Modification and Performance Evaluation of Date Palm Leaf and Leaf-end Pruning Machine

Mostofi Sarkari, Mohammad Reza

***Abstract*— Modification of date palm leaf and leaf-end pruning machine was carried out according to the following aspects: Considering the conventional pruning method, Geometric dimension of the usual garden tool (sickle) or local named Acfea, Morphological form of date palm tree, Designed machine dimension.**

In this study, the main aims were focused on: Agronomical specifications, - machine net weight, - on farm operation, - application efficiency. To design and develop this machine, a lightweight Hydro-motor as well as proper size frame, handle, proper, hydraulic control valve and a disk-type cutting blade were used. The machine is able to pruning the leaves and leaves-end with depth of up to 10 cm. In general, two changes were considered for on farm application: as a part of date palm service machine and /or a self-operating machine.

In the first phase, because of the lack of enough space for bucket of machine to reach the date palm trunk, pruning operation can be perform from a distance from 1 to 2 meter from the main tree trunk; therefore, the designed machine was equipped with a 3-meter length boom so it can be controlled from the lifting cabin. In the second phase, for the trees that are not higher than 4 meters, the machine can be used as a self-operating machine by ladder.

The machine was equipped with a short and convenient handle, which will help the pruner to reach the tree trunk for pruning the leaves and leaves' end.

The prototype pruning machine was installed to the tractor MF-285 and site conditions to test and evaluate performs the machine technical and ergonomically parameters was successful. Field operation of tractor mounted leaf and leaf-end pruning machine was performed in Date Palm and Tropical Fruits Research Institute. 95% of the confidence interval of pruning leaf and leaf-end were achieved between 8 to 14 s and 10 to 19 s, respectively. The total pruning time was gained between 9.9 to 13.8 min for each tree.

***Index Terms*—Leaf and Leaf End of Date Palm, Pruning Machine, Pruning.**

I. INTRODUCTION

Considering the scattered trees, the cultivated area of the palm groves of the country has been estimated about 244000 hectares in 2010 – 11; 83.8% of it has been the fertile trees and rest 13.2% has been infertile trees (seedlings). From about 250000 hectares of the fertile trees, 91.2% have been irrigated. The most fertile area for dates is in Sistan & Baluchistan Province with 17% of area. Then, are Boushehr, Hormozgan, Jiroft and Kahnouj, Khuzestan, Kerman, and Fars Provinces, respectively with 15.7, 16, 15.5, 13.2, 11 and 10.1 % of the share of the cultivated fertile areas for dates. The seven mentioned provinces have totally had 98.4 % of the fertile areas of dates [1].

The production amount of date in the country has been estimated about 1 million ton, which 95.6% of it has been gained from the irrigated lands. The production share of the dry lands has been 4.4 %. Despite the fourth rank of the fertile lands, Jiroft & Kahnouj area has been found in the first rank or dry lands with 19.8 of the production amount. Khuzestan, Sistan and Baluchistan, Hormozgan, Boushehr, Kerman, and Fars are ranked after that with the percentages of 15.2, 14.1, 15.1, 13.5, 12.2, and 8.9, respectively for production shares of the country. The mentioned seven provinces have produced 99.6 % of the country's date [1].
The yield of the date for the irrigated lands has been 5149.3 $kg.ha^{-1}$ and for the dry lands, it has been 2471.9 $kg.ha^{-1}$. The most and the least yield of irrigated lands have been respectively for Kohgilouyeh and Boyer Ahmad Province with 10459.3 $kg.ha^{-1}$ and Isfahan Province with 241.4 $kg.ha^{-1}$. The highest dry land yield is for Sistan and Baluchistan Province with 2850.7 $kg.ha^{-1}$ and the lowest yield is for Fars Province with 1289.4 $kg.ha^{-1}$[1].

According to the conducted investigations and with considering the average of 200 trees per hectare, 15 to 20 leaves with the weight of 10 kg and 220000 hectares of fertile gardens, about 440000 tons of the date palm leaves will be pruned. On the other hand, with the similar amount for the leaf-end of date palm with a weight of 7.5 kg, more than 330000 tons of the date palm leaf-ends will be pruned. With the average price of 800 Rials for each kg of leaf and leaf-end, an amount of 616 billion Rials will be the interest of the farmers. With considering the semi-industrial production price of this machine about 50 million Rials, about 12320 machines can be bought with the mentioned price. In other words, in each 18 hectares of the palm gardens, it can benefit from one tractor pruning machine.

Given the date palm is from tropical fruits, from the opinion of the experts, pruning of the green leaves and leaf-ends of the date palm is a significant matter about preventing from forming a place for the collection of pests and diseases and removing the remaining fibers among the leaf-ends[2, 10, 20].

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Mostofi Sarkari, Mohammad Reza is with the Agricultural Engineering Research Institute, Agricultural Research, Education and Extension Organization, Tehran, Iran. (E-mail: mostofi08@gmail.com).

TABLE I: The Statistics of the Cultivated Area, Production Amount and Yield of Date In 2011

Row	Province	The cultivated area (hectare)			Production (Ton)	Yield ($kg.ha^{-1}$)
		Infertile	Fertile	Total		
1	Isfahan	154	180	334	35	194
2	Boushehr	4245	34917	39162	172743	4947
3	South Khorasan	71	242	313	585	2417
4	Khuzestan	10982	31213	42195	160477	5141
5	Semnan	41	46	87	242	5204
6	Sistan and Baluchistan	10138	35849	45988	154390	4307
7	Fars	3270	28047	31317	124500	4439
8	Kerman	5534	28660	34194	165000	5757
9	Kermanshah	343	165	508	1653	10003
10	Kohgilouyeh & Boyer Ahmad	49	39	88	140	3590
11	Hormozgan	2147	33954	36101	102770	3027
12	Yazd	950	3222	4172	9824	3049
13	Jiroft Region	2752	34890	37642	216318	6200
Total	40678	231425	272103	1108677	4791	

TABLE II: The Fertile and Infertile Cultivated Area of the Targeted Provinces

Province	Fertile (hectare)	Province	Infertile (hectare)
Sistan & Baluchistan	35849	Khuzestan	10982
Boushehr	34917	Sistan & Baluchistan	10139
Jiroft Region	34890	Kerman	5534
Hormozgan	33954	Boushehr	4245
Khuzestan	31213	Fars	3270
Kerman	28660	Jiroft Region	2752
Fars	28047	Hormozgan	2147
Total	227530	Total	39069

Today, sickles, chain motor sprocket pruning machines are used in the country. The use of sickle is hard and difficult, and using the motored pruning machines is not economic and needs skilled workers. Pruning action becomes possible yearly in the young palms with a height of 3 to 4 meters; also for the middle-aged and older palms, it becomes possible through climbing the tree and manually doing it. Day by day, because of the decrease of the number of skilled workers and the lack of interest of the youth in such works, the cost of pruning increases and this makes the need of mechanization of pruning avoidable. Most of the pruning machines for palms are imported and within the country, there is no machine except the manual machine which is called sickle; and in most of the palm gardens, pruning either is manually done or is not done at all [17]. To mechanize pruning of date palm and its benefits have been proved all over the world [21]. Each year, about 12 to 15 green leaves are pruned from the palms and the results of the studies show the part of pruning the young leaf to the existing leaves must be 2:1[4]. The existing leaves on the palm are pruned in the intervals of 3 – 5 years. Two rows of these leaves should preferably remain under the palm crown [6, 9]. Based on the studies of Corner (1966), about botany, the number of the young leaves and the existing leaves on the palm is similar. With emerging the young leaves, the previous ones become yellow and brown and must be pruned. Of course, the stems of oil palm and the date palm have different types and the way of pruning them is different, too[14]. Mostofi and Ehsani (1996) sampled and designed the pruning date leaf-end machine and tested and found out it in the gardens of Hormozgan Province. The results pointed to that with each fueling, this machine could do the pruning for 30 to 35 minutes; and the time of pruning each palm with this machine is 15 to 20 minutes; this is while this work lasts for 55 to 60 minutes in manual way. Therefore, in the time of each fueling, we can prune two trees and in a workday, each worker with six hours of work can prune 20 – 24 palms (Figures 1 and 2).

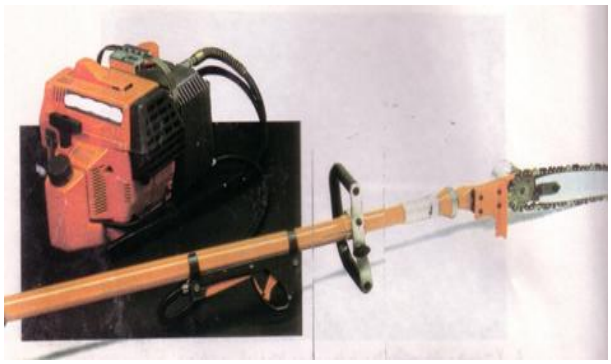

Fig. 1. The Pruning Machine Equipped With the Sprocket Blade and Canvas

Fig. 2. The Hand and Basis of the Machine Which Have Been Made Based On the Physical Characteristics of the Manual Pruning Device

Pruning the date leaf and leaf-end has been from the research subjects [14]. There are different pruning machines out of the country; from them, we can refer to Makita returning blade self-charge model, Bush circular blade, and Haskovarna sprocket blade, which an example of them has been shown in Figure 3. It should always use the cutting instruments that provide a clean-cut. It has been suggested to use a solution of water and bleaching agent and keep the blade in it for five minutes to sterilize it [13].

Fig. 3. Imported Pruning Devices

Therefore, on to the investigations conducted on the domestic and foreign resources, the following purposes have been followed in this paper:

1. Optimization of the tractor-mounted pruning machine for leaf and leaf-end
2. Workshop and farm performance evaluation of the machine

II. Materials and Methods

The provincial survey attempt was conducted for receiving the technical information about how to use the existing leaf and leaf-end pruning machine for seven major provinces of date palm production including: Sistan & Baluchistan, Jiroft, Boushehr, Hormozgan, Fars, Kerman and Khuzestan. To this end, the questionnaire consisted of the agricultural information of the palm and the geometric characteristics was completed including height and the distance between the palms and its row and the time limit of using the machine in the pruning operation. The current paper refers to two implementation phases.

1. Optimization of Tractor mounted Pruning Machine: to optimize the machine, it was used the provincial survey attempt data and built the sample machine by building ergonomic handle and selecting proper hydraulic motor. The built machine has electrical power on and off buttons and the hydraulic system of the machine is connected to the hydraulic output of tractor. With powering it on and off, the oil flows reach the hydro-engine through hoses and the circular blade start spinning and the machine does the pruning of leaf and leaf-end. Now, for any reason, if the system needs to turn off immediately, with pressing the off button, it will be turned off. The safety valve and pressure-reducing valve will be used to set the hydraulic pressure of the system in emergency times.

2. Workshop performance evaluating and repairing possible defects of the machine: testing machine in the workshop includes the ease of connections and disconnections from tractor, and ease of use and lightweight of the handle; also, it will cut woods with diameter of 8 – 10 cm to find out its performance.

Checking the current status of pruning the leaf and end-leaf of palms in Sistan & Baluchistan, Khuzestan, Kerman, and Fars Provinces and area of south of Kerman:

A. Sistan & Baluchistan Province

The pruning including making up and thinning the cluster, collecting pollen, pollinating, pruning, and spraying was studied in different stages of growth of the fruit. Unfortunately, no pruning has been done with a machine, even with manual or motorized saws. Pruning is just done in a very small amount in private gardens using manual saws. The only standby machine in the area was the twig-cutting machine, which cut the remnants of leaves and leaf-ends; and they were used to feed livestock (Figure 4).

Fig. 4. Manual Pruning of the Leaf-End (Right) and the Tractor Powered Shredder (Left)

B. Khuzestan Province

The pruning including making up and thinning the cluster, collecting pollen, pollinating, pruning, and spraying was studied in different stages of growth of the fruit (Kharak, Rotab, and Date). All of pruning were done manually and using sickle, and in some cities (Behbahan), the manual saws were used. In private gardens, the pruning operations were done using the manual saws (Figure 5).

Fig. 5. The Status of Palm Gardens of Khuzestan Province

C. Kerman Province and South Kerman

The major types of the province: more than 80% of producing province is Mazafati type, and the other types are Halili, Kalouteh, Karout, Qasb (Zahedi) and Piaram (Figures 6 and 7).

Fig. 6. The Status of Palm Gardens of Kerman Province and South Kerman

Fig. 7. Manual Pruning of Leaves in the Palm Gardens of Kerman Province

About the use of mechanized equipment in gardens for pruning, it could refer to the manual and motorized saws, which have been used. Pollen collecting is manually and pollination in some gardens is done using machines and in some others manually. Harvest is done manually in all gardens; but there is the elevator machine made by Lajvar Company in Jiroft and Kahnouj townships, which has been previously used, but now it is not used because of the problems of the mentioned machine (longtime for opening and closing of the base jacks, lack of stability in height, lack of supply of sparse parts of the machine and the related tractor).

D. Fars Province

The pruning operation including making up and thinning the cluster, collecting pollen, pollinating, pruning, and spraying was studied in different stages of growth of the fruit (Kharak, Rotab, and Date). All of leaf and leaf-end pruning were done using Parvanda and leaf pruning was done manually and using sickle, and in some cities, the pneumatic saws were used. In private gardens, the pruning operations were done using the manual and motorized saws.

The technical and economic possibility of building the date palm leaf and leaf-end tractor-mounted pruning machine

- About the fact the cultivated area of fertile palm gardens of the five studied provinces 153930 hectares, in more than 50 % of the total area, the pruning can be done using the date leaf and leaf-end tractor mounted pruning machine.
- Based on the investigations done and considering the average of 210 date palms per hectare, 12 to 15 leaves with a weight of 20 to 30 kg and 227000 hectares of fertile garden in the target provinces, about 1191.75 thousand tons of date leaves will be pruned.
- On the other hand, with similar amounts of date leaf-ends with a weight of 10 to 15 kg, more than 595.875 thousand tons of date leaf-ends are harvested.
- With the average price of 800 Rials for each kg of leaf and leaf-end, an amount of 1430 billion Rials will be the interest of the farmers.
- With considering the semi-industrial and mass production price of this machine about 50 million Rials, about 28600 machines can be bought with the mentioned price.
- In other words, for each of the wanted provinces, it can buy 4085 tractor mounted pruning machine.

Optimization of the date leaf and leaf-end tractor-pruning machine includes:

- Design and building: hydraulic circuit and the cutting part of the pruning machine
- To carry out and use the hydraulic power of tractor in the pruning machine, the hydraulic calculations including torque, speed and power have been carried out.
- The built machine has hydraulic power on and off keys and the hydraulic system of the machine is connected to the hydraulic output of the tractor.
- With powering it on and off, the oil flows reach the hydro-engine through hoses and the circular blade start spinning and the machine does the pruning of leaf and leaf-end.
- For following the safety and security of the user, for any reason, if the system needs to be immediately turned off, with pressing the off button, it will be turned off.
- The safety valve and pressure-reducing valve were used to set the hydraulic pressure of the system in emergency

times.

Designing and Building the Hydraulic Circuit

The hydraulic equipment used in the hydraulic circuit includes:

- Oil inlet hose from tractor to the machine and transferring oil
- Shut-off and plug valve for oil flow
- Oil pressure gauge
- Input oil pressure regulator
- The under-valve tool for installing solenoid valve
- 12 V DC solenoid valve for switching the hydraulic flow to the hydro-engine
- Flow control valve for adjusting the rotation speed of hydro-engine
- TFU 100 hydro-engine with the capacity of 2.6 cube cm per rotation, minimum and maximum pressure of 200 to 220 times (according to the hydraulic characteristics of MF-399 and MF-285 tractors)
- The relevant hydraulic connections

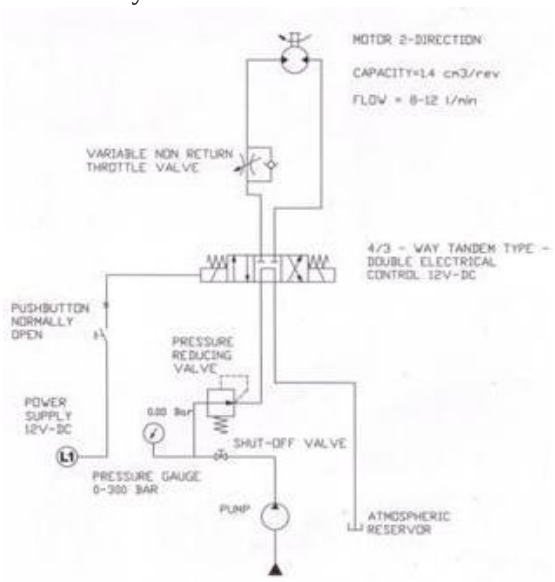

Fig. 8. Hydroelectric Circuit of the Pruning Machine

Calculations of the Needed Hydro-engine Power

- Calculating the hydro-engine torque

$$T(N.m) = 0.016 \times \Delta P(bar) \times Vg\ (cm3) \quad (1)$$

- Calculating the rotation speed of hydro-engine

$$N(rpm) = 1000 \times Q(lit.min^{-1}) / Vg\ (cm3) \quad (2)$$

- Power of hydro-engine

$$P(kw) = T(N.m) \times N(rpm)/9550 \quad (3)$$

Which,
T= hydro-engine torque, N.m .
ΔP= variable pressure, bar.
V_g = capacity of hydro-engine, cm^3 .
N = rotation speed, rpm.
Q = oil flow, $lit.min^{-1}$.
P = hydro-engine power, W.

For the hydro-engine of the pruning machine, the following features were calculated:

T= 0.84 N.m N=4000 rpm,
P= 0.352 kW = 352 W

So, a TFU 100 hydro-engine with dimensions of 57*73*56 mm^3, minimum and maximum rotation speed of 1000 to 4000 rpm in the ideal pressure of 200 to 220 bar were selected.

Fig. 9. Sample of The Date's Tractor Mounted Pruning Machine.

The cutting part of pruning machine- Mechanical equipment

- The main body on which the handle, hydro-engine and blade guard are installed
- Handle of aluminum for picking the pruning machine and a tool for keeping the inlet and outlet hoses
- The front handle is for better control of the blade when cutting and placing of the base of power switching button of the 12 V solenoid valve.
- The blade guard is for supplying the user's safety and preventing from throwing of the cutting chips to the user.
- According to the results of the study of Mostofi & Ehsani (1996), a circular blade with diameter of 18 cm was selected for cutting the leaf with the diameter of 2 to 3 and leaf-end with the depth of 8 to 10 cm.

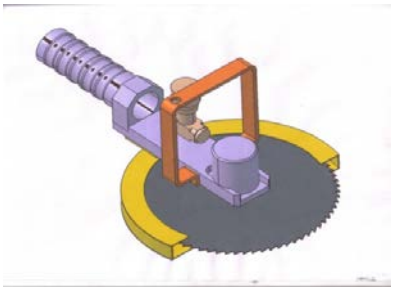

Fig. 10. The Built Handle and Blade

Fig. 11. The Sample Date's Tractor Mounted Pruning Machine.

III. RESULTS

A. Workshop Evaluation

Workshop test and fixing possible faults of the machine: the test of machine in the workshop includes the ease of connections and disconnections from the hydraulic outlet of

tractor, and ease of use and lightweight of the handle (the total weight of handle, main body and blade is 5 kg), also, it cut woods with diameter of 8 – 10 cm to study its performance and efficiency (simulation of the sector of the leaf with the depth of 8 cm to maximum of 10 cm); all were successful with clean cut in a short time for woods with radius of 2 to 3 cm (simulation of the leaf pruning) and 8 to 10 cm (leaf-end pruning). There are two important points about the created heat in the hydraulic system of tractor in a workday (8 to 10 hours). First, given the leaf and leaf-end pruning machine is supposed to be an item of the lifter machine of the dates in the country (date palm services) and installed on the hydraulic output of the U form basket, in this case, because of reducing oil friction, the hydraulic hoses will not be heated. About the second case in which the leaf and leaf-end pruning machine is used for the date palms with the height of 2 to 2.5 m (Mazafati variety), the tractor should be equipped with the oil cooler system with lower costs to prevent from the heating of the hydraulic hoses in longtime use.

B. Farm Assessment of the Tractor Mounted Pruning Machine

The date leaf and leaf-end tractor-mounted pruning machine was assessed in the palm gardens of the research station of Omol-Tamir Date Research Institute located in km 10, Khorramshahr-Ahwaz coastal road. This station is located in the north longitude of 31 degrees and 12 minutes and east latitude of 48 degrees and 33 minutes. The characteristics of Omol-Tamir research station groves are shown in Table 3.

TABLE III: Omol-Tamir Research Station Groves

Type	Density (cube m)	Height of the palm (m)	Pruning type
Barhi	8×8 and 8×10	3.5 - 4	Leaf and leaf-end
Mojval	8×8	3 - 3.5	Leaf and leaf-end

The assessed treatment was the height of leaf-end with two levels of 0.5 to 1m and 1 to 2m; and because of the manual pruning, its palms had not been pruned (Fig. 16). The evaluated traits included the duration of cutting leaf, the duration of cutting leaf-end, the duration of suitable locating of the machine next to the palm, the duration of moving and reaching to the next palm, and finally the total time of pruning leaf and leaf-end.

Fig. 16. The Status of Leaves and Leaf-Ends of the Groves of Date Research Institute

A hundred leaves and leaf-ends was assessed (Figure 17) and the results are shown in tables 4 and 5 as the duration of cutting leaf-ends in two height levels using two-way t test; so in table 5, it is followed the duration of cutting leaf-ends in two height levels has been significant in 99% of confidence level. The average time of cutting leaf-end in the height of 0.5 to 1 m was 9.3 seconds; while this was 20.3s for the height of 1 to 2 m; so the standard deviation and standard error increase in the two height levels of treatment of cutting leaf-ends. By averaging the time of cutting the leaf-ends for 10 cuts of each palm, the results of the analysis are shown in Tables 6 and 7.

TABLE IV: Analytical and Descriptive Indices of Cutting Leaf-Ends

Height	Number	Mean	Standard Deviation	Standard Error
0.5 – 1	50	9.3	4.9	0.7
1 – 2	50	20.3	10.3	1.5

TABLE V: T Test for Cutting Leaf-Ends

t	df	Significance level
**6.8	98	0.000

** 99% confidence.

Fig. 17. Pruning of Leaf and Leaf-Ends in two Treatment Levels of Height– (Right 0.5 to 1 m) and (Left 1 to 2 m)

As it can be seen in Table 7, in this assessment method, the results had the least standard deviation and standard error and the two-way t test is significant for the different levels of the height treatment in the confidence level of 99%.

The confidence duration of time of cutting leaves and leaf-ends was analyzed and independently calculated for the leaf-ends of two height levels and dependently calculated for cutting leaves and the results are shown in tables 8, 9 and 10.

TABLE VI: The Analytical and Descriptive Indices for the Average of 10 Durations of Cutting Leaf-Ends for Each Palm

Height	Number	Mean	Standard Deviation	Standard Error
0.5 – 1	5	9.3	2.46	1.10
1 – 2	5	20.3	0.76	0.34

TABLE VII: T Test for the Average of 10 Durations of Cutting Leaf-Ends for Each Palm

t	df	Significance level
**9.5	8	0.00

** 99% confidence.

As seen in tables 8 and 10, the confidence duration for the different levels of height for cutting the leaf-ends is 6 – 12 seconds in the minimum level and 19 to 21 seconds in maximum level and these were significant in the confidence level of 99%. Finally, the total time of pruning the palm (leaves and leaf-ends) was analyzed and its confidence duration is shown in Table 11.

TABLE VIII: The Confidence Duration of Leaf-Ends Cutting Time In Different Height Levels

Height	t	df	Significance level	Average	95% confidence duration	
					Low level	High level
0.5 – 1	**13.3	49	0.000	9.32	7.92	10.73
1 – 2	**13.8	49	0.000	20.27	17.34	23.21

** 99% confidence.

TABLE IX: Analytical and Descriptive Indices for the Average of 10 Durations of Cutting Leaf-Ends for Each Palm

Height (m)		Number	Average	Standard deviation	Standard error
0.5 – 1	Leaf-end	5	9.3	2.46	1.10
	Leaf	5	8.3	3.17	1.42
1 – 2	Leaf-end	5	20.3	0.76	0.34
	Leaf	5	14.7	3.97	1.77

TABLE X: The Confidence Duration of the Leaves and Leaf-Ends Cutting Time In Different Height Levels

Height (m)		T	df	Significance level	Average	95% confidence duration	
						Low level	High level
0.5 – 1	Leaf-end	**8.5	4	0.001	9.32	6.26	12.37
	Leaf	**5.8	4	0.004	8.32	4.38	12.25
1 – 2	Leaf-end	**59.6	4	0.000	20.27	19.33	21.22
	Leaf	**8.3	4	0.001	14.69	9.77	19.63

** 99% confidence.

TABLE XI: The Total Time of Pruning and Confidence Duration of the Studied Traits in Palm Pruning

The studied traits	Number	Average	Standard deviation	Standard error	95% confidence duration	
					Low level	Low level
Leaves cutting time (s)	10	11.51	4.77	1.51	8.09	14.92
Leaf-ends cutting time (s)	10	14.79	6.02	1.90	10.48	19.11
Locating time (s)	10	3.50	0.71	0.22	2.99	4.01
Moving time (s)	10	12.50	1.17	0.37	11.66	13.34
Total pruning time (s)	10	42.31	9.88	3.13	35.24	49.38

Fig. 18. (Right) Performing Leaves Pruning and (Left) the Pruned Leaves.

The confidence duration of leaves' pruning time is 8 to 14 seconds and for leaf-ends, it is 10 to 19 seconds. The total time of pruning for each palm in the confidence duration of 35 to 49 seconds is 9.9 to 13.8 minutes for leaves and leaf-ends; and it is significantly different from the pruning time of 15 to 20 minutes of the built pruning machine (Mostofi and Ehsani, 1996); and this shows preferring this machine is better than the previous samples.
The confidence duration for pruning each hectare of groves (considering the average of 200 palms in each hectare and 80% the machine efficiency) was gained in the range of 39.6 to 55.2 hours (about 4 to 5.5 days) and this is significantly different from the manual pruning time of 18 to 20 days (10 hours a day).

IV. Conclusion

1. The confidence duration of cutting time is 8 to 14 seconds for leaves and 10 to 19 seconds for leaf-ends. The total pruning time for each palm in the confidence duration of 35 to 49 seconds was got 9.9 to 13.8 minutes for leaves and leaf-ends.
2. The confidence duration for pruning each hectare of grove (considering the average of 200 palms in each hectare and 80% of the machine efficiency) was earned in the range of 39.6 to 55.2 hours.
3. It is suggested the farm assessment and test of performance the sample tractor-mounted pruning machine for date leaves and leaf-ends be conducted with the other existing pruning machines in specific experimental design.
4. It is recommended to evaluate the efficiency of the samples of hydraulic pruning machines in the current Malaysian and Italian lifter machines with hydraulic output in their basket.
5. The need of using light garden and agricultural tractors for palms to benefit from the hydraulic pruning machine
6. It is advised to supply and widely use of the tractor mounted branch-cutter machine for cutting the date leaves for feeding livestock and producing compost fertilizer in the greenhouses; and to perform a factory for producing MDF and chipboard from the date leaf-ends, which can be a suitable and cheap raw material for this factory. The problem of pruning the leaves and leaf-ends of palms will be solved with this strategy.

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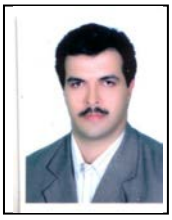

Mostofi Sarkari, Mohammad Reza, is a scientific board member of Agricultural Engineering Research Institute. A place and/or date of birth is Tabriz, 21/03/1967. My educational background is listed as follows: BSc-Tabriz University-1986-1990, MSc Tehran University-1991-1993 and PhD Cranfield University at Silsoe Collage, 1996-2000.My field of study were power and agricultural machinery engineering.

He is Scientific Board Member in AERI since 1993 as A Research Officer. Precision Farming, translated in 2013. Current and previous research interests are Precision Farming (Yield Monitoring and Mapping system).

Dr. Mostofi Sarkari, M. R., Memberships in American association for science and technology (AASIT).