

Article

A number of proposed techniques for some date palm farming operations

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Abstract: (1) Introduction: Date palm cultivation plays an important position in the Algerian agricultural production system. The palm tree requires very special care, particularly around the crown. Nowadays, farming operations are still carried out using manual labor and are therefore dangerous. For this reason, the use of machinery is absolutely crucial, especially in view of the shortage of skilled labour and the ever-increasing number of palm trees. (2) Methods: In our work, we carried out a detailed field survey of palm grovers. As a result of this survey, we developed a special pulley that makes it easier to lower the date bunches, and we also suggested using the rotovator instead of the hoe or the backhoe loader. (3) Results: These techniques could make cultivation much easier. (4) Conclusions: The results obtained from this study constitute an important achievement for the date palm sector in Algeria and may open up wide prospects for other research work in the field.

Keywords: Date palm, cultivation, mechanization, farming operation, machinery.

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1. Introduction

The palm grove is presented as an island of greenery in the middle of the desert landscape of North Africa and South-West Asia. This region stretches from Morocco in the west to the Iranian-Indian border in the east, and from the southern part of Syria in the north to southern Yemen. This crop appeared in southern Mesopotamia from the 5th millennium BC onwards, but it would appear that oasis agriculture was developed mainly during the early Bronze Age (3000 BC). This agrosystem would have been built in different areas of the Near East [1].

Date palm cultivation occupies an important place in the Algerian production system and is a major resource for the majority of the inhabitants of the country's Saharan regions. Statistics show that there are over 18 million palm trees occupying an area of over 160 thousand hectares [2]. Algeria is known for its production of Deglet Nour, a variety of dates originating in the Biskra region that has a high commercial value. This is essentially due to the colonial administration and the Algerian state, which encouraged the cultivation of this cultivar in view of the demand from the European market [3].

It goes without saying that the use of machinery has considerably boosted the development of this agricultural sector, especially given the shortage of skilled labour, while the number of palm trees that are being cultivated is constantly increasing. In this context, little research has been carried out in Algeria, with the exception of the work of the CRSTRA, which has been working in this field [4] [5] [6].

Based on our work in the field and our discussions with the farmers, we have come up with many new ideas to improve the working conditions of the farmers. These include a special roller for lowering the bunches of dates and other techniques that could provide an alternative to traditional methods of loosening the soil.

2. Materials and Methods

2.1. Proposal for a pulley

2.1.1. Design of the device

Date palms that are semi-soft or soft, which make up the majority of date palms that are cultivated, have their bunches lowered by rope or by two or three climbers (Regabe), depending on the palm's height. Dry date varieties harvest their crop by tossing the bunches from the palm's crown onto a sheet that is laid out on the ground. With both methods, the climber loses a considerable amount of time and is exposed to risks (imbalances during the descent of the bunches).

Using SolidWorks software, a pulley was created to help climbers lower the bunches safely and quickly in order to get around these limitations.

2.1.2. Pulley Description

This pulley consists of the following parts (diagram 1):

- Pulley support,
- Power hook of bunches,
- Protective cover,
- Spring (spiral-shaped) rope return.
- Rope,

It has a braking system that ensures it descends at a speed that is appropriate for its weight. This mechanism consists of:

- a spool of plastic rope,
- two jaws with rollers,
- of a main support of the mechanism.

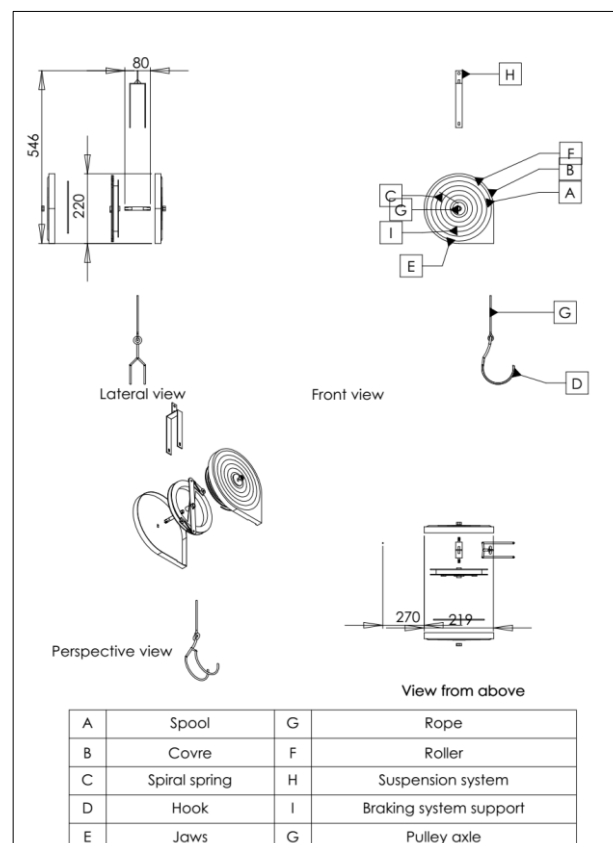


Figure 1: Diagram of the pulley

2..2. Soil loosening tool

Generally, the soil is loosened once every three to four years. It takes place from early December to mid-February, when palm growth slows down. During this operation, farmers turn over the soil surrounding the palm using a hoe (Figure 2) or mechanically with a backhoe (Figure 3). Soil loosening is usually accompanied by soil enrichment. The depth of manual loosening varies between 20 and 40 cm, while the use of a back-loader allows a depth of up to 70 cm, depending on rooting. Farmers often use the backhoe to widen the irrigation basin.



Figure 2. Manual soil loosening



Figure 3. Loosening with backloader

As we have already seen in the literature, particularly with regard to date palm cultivation in Algeria ([7] [8]), this operation is very arduous and costly using a hoe and a backhoe loader. As an alternative, we propose the use of the rotovator (Figure 4).



Figure 4. Rotovator

3. Results and discussions

3.1. Pulley

3.1.1. Operating principle

The operating principle of this pulley is very simple. After cutting, the bunches are placed on the hook of the pulley by the operator. As soon as the hook is released, the bunches move downwards (under their own weight) at a constant speed, thanks to the braking mechanism. Once the bunches have been unloaded from the hook, the spiral spring winds up the rope. At the same time, inside the pulley, the rotation of the spool moves the

jaws apart, causing friction between the rollers and the external cover. This friction serves to slow down the unwinding of the spool (figure 5).

3.1.2. Functional evaluation

The time needed to lower a bunche varies according to the height of the palm, the weight of the bunche and the skills of the climber. We estimate that the average time to lower a bunche is 15 seconds, so for 120 palms (optimum planting density for one hectare), the climber spends around 5 hours, plus the effort involved. We believe that using this pulley will minimise this time and effort.

This pulley is made up of simple parts, which do not require a great deal of technology to manufacture, and mechanisms that are easy to repair. As a result, our pulley is affordable for all growers.

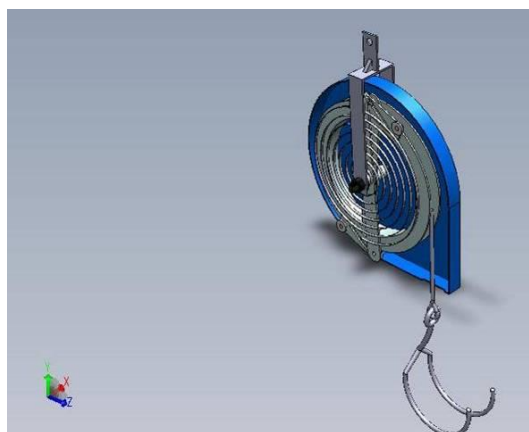


Figure 5. Pulley in 3D

3.2. Alternative to soil loosening

Table 1 shows a comparison between the different tools.

Table 1: The difference between tools

Criteria	Hoe	Rotovator	Back loader
Risk of cutting the roots	Very low	Weak	Big risk
Time of realization of a 3x3m bowl	2.5 hours	10 minutes	40 minutes
Arduousness of work	Very painful	little painful	convenient
Working depth	Up to 30 cm	Up to 40 cm	Up to 1 m
Cost of conducting	800 to 1000 DA	200 DA	1500 DA / hour
Operating width	23 cm	Up to 1 metre	50 cm
Transporting	Portable and very light	Simple	Automobile but with a difficult maneuverability in the palm grove
Maneuverability	Manuelle et usuelle	Facile	
Cost of the tool	500 DA	70000 DA	Very expensive 12000000 DA

The table above shows that the rotovator is more advantageous for the farmer in several aspects. Investing in a rotovator considerably reduces both the labour involved and the cost of the operation. What's more, the rotovator can be used to control weeds.

For farmers who prefer the backhoe loader, investing in a hydraulic shovel that can be mounted on the farm tractor is more advantageous, as it costs significantly less than the backhoe loader (20 times less).

4. Conclusion

In this article, we have seen the design of a special pulley that makes it easier to lower the bunches of dates, and we have also suggested using a rotovator instead of a hoe or backhoe loader and investing in a backhoe that can be attached to an agricultural tractor rather than a backhoe loader.

Of course, there are no limits to innovative ideas, but what we have outlined above represents only a small part of the mechanization of date palms, which is almost non-existent in Algeria.

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