalk puller was 2.5 times more and fuel consumption was 2.5 times less than cutting blades. Demin (1978) observed that an average pull force of 903 N is required in soil with 5% moisture content. Deshmukh (1986) indicated that there exists a direct relationship between tap root depth of cotton plant and pull force.

In this research, after reviewing different methods, the selected method for stalk pulling was two cleat cylinders, which were placed on a main chassis. This machine works with proper tilt angle and rotating speed by applying transmission system from proper diesel power.

MATERIALS AND METHODS

The study was conducted at El-Serw, Damietta Governorate during 2008/2009. The tests were conducted on most common variety of cotton crop (Giza 86), which was sown at a row spacing of 60.0 cm. Soil structure was clay having 64.12 % clay, 18.9 % silt and 16.88 % sand. All obtained data through the study was tabulated and statistically evaluated by MINITAB computer program.

Preparing cotton stalks puller prototype:

The design components were as follows (Figure 1): Mechanism to fix cylinders and axes mechanism, Mechanism for transmission system connection to chassis and, source of power installation on chassis. Two oriented arms are connected to chassis. The puller was constructed with two cylinders that were closely placed in parallel with a changeable tilt angle. The two cylinders (5.0 mm thickness) were completely covered with hard rubber (20.0 mm thickness) as the distance between them longitudinally should be cancelled since the rubber is compressed inwards and outwards to minimum and maximum stalks diameter. Two compressed springs (each ended with a rotating wheel to lessen the friction with rubber), are installed aside of the two cylinders to adjust the clearance between the two cylinders to the least extent. The two cylinders rotate against each other (clockwise with the left cylinder and anticlockwise with the right one) to snatch cotton stalks while continuous rotating. Main chassis was positioned on two tires to facilitate motion on the field. Three holes on the main chassis represent 20, 45 and 65 degrees were made as a curve shape to control changing the tilt angles while proceeding treatments. Two groups of conic gears were used to transmit power to the cylinders. Two pulleys were used for transmitting power from engine to gears shaft and three pulleys for changing the rotating speed. A special clutch was used to severance and connect the power. All shafts are mounted on ball bearings, which are placed in bushes. Some aiding attachments were welded and fixed to the main chassis to direct the lifted stalks off the puller. Two oriented arms were tightened to the main chassis to direct the puller by laborer. An engine of 7.35 kW was installed on the main chassis to provide power to all the puller components. After completing prototype construction, the puller performance was tested and evaluated in the field. The characteristics of the used engine are shown in Table (1).

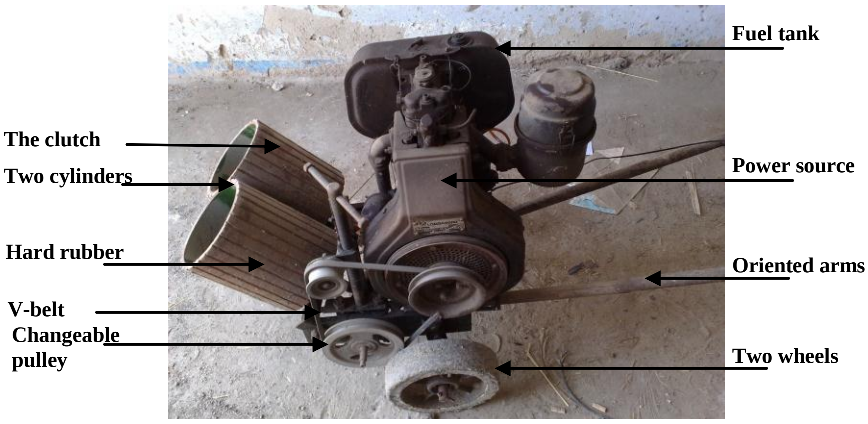

Fig (1): A prototype of cotton stalks puller

Table (1): The characteristics of the used engine

Items	Characteristics
Engine	Diesel
Model	Grillo (131)
Engine power (kW)	7.35
Rotation speed (rpm)	540
Weight (kg)	75
Manufacture	Italy

Test factors

Three tilt angles of 20, 45 and 65^0 were selected. Rotating speed was investigated at 450, 300 and 180 rpm (represent 47.14, 31.5 and 18.9 m/s). Rough and soft contact surface was evaluated with each rotating speed and tilt angle. All these parameters were tested under three stalks moister content of 60, 38 and 22 % (samples were taken from soil surface to 30 cm height of the stalks). The experiment was conducted under three levels of soil moisture of 26, 19 and 11 %. Providing an interval of 10 days in stalk lifted varied soil moisture and moisture was recorded. During the field tests, soil bulk density measurements of 1.29, 1.17 and 1.12 g/cm^3 under 26, 19 and 11 % soil moisture content respectively, were taken down. Soil samples were collected near the plants from a depth of 5 to 45 cm in the experimental field. A core sampler was used to measure bulk density and moisture of soil. Observations, such as, lifted force, stalk diameter, stalk height and tap root depths were recorded in the field.

Spring weighing scale and a rope were used to estimate the lifted force in purpose of sizing the engine needed. Effect of rope tension was taken as negligible during measuring. Three samples were taken and the average of stalks diameter was measured by using a micrometer. Stalks height were also measured. Time needed according to stalks height with determined ground speed was taken into consideration. Three replicates with all parameters were taken and finally all obtained data was analyzed using SPSS software. The ground speed of machine in this method depended upon laborer pushing force (3.5 - 4.0 km/h) which was appropriate speed to a one row machine.

Measurements

1- Amount of lifted cotton stalks:

The lifted cotton stalks (L_s) ton/feddan was determined by weighing the stalks, lifted by the lifting unit, (Mg) collected from an area of 10 m^2 by using the following equation:

$$L_s = \frac{W \ x \ 4200}{10 \ x \ 1000} = W \ x \ 0.42 \quad ton / \ feddan................................(1)$$

The lifted stalks percent (L_{st}, %) was calculated also by using the following equation:

$$L_{st} = \frac{W}{W_t} \ x \ 100 \quad ....(2)$$

Where,

W= the mass of lifted stalks, Mg.

W_t= the mass of total stalks, Mg.

2- Unlifted stalks (U)

The unlifted cotton stalks were manually lifted by hand for the same mentioned area 10 m^2. The weight of stalks was determined and unlifted (U) was calculated according to the following equation:

$$U = \frac{W_{un}\ x\ 4200}{10\ x\ 1000} = W_{un}\ x\ 0.42 \quad ton/feddan \text{..............................(3)}$$

The percentage of unlifted stalks (Up) was calculated by using the following equation:

$$U_p = \frac{W_{un}}{W_t}\ x\ 100 \quad \text{...(4)}$$

Where,

W_{un}= the mass of unlifted stalks, Mg.

3- Damaged stalks, (D)

The damaged lifted stalks (D) ton/feddan was determined by weighing the cut stalks (C), and smashed stalks (B), lifted by the lifting unit, which collected from an area of 10 m^2 by using the following equation:

$$D = \frac{(C+B)\ x\ 4200}{10\ x\ 1000} = (C+B)\ x\ 0.42 \quad ton/feddan \text{.......................(5)}$$

The percentage of damage cotton stalks, D_p % was calculated also by using the following equation:

$$D_p = \frac{(C+B)}{W_t}\ x\ 100 \quad \text{...(6)}$$

Where, C=cut stalk, Mg.

B= smashed stalks, Mg.

4- Lifting efficiency (η_l, %):

Lifting efficiency η_l means the undamaged cotton stalks lifted over the soil surface. The puller efficiency was calculated according to the following equation:

$$\eta_1 = \frac{W-(C+B)}{W_t}\ x\ 100 \quad \text{...(7)}$$

5- Fuel consumption rate:

Fuel consumption was estimated by accurately completing the fuel tank immediately after executing each change in rotating speed which was the sole parameter affected.

RESULTS AND DISCUSSION

Effect of different parameters on lifted stalks percentage, L_{st}

Fig. 2 and Tables 2,3 and 4 show the effect of stalks moisture content, tilt angle and rotating speed under contact surface condition on lifted stalks percentage, L_{st} (equation 2). The L_{st}, % of 97.68, 96.43, 97.38; 96.89, 97.77, 98.46 and 93.67, 92.28, 91.76 % were obtained under soil moisture content of 26, 19 and 11 %, and rotating speed of 47.14, 31.5 and 18.9 m/s, respectively. The lifted stalks percentage L_{st}, % results were under rough contact surface and tilt angle of 45^0 were under the same conditions with soft contact surface the results were 86.82, 84.24, 84.81; 96.82, 95.78, 94.75 and 87.57, 86.87, 86.15 %, respectively, Tables 2, 3 and 4. L_{st}, % were 97.58, 97.27, 97.08; 96.89, 97.77, 98.46 and 89.88, 89.82, 90.64 % by tilt angle of 20, 45 and 65 degree and rotating speed of 47.14, 31.5 and 18.9 m/s, respectively under rough contact surface and soil moisture content of 19 %. The highest value of lifted stalks was 98.46 % achieved under soil moisture content of 19 %, tilt angle of 45 degree, rotating speed of 18.9 m/s with rough contact surface. These results may be due to the less contact surface and time needed for capture and lifting. Data statistical analysis showed a significant effect ($p<0.5$) of interaction among all parameters on the percentage of lifted stalks.

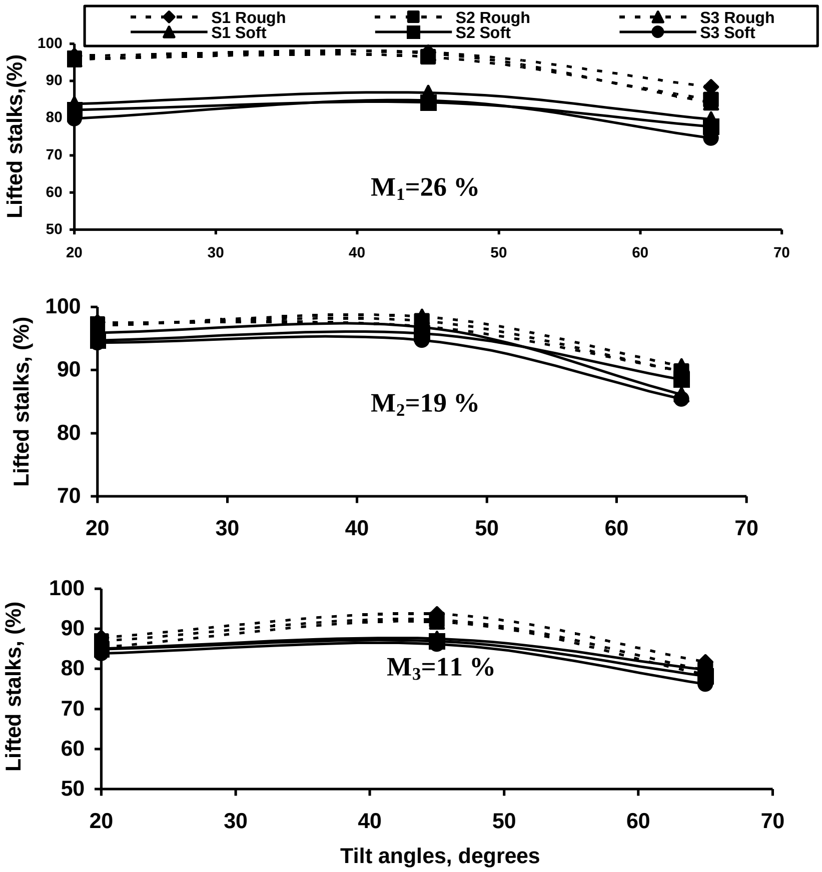

Fig (2): Effect of tilt angle on lifted stalks percentage.

Effect of different parameters on unlifted stalks percentage, U_p

Fig. 3 shows the effect of stalks moisture content, tilt angle and rotating speed under contact surface condition on unlifted stalks percentage, U_p (equation 4). The U_p under rough contact surface and tilt angle of 45^0 were 2.32, 3.57, 2.62; 3.11, 2.33, 1.54 and 6.33, 7.72, 8.24 %. These results were obtained under soil moisture content of 26, 19 and 11 %, and rotating speed of 47.14, 31.5 and 18.9 m/s, respectively. Under the same conditions with soft contact surface the results were 13.18, 15.67, 15.19; 3.18, 4.22, 5.25 and 12.43, 13.13, 13.85 %, respectively, Tables 2, 3 and 4. U_p was 2.42, 2.73, 2.92; 3.11, 2.23, 1.54 and 10.12, 10.18, 4.36 % by tilt angle of 20, 45 and 65 degree, respectively under rough contact surface and soil moisture content of 19 %.

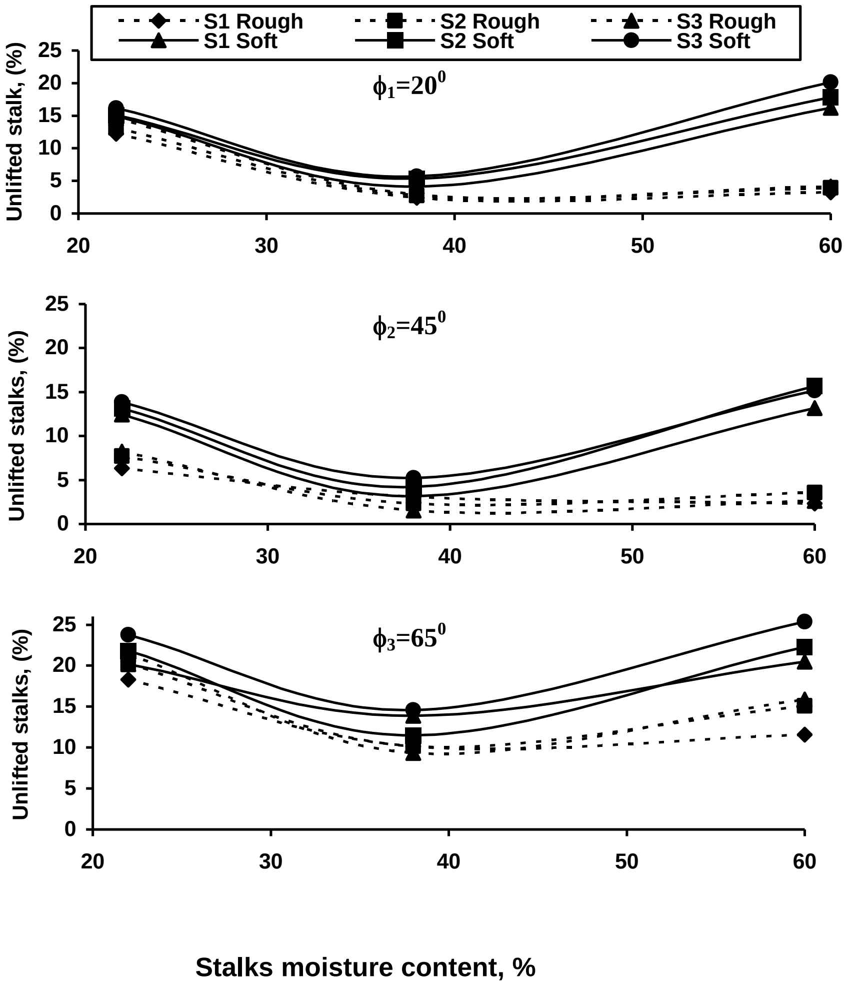

Fig (3): Effect of stalks moisture content on unlifted stalks percentage.

The lowest value of unlifted stalks 1.54 % was achieved under soil moisture content of 19 %, tilt angle of 45 degree, rotating speed of 18.9 m/s with rough contact surface. These results may be due to the less contact surface and time needed for capture and lifting cotton stalks. Data statistical analysis showed a significant effect ($p<0.5$) of interaction among all parameters on the percentage of lifted stalks.

Effect of different parameters on damaged stalks percentage, D_p

Fig. 4 shows the interaction of stalks moisture content, tilt angle and rotating speed under contact surface condition on the percentage of damaged stalks, D_p (equation 6).

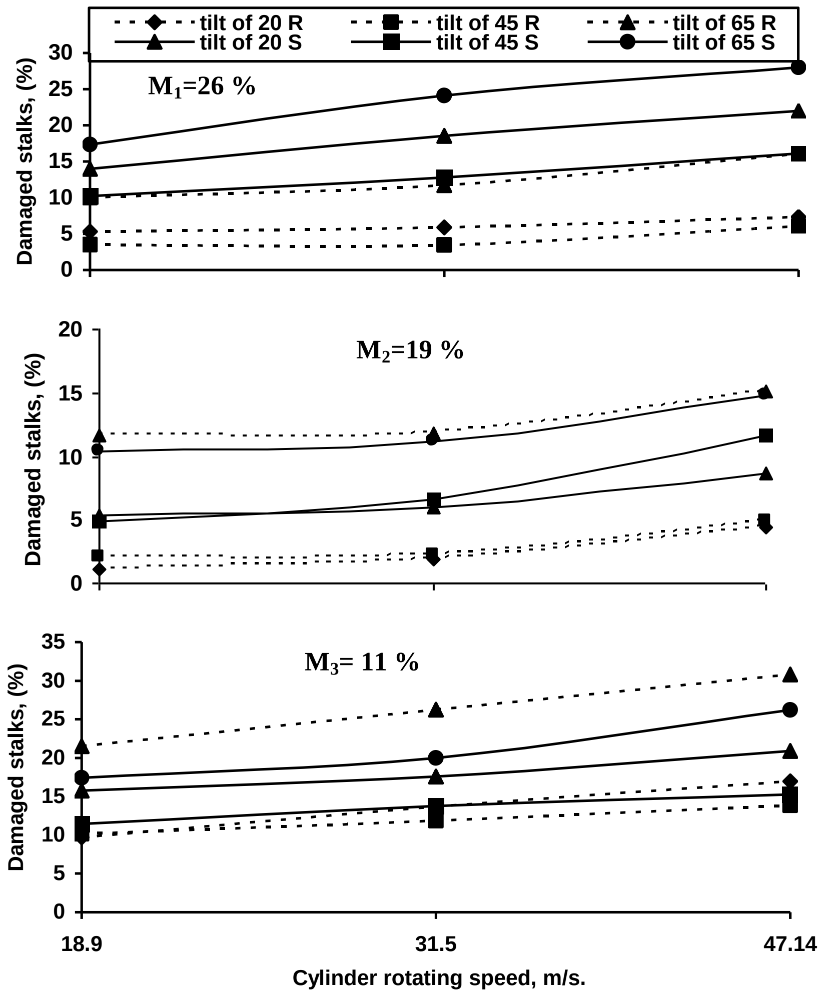

Fig (4): Effect of cylinder rotating speed on damaged stalks percentage.

Increasing rotating speed resulted in increasing D_p. The D_p under tilt angle of 20^0 under rough contact surface with soil moisture content of 26 % were 7.34, 5.88 and 5.32 were under rotating speed of 47.14, 31.5 and 18.9 m/s, respectively. The same trend was shown under tilt angle of 45^0 and 65^0. Under soil moisture content of 19 % the D_p was 4.48, 1.87 and 1.18 %. Also, under soil moisture content of 11 % the results were 16.98, 13.67 and 9.69 %. All these results were under the same previous conditions. The lowest value of D_p 1.18 % was by rotating speed of 18.9 m/s with tilt angle of 20 degree under soil moisture content of 19 % and rough contact surface, Tables 2, 3 and 4. The decrement of D_p with increasing rotating speed may be due to the sufficient time needed for capture and lifting cotton stalks. Results with rough contact surface were generally better than soft contact surface. Data statistical analysis showed a significant effect ($p<0.5$) of interaction among all parameters on the percentage of damaged stalks.

Table (2): The percentage of lifted stalks (H_S) under soil moisture content (M_1) of 26 % and stalks moisture content (C_1) of 60 %

Treatments		Soft contact surface				Rough contact surface			
	Speed, m/s	L_{st}	U_f	D_p	η_l, %	L_{st}	U_f	D_p	η_l, %
ϕ_1= 20^0	S_1 = 47.14	83.80	16.20	22.0	61.8	96.74	3.26	7.34	89.4
	S_2 = 31.5	82.15	17.85	18.55	63.6	96.08	3.92	5.88	90.2
	S_3= 18.9	79.88	20.12	13.98	65.9	95.82	4.18	5.32	90.5
ϕ_2= 45^0	S_1 = 47.14	86.82	13.18	16.12	70.7	97.68	2.32	6.08	91.6
	S_2 = 31.5	84.24	15.67	11.74	72.5	96.43	3.57	3.43	93.0
	S_3= 18.9	84.81	15.19	10.21	74.6	97.38	2.62	3.48	93.9
ϕ_3= 65^0	S_1 = 47.14	79.7	20.50	28.0	51.7	88.35	11.56	16.04	72.4
	S_2 = 31.5	77.72	22.28	24.12	53.6	84.92	15.08	11.72	73.2
	S_3= 18.9	74.63	25.37	17.33	57.3	84.13	15.87	10.03	74.1

Table (3): The percentage of lifted stalks (H_S) under soil moisture content (M_2) of 19 % and stalks moisture content (C_2) of 38 %

Treatments		Soft contact surface				Rough contact surface			
	Speed, m/s	L_{st}	U_f	D_p	η_l, %	L_{st}	U_f	D_p	η_l, %
ϕ_1= 20^0	S_1 = 47.14	95.87	4.13	8.67	87.2	97.58	2.42	4.48	93.1
	S_2 = 31.5	94.67	5.33	5.97	88.7	97.27	2.73	1.87	95.4
	S_3= 18.9	94.31	5.69	5.31	89.0	97.08	2.92	1.18	95.9
ϕ_2= 45^0	S_1 = 47.14	96.82	3.18	11.72	85.1	96.89	3.11	4.89	92.0
	S_2 = 31.5	95.78	4.22	6.58	89.2	97.77	2.23	2.27	95.5
	S_3= 18.9	94.75	5.25	4.85	89.9	98.46	1.54	2.06	96.4
ϕ_3= 65^0	S_1 = 47.14	86.13	13.87	14.73	71.4	89.88	10.12	15.08	74.8
	S_2 = 31.5	88.5	11.5	17.4	71.1	89.82	10.18	11.82	78.0
	S_3= 18.9	85.4	14.60	10.40	75.0	90.64	9.36	11.64	79.0

Table (4): The percentage of lifted stalks (H_S) under soil moisture content (M_3) of 11 % and stalks moisture content (C_3) of 22 %

Treatments		Soft contact surface				Rough contact surface			
	Speed, m/s	L_{st}	U_f	D_p	η_l, %	L_{st}	U_f	D_p	η_l, %
$\phi_1 = 20^0$	S_1 = 47.14	85.08	14.92	20.88	64.2	87.78	12.22	16.98	70.8
	S_2 = 31.5	84.9	15.10	17.60	67.3	86.87	13.13	13.67	73.2
	S_3= 18.9	83.86	16.14	15.76	68.1	85.39	14.61	9.69	75.7
$\phi_2 = 45^0$	S_1 = 47.14	87.57	12.43	15.27	72.3	93.67	6.33	13.87	79.8
	S_2 = 31.5	86.87	13.13	13.77	73.1	92.28	7.72	11.88	80.4
	S_3= 18.9	86.15	13.85	11.45	74.7	91.76	8.24	10.16	81.6
$\phi_3 = 65^0$	S_1 = 47.14	79.81	20.19	26.21	53.6	81.72	18.28	30.82	50.9
	S_2 = 31.5	78.2	21.80	20.00	58.2	79.75	20.25	26.25	53.5
	S_3= 18.9	76.22	23.78	17.42	58.8	78.61	21.39	21.51	57.1

Effect of different parameters on the lifting efficiency, (η_l, %)

Fig (5) revealed that, both soil moisture and stalks moisture affected the lifting efficiency, η_l, % (equation 7). The η_l, % was 89.4, 93.1 and 70.8 % under soil moisture content of 26, 19 and 11 %. These results were under tilt angle of 20^0 and rotating speed of 47.14 m/s by using rough contact surface. Maximum η_l, % of 96.4, 93.9 and 81.6 % was obtained under soil moisture of 19, 26 and 11 %, respectively, Tables 2, 3 and 4. Differences in η_l, % results were according to damaged and cut stalks as roots remained without lifted especially with higher rotating speeds. These results are directly proportion with stalks moisture content. Most obtained data under stalks moisture content of 38 % is higher than stalks moisture of both 22 and 60 %. This may be due to the effect of cohesion and adhesion force according to stalks moisture content. The difference in irrigation date from experimental plots to another in the same farm resulted in the obtained results.

The results showed that increasing tilt angle from 20 to 45 degree resulted in increasing lifting efficiency, η_l %. While increasing tilt angle to 65 degree decreased the percentage of lifting efficiency, η_l, % (Fig 2). If there is enough soil moisture content during uprooting, tilt angle of 45 degree shows the best performance, but using tilt angle of 65 degree increase the rate of stalks and roots remained in soil with the decrease of soil moisture content. Data showed that η_l, % of 93.1, 95.4 and 95.9 was obtained under tilt angle 20 degree. While under tilt angles of 45 degree the η_l, % was 92.0, 95.5 and 96.4. Tilt angle of 65 degree gave η_l, % of 74.8, 78.0 and 79.0 %. All these data were obtained under rotating speed of 47.14, 31.5 and 18.9 m/s, respectively, Tables 2, 3 and 4 and soil moisture content of 19 % with stalks moisture content of 38 % under using a rough contact surface. These results could be discussed as tilt angle of 45 degree gave a sufficient contact surface with cotton stalks that gave a sufficient time for lifting, while the contact surface decrease with both other tilt angles. So the appropriate selection for tilt angle of 45 degree around 19 % soil moisture content during uprooting with low level of stalks moisture content gave desirable results.

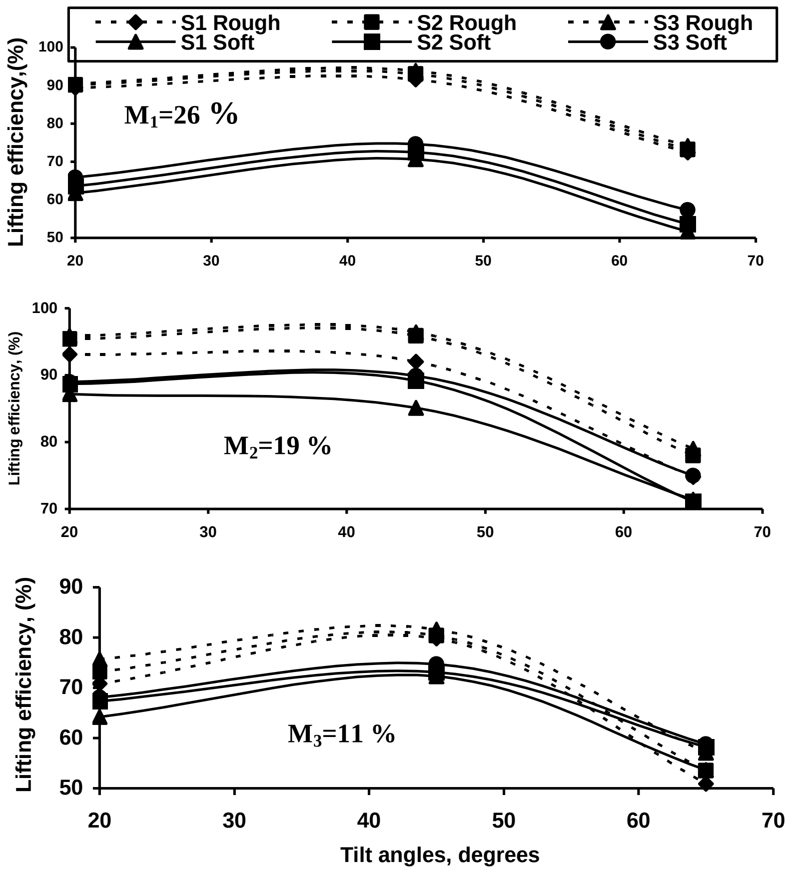

Fig (5): Effect of tilt angles on lifted stalks percentage.

Decreasing rotating speed resulted in increasing η_l, %. Rotating speed 47.14, 31.5 and 18.9 m/s resulted in η_l, % of 92.0, 95.5 and 96.4 % under soil moisture of 19 % with rough contact surface and tilt angle of 45^0. Maximum η_l, % of 90.5, 93.9 and 74.1 % was by rotating speed of 18.9 m/s under soil moisture and stalks moisture content of 26 and 60 %, respectively under rough contact surface. The η_l, % of 95.9, 96.4 and 79.0 %; 68.1, 74.7 and 58.8 % were obtained under both soil and stalks moisture content of 19, 38 % and 11, 22 %, respectively. All discussed data were under rotating speed of 18.9 m/s. Selecting rotating speed 18.9 m/s with tilt angle 45^o under soil moisture content of 26 % showed the best η_l, % 96.4%, Tables 2, 3 and 4. However, statistical analysis revealed insignificant effect among some treatments and their interactions using F test at 5 % of probability and its significant level. Maximum η_l, % (96.4) is related to second factor of tilt angle treatment (ϕ_2) 45 that has a significant difference with others.

Generally, rotating speed of 18.9 m/s gave the best results according to decreasing the unlifted and damaged stalks and roots especially with low level of stalks moisture content. Data statistical analysis showed a significant effect ($p<0.5$) of different parameters under study on the lifting efficiency.

Rough contact surface (Tables 2, 3 and 4) showed better results than soft surface in all treatments. The interaction between surface contact condition and stalks moisture content showed that, with the reduction of stalks moisture content, the rough surface showed the best results in all treatments. Lifting efficiency (η_l, %) of 91.6, 93.0 and 93.9 % were obtained with rough contact surface and stalks moisture of 60 % under tilt angle of 45^0. While η_l, % under the same conditions with soft contact surface were 70.7, 72.5 and 74.6 %, Tables 2, 3 and 4. All these results were obtained with rotating speed of 47.14, 31.5 and 18.9 m/s, respectively and under soil moisture content of 26 %. All other treatment showed similar results which shown on presented figures and tables. Data statistical analysis showed a significant effect ($p<0.5$) of contact surface condition on lifting efficiency, %.

Effect of rotating speed on fuel consumption

The increase in hourly fuel consumption by increasing rotating speed is attributed to the increase in engine velocity to cope with the rotating speed as the increase in rotating speed needed to more engine shaft rotation. With rotating speed of 47.14, 31.5 and 18.9 m/s, fuel consumption was 5.47, 5.12 and 4.68 l/h, respectively under different parameters of soil moisture content and tilt angles. Increasing rotor speed increase hourly fuel consumption due to the increase in revolutions per unit time. There was no relationship between lifted stalks and fuel consumption. Tilt angle had no effect on fuel consumption. Surface contact condition affected fuel consumption according to puller field capacity.

Conclusion and Recommendations

- The tilt angle of 45 degree with rotating speed of 18.9 m/s and the rough contact surface of cotton stalks puller were the appropriate technical parameters of the machine performance which will be considered in the following prototype.
- Construction of prototype machine with 2 units in case of using mechanical planting to increase field capacity and efficiency of the cotton stalks puller.
- Appropriate time for cotton uprooting stalks is immediately after ending of picked last cotton lint that is about month of October, which stalks are still soft.
- It is advisable to delay the last irrigation time before performing the puller to gave an appropriate time for stalks to lost most of its moisture content before irrigation.

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تطوير آلة لتقليع حطب القطن

يوسف يوسف رمضان رمضان
معهد بحوث الهندسة الزراعية- مركز البحوث الزراعية – الدقي – الجيزة- مصر

تواجه زراعة القطن فى مصر معوقات كثيرة خاصة ارتفاع تكاليف جني المحصول ومقاومة الآفات وعمليات الخدمة والحصاد والذي يمثل تقليع النباتات المشكلة الكبرى عند كثير من المزارعين. وقد اعتادت بعض المزارع تقطيع النباتات أو فرمها وخلطها بالتربة كسماد عضوى إلا أن كلتا الطريقتين غير مرغوب فيهما تماما عند المزارع المصري لما تسببه عمليه الحش أو الخلط فى التربة من مشاكل مع المحصول التالي وغالباً أثناء حش البرسيم المصري مع تأخر تحلل النباتات فى التربة ولذلك يضطر المزارع على تأجير العمالة التى تقوم بتقليع نباتات القطن بعد الجنى وتصل تكاليف تقليع الفدان الواحد إلى ٢٥٠ جنيه مصري وقد تزيد عن ذلك حسب رطوبة التربة. لذلك كان من الضروري على المشتغلين ببحوث الهندسة الزراعية حل هذه المشكلة وذلك دعماً لزراعة القطن فى مصر. وقد أجريت هذه التجربة فى مزرعة خاصة بمنطقة السرو – دمياط على صنف قطن جيزة ٨٦ بهدف تطوير آلة محلية الصنع سهلة الصيانة يمكن تصنيعها فى الورش المحلية من خامات محلية تسهم فى حل مشكلة من مشاكل زراعة القطن فى مصر. تتكون الآلة من شاسيه عليه اسطوانتين مكسوتان بالكاوتشوك المقوى (أملس & خشن) تدوران فى اتجاه معاكس بسرعات مختلفة ٤٧.١٤ ، ٣١.٥ ، ١٨.٩ م/ث مع زوايا ميل مختلفة ٢٠ ، ٤٥ ، ٦٥ درجة وقد استخدم عدد من الطارات لإعطاء السرعات المناسبة ، تحت درجة رطوبة للتربة ٢٦ ، ١٩ ، ١١ % حيث كانت رطوبة السيقان ٦٠ ، ٣٨ ، ٢٢ % عند نفس درجات رطوبة التربة ، وقد استخدم محرك ديزل ٧.٣٥ كيلو وات إعطاء القدرة المناسبة لإجراء المعاملات.

وقد أظهرت النتائج بعد تحليلها إحصائياً أن استخدام سرعة دورانية ١٨.٩ م/ث وكذلك زاوية ميل ٤٥ درجة مع درجة رطوبة للمحصول ٣٨ % ورطوبة تربة ١٩ % أعطى أفضل النتائج حيث وصلت النسبة المئوية للسيقان المخلوعة ٩٦.٤ % تحت ظروف التشغيل المذكورة وأقل معدل استهلاك للوقود ، كما أن أغلب النتائج مع سطح تلامس خشن أفضل من السطح الناعم. وينصح بتأخير الرية الأخيرة فى القطن حتى تجف النباتات إلى أقصى درجة حيث أن ذلك يزيد النسبة المئوية للنباتات المخلوعة ، مع تصنيع الآلة على السرعة وزاوية الميل المناسبة وزيادة عدد وحدات التقليع على نفس الآلة وذلك لرفع السعة الحقلية للآلة.

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