Available online at www.elixirpublishers.com (Elixir International Journal)

Mechanical Engineering

Elixir Mech. Engg. 109 (2017) 47879-47881

ISSN: 2229-712X

Effect of Cutting angle for a Locally Assembly Motorized Vibration Cutter on Some Operational Characteristics Used for Date Palm Fronds Cutting

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ARTICLE INFO

Article history:

Received: 16 June 2017;

Received in revised form:

25 July 2017;

Accepted: 5 August 2017;

Keywords

Cutting angle,
Cutting time,
Frond cutting,
Vibration,
Noise,
Cutting level,
Productivity and Efficiency.

ABSTRACT

The experiment was conducted to evaluate the effect of cutting angle for locally assembly motorized vibration cutter on some operational characteristic used for date palm frond cutting. An implement was fabricated to cut the fronds around the date palm tree trunk. Three cutting angles included 45,60 and 90° was used in this study. One frond cutting time, One palm frond cutting time, cutting level, noise level, vibration, productivity and efficiency was measured in this experiment. Complete block design with three replications was used in this study. Least significant differences (L.S.D) under 0.05 level was used to compeer the mean of treatment. The results showed that 45° cutting angle gave a lower time in cutting one frond and one palm fronds stood 2.65 sec and 2.40 min respectively, also gave less differences in surface cutting level, level of noising and vibration stood 5.28 mm, 79.37 db and 5.22 $m.sec^{-2}$ respectively. Also it gave the same amount of productivity with 60° cutting angle stood 8.01 palm /h. 45° cutting angle gave a high efficiency it got 80.23%, using a manufacturing equipment for cutting date palm frond was successfully done.

1. Introduction

Date palm (*phoenix dactylifera* L.) considers as a major fruit crop in most Arab countries, it has been conducted with sustaining human life from long history. The tradition of the people in the old world is a major agricultural crop commercial tree(Ahmad and Andrzej,2012).It has along trunk ,with about 30m height and lives about 100 years (Morton,1978). There are a numbers of operation that need to performed during several times of the year to maintain the date palm crown (Anoon,2002).So,each tree need to climbed many time a year to carry out many hand operations. Cutting the dry and dead fronds is one of important date palm maintenance because,it impedes the worker to climb the trunk to do many operation like pollination and harvesting (Ahmed and Andrzej,2012).Traditional tool are used to cut the palm fronds like knives and saws.These tools has many disadvantages ,normally they need more energy for frond cutting .It is mainly comes from worker ,this effort can be reduce by sharpness the tool edge and worker self-skill, therefore, the worker should be strong enough to maintain his body energy ,a long time day generally,workers con not be able to maintain his energy for the whole day and normally stop when they fell tired ,(Jelani,1998).So,tools and Implements are playing a big role to reduce effort ,cost and operation time.Therefore,farmers have to think for manu facturing new equipment used a motorized power to cut the palm frond in minimum effort and cost.

There are many factors are affecting in cutting plant material,(Ahmed et al,2000).The physical properties of plant material,react against the cutting tool,method of cutting, cutting angle and speed of cutting (Person,1978 and Feller,1959).

Cutting angle considers as one of significant factor in the cutting force and energy requirement. Experiment was conducted on oil palm frond showed the 45° angle required less force than 90°.Therfore, increase in cutting angle lead to increase in cutting force (Jelani,1998). According the important of using and testing a local assembly motorized cutter for date palm fronds in decrease the time and effort in different cutting angle to know which angle the best,this study was conducted.

2. Materials and Methods

The experiment was carrying out for testing a palm fronds motorized cutter.Three cutting angle included 45°,60°and 90° were used in this experiment.Time of one frond cutting,three rows of frond time cutting, level of surface cutting,hand tool vibration,noise and field productivity was measured in the experiment.Randomized complete block design (CRBD) with three replications was used in this study,lest significant different (L.S.D) and 0.05 levels were used to compare the mean of treatment.

A new motorized vibrator cutter was manufactured and assembled at the local mechanical workshop in the department of agricultural machines and equipment,college of agriculture university of Baghdad,the implement consist of many main parts.

2.1. Components of equipment, (Fig.1).

The motorized vibrator palm frond cutter consists of the following parts:-

1. Engine,it has 2 hp,gasoline fuel,3000-5000 rpm.

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2. Flexible connection,it consists of rubber tube and rotary flexible shaft 0.5 cm rectangle section.
3. Fixed connection,consist of rotor circle section shaft with radius of 6.8 mm inside of aluminum pore with 2.5 cm diameter.
4. Bevel gear case,used to convey the rotary motion to vibration motion.
5. Cutting tool, it is considers as a rigged curved knife.

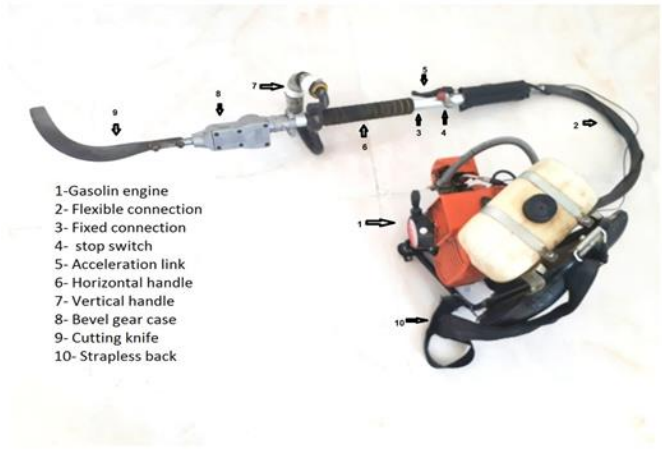

Fig 1. Motorized vibration date palm fronds cutter.

2.2. Studied Properties

2.2.1. Cutting for one frond time (frond.sec).

Time measured by using stop watch when used cutter device in palm field.

2.2.2 Cutting three rows of palm frond time

Time measured by using same method in 2.2.1.

2.2.3 Cutting surface level

Measured the different in cutting surface level variance (mm).

Measured by using noise meter (db)

2.2.4. Noise

Measured by using noise meter (db)

2.2.5. Vibration

Measured by using vibration meter ($m.sec^{-2}$).

2.2.6. Productivity

It was measured by calculate the total time of cutting including the lost time for rest and moving in the field also the time of refuel the engine and maintenance in one palm per hour (palm.h).

2.2.7 Field efficiency

Field efficiency was measured by using the following question which proposet by(hunt,1980)

$$\mathbf{Fe=P_p/P_t\ x100}$$

Whereas: **Fe**= Field Efficiency %,Pp = Practical productivity, Palm/ h

$\mathbf{P_t}$= Theoretical productivity Palm/ h

3. Results and discussion

3.1 Cutting for one frond time,(Sec).

Table 1 shows the effect of cutting angle on time for one front cutting,45°cutting angle showed the superiority in the time of cutting one frond stood 2.65 sec compared with 60° and 90° they got 3.86 and 4.15 sec respectively.

3.2 cutting for one date palm time,(min).

Table 1 shows the effects of cutting angle on time of cutting three rows of date palm tree,90° cutting angle showed the superiority in the cutting time stood 2.72 min compared with 60°and 45°which they got 2,43 and 2.40 min respectively.So,the 45°cutting angle got the less time to cut the three rows of date palm fronds,the reason for that because the 45°cutting angle need less force and energy required than 90°,this results agree with the results of (Jelani,et al,1998).

3.3. Variation in surface cutting level, (mm**).**

The result in table 1 showed the effects of cutting angle in cutting leveling.45° cutting angle showed the superiority in the variation of cutting level stood 5.28 mm compared with 60°and 90°which they got 5.61 and 6.17 mm respectively.The 45°cutting angle got the less differences in leveling of cutting,the reason for that may be because the 45°cutting angle need less force and energy required than 90.

3.4. Noise level (db)**.**

Table 1 showed the result of noise level test of an equipment.45° cutting angle got less amount of noising level stood 79.39 db compared with 60° and 90° which they got 78.65 and 80.66 db respectively .the reason for that may be due the less power required to cut fronds .

3.5. Vibration level ($m.sec^{-2}$).

The results in table (2) showed the effect of cutting angle in level of vibration that translate to the worker hand,the effect of 45°cutting angle showed the superiority to get lower vibration stood 5.22 $m.sec^{-2}$compared with 60° and 90° which they got 5.34 ,5.28 respectively.

3.6. Productivity (palm/h)**.**

The relationship of cutting angle to the one date palm fronds cutting productivity is shown in table 2,the 45°and 60°did not differ on the field productivity,which they stood 8.01 palm per hour,but the 90°got 7.62 palm per hour,The result noticed that increased the cutting angle from 45 to 90° decreased productivity.

3.7. Field productivity efficiency (%).

Table 2 shows significant effect of used cutting angle 45,60,90°on the field efficiency,45°cutting angle got a highest efficiency stood 80.23 % compared with 60 and 90° which they got 89.51 and 75.51% respectively,the result showed increase in cutting angle led to decrease to field efficiency,the reason due to the increase of cutting angle which lead to increase cutting force also increase of cutting time.

Table 2. The effect of the cutting angle on the vibration level, productivity, cutting efficiency of productivity.

Angle	Vibration level $m.sec^{-2}$	Productivity. Palm/ h	Efficiency of productivity %
45°	5.22	8.01	80.23
60°	5.34	8.01	89.51
90°	5.28	7.62	75.51
LSD	0.114	0.215	2.385

4. Conclusion and Recommendation

Using the locally assembling equipment for cutting date palm fronds is successfully done.Due to the above results it is clear that cutting angle got the lower time in one frond

Table 1. The effect of the cutting angle on the time of frond cutting, one palm fronds cutting time, cutting surface leveling and noise.

Angle	One frond cutting time sec	One palm fronds cutting time /min	Cutting surface leveling/mm	Noise/db
45°	2.65	2.40	5.28	79.37
60°	3.87	2.43	5.61	78.65
90°	4.15	2.72	6.17	80.66
LSD	0.09	0.114	0.129	1.030

cutting,cutting one date palm,also got lower vibration in cutting level,noise and vibration compared with the other angles. on the other hand ,45 cutting angle got a highest field productivity and field efficiency,therefore using 45°cutting angle to cut date palm fronds which gave the best results was recommend.

References

1.Ahmad, D. S.K Roy and A.R. Jaelani,(2000). Evaluation of Design Parameters of Cycle Cutter and Claw Cutter for Cutting Oil Palm Frond. AMA Journal. 31(2): 55 – 60.

2.Ahmed and Borowy,(2012). cultivation of date palm in Iraq .Annales Universitatis Mariae Curie- sklodowska Lublin-polonia. Vol.xxII (1) Section EEE .

3.Anon,(2002). "UAE Farmers Ready For Date With MechanicalPollination", http://www.uaenteract.com/uaeint_main/newsreport/2001012 2.htm#UAE%20FARMERS%20 READY%20FOR%20DATE%20WITH%20MECHANICAL %20POLLINATION.

4.Feller,R.(1959).Effect of knife angles and velocities on cutting without a counter-edge .J.Agri.Eng.Res.4:227-293.

5.Jelani,A R;D. Ahmad;Ahmad H.;Azmi Y. and Johari J. (1998).Force and Energy Requirements for Cutting Oil Palm Frond .Journal of Oil Palm Research Vol.10 .No.2.pp.10-24.

6.Hunt,D.,(1980) Farm Power and Machine Management ,the Laboratory Manual of Work Book .Iowa State University.

7.Jelani, A. R.,(2008); Cantas ™ - A tool for the Efficient Harvesting of 0il Palm Fresh Fruit Bunches. Journal of Oil Palm Research .vol.20p.548-558.

8.Morton, J., (1987); "Date *Phoenix Dactylifera*," in: *Fruits Of Warm Climates*,Miami,Creative Resource Systems, Inc.,Winterville, NC,http://www.hort.purdue.edu/newcrop/morton/ index. html (last updated: 4/2/1999).

9. Persson , S.,(1987). Mechanics of Plant Cutting Material. Michigan.American Society of Agricultural Engineers.