

Date Palm Plantations: A Future Sustainable Support to Forests

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Abstract:

The date palm plantations are among the most dispersedly distributed plantations in the world (37 countries in 5 continents). Taking the world dates production as a criterion, the cultivation of date palms is expanding with time (the paper includes an equation for estimation). The date palm represents a Keystone species and the tree of life creating in arid and semi-arid regions a microclimate that offsets the effects of drought and allows the intensification of agriculture and intercropping that increase productivity of water and profits per unit area (the paper includes a case study of technical and economic feasibility study of intercropping with date palms in New Valley governorate, Egypt). The date palm plantations represent a sustainable well-managed plantations secure from threats of fire in traditional forests. Besides, the date palm is capable of absorbing carbon dioxide and thus contributing to decrease the deleterious consequences of climate change (the paper includes an estimation of CO₂ absorption). In addition, the fruits of the date palms (dates) could effectively contribute in the realization of food security.

Key words:

Date Palm Plantations- Forests- Forest Coverage

1. Status of Forest Coverage in the World

1.1. The world has a total forest area of 4.06 billion hectares (ha), which represents 31% of the total land area.

1.2. The world has lost 178 million ha of forest since 1990, which is an area about the size of Libya. But the rate of net forest loss declined from 7.8 million ha per year in the decade 1990-2000 to 5.2 million ha per year in 2000-2010 and 4.7 million ha per year in 2010-2020. Africa had the largest annual rate of net forest loss in 2010-2020, at 3.9 million ha, followed by South America, at 2.6 million ha [3].

1.3. The results over ten-year period from 2003 to 2012 indicate that an average of 341 million hectares, or 2.6% of all land area, was burned annually [5].

1.4. In the 75 countries that reported on insect pests, diseases and severe weather events, the total forest area affected by these disturbances, overall years reported was 141.6 million hectares, representing 5% of the total forest area in these countries (2807 million hectares) [5].

1.5. Conclusion

There is a need to search for support tree coverage to compensate the current and future losses in forest coverage and the burned portions of forest. Within this framework the date palm plantations can serve as this sustainable support tree coverage.

2. Expansion of Cultivation of Date Palms in the World

Fig.1 illustrates the expansion of cultivation of date palms in the world. The number of countries with date palm plantations has increased:

From 23 countries in 1960
To 25 countries in 1980
To 36 countries in 2000
To 37 countries in 2020

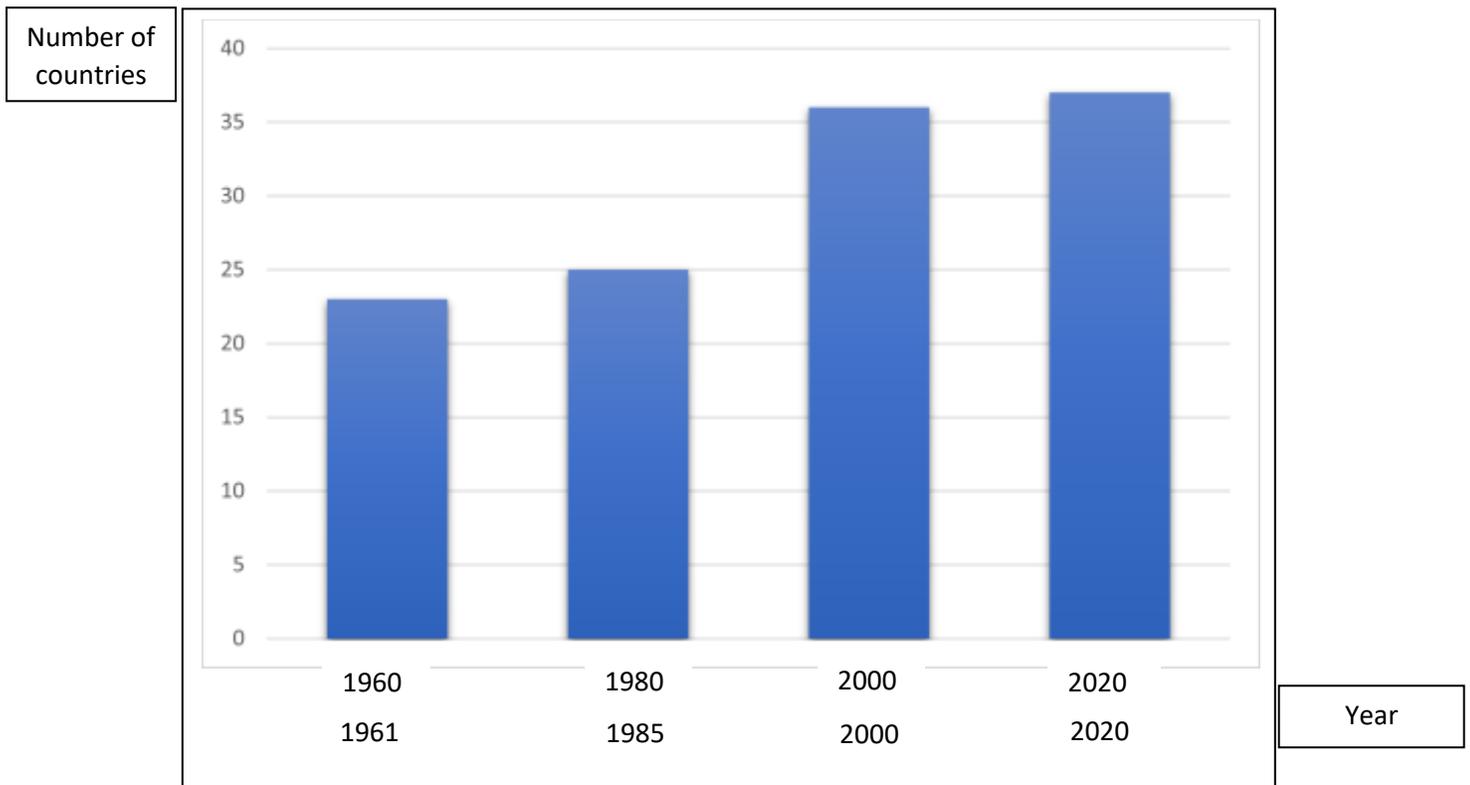


Fig.1 Number of countries having date palm plantations in the world

3. Estimation of the World Production of Dates

Proceeding from the estimations of the world production of dates [4]

Year	1961	1985	2001	2017
Millions of tons	1.8	2.8	5.04	8.06

¹The best fit quadratic function is:

$$Y=2.93562- 0.1185899X + 0.00314954X^2$$

Where Y is the date palm world production in millions of tons and X is the difference between the year and 1950.

Table.1 and Fig.2 give the estimation of world dates productions: from 1961 until 2200.

Table.1: Estimation of the World Dates Productions.

year	dates production (million tons)
1961	1.8
1985	2.8
2001	5.04
2017	8.06
2050	22.57
2100	56
2150	105.19
2200	170.13

¹ This function has been found by Prof.Dr. Mamdouh Fahmy.

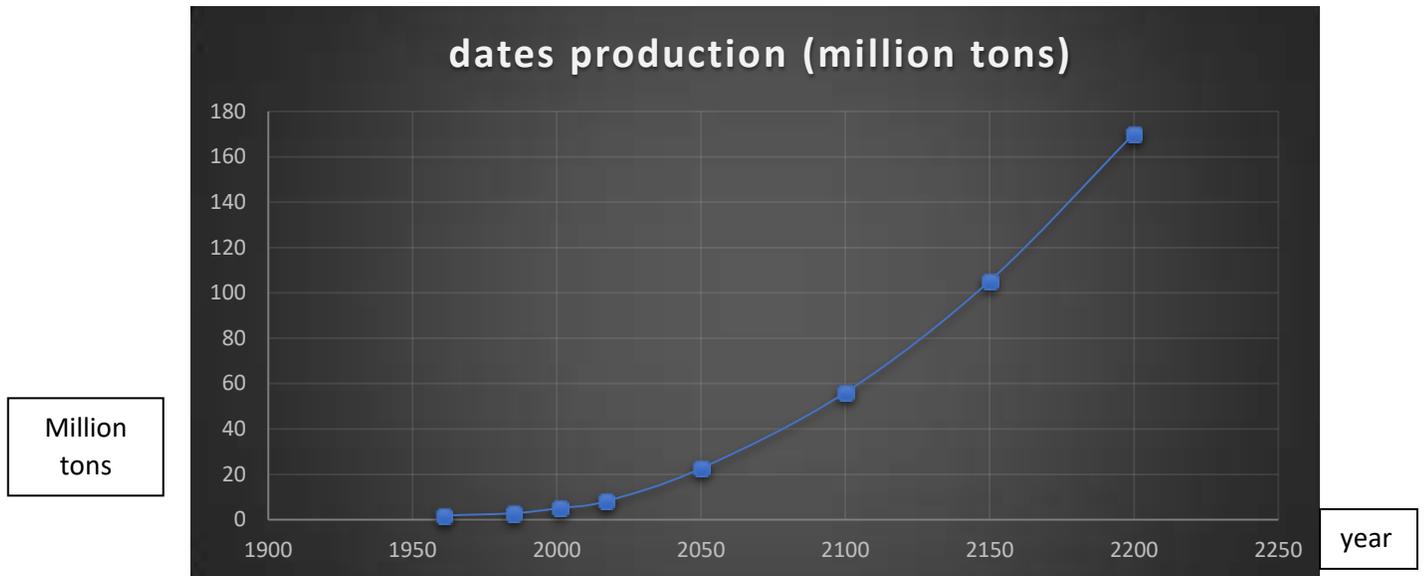


Fig.2 Estimation of the World Dates Productions

Taking an average annual world dates productions of 40 kg/palm [5], it is possible to estimate the world date palm number until 2200, as shown in Fig.3.

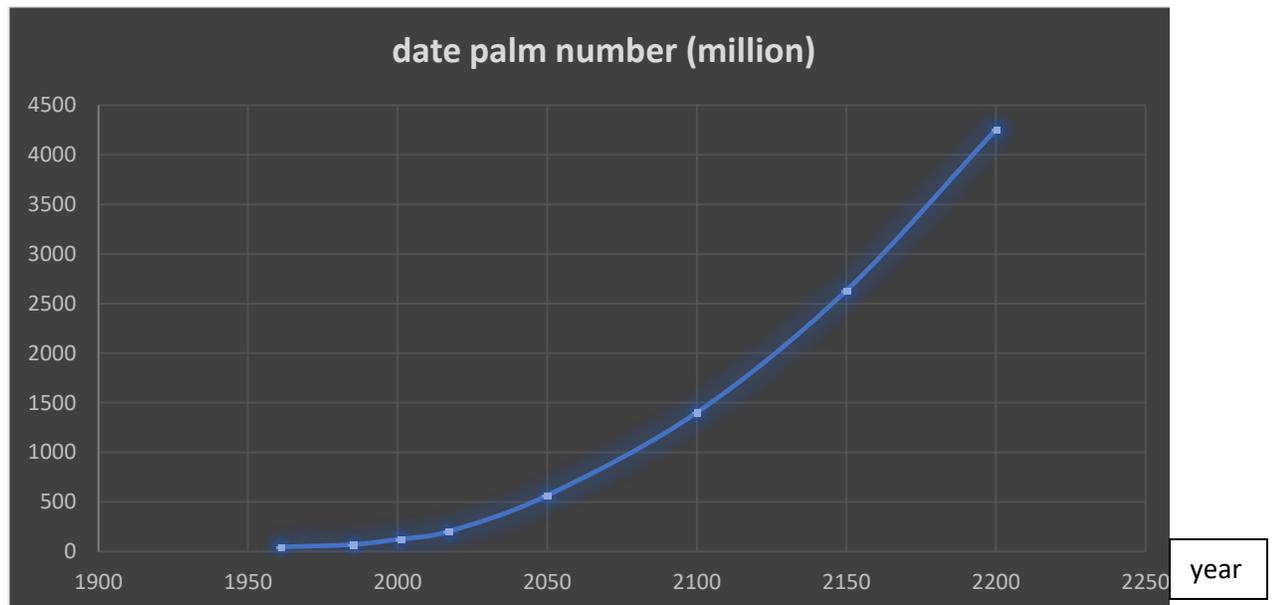


Fig.3 Estimation of the Number of Date Palms in the World

4. A Technical and Economic Feasibility Study of Horticulture Intensification of Date Palm and Mango in New Valley Governorate

4.1. Table.2 illustrates the annual horticultural care costs (Egyptian Pounds) for date palm (Saidi) and mango, whereas table.3 illustrates the total revenues (L.E) per hectare for date palm and mango combined.

Table.2: Estimation the annual horticultural care costs (Egyptian Pound) for date palm (Saidi) and mango.

YEAR	Harvest	Technical operations for trees	Pest control	Fertilization	Total L.E/ Hectare
First	-----	1000	500	1000	2500
The second	0000	0000	500	1500	2000
The third	500	5000	1000	2000	4000
The fourth	500	5000	1500	3000	5500
Fifth	1000	1000	2000	4000	8000
Sixth	1000	1500	2000	5000	8500
Seventh	1500	2000	2000	5000	10500
Eighth	1500	2000	2000	5000	10500
The ninth	2000	2000	2000	5000	11000
Tenth	2000	2000	2000	5000	11000
Eleventh	2000	2000	2000	5000	11000

Table.3: Estimated total revenue (Egyptian Pound) per hectare for date palm and mango combined

YEAR	Total annual revenue/ha of mango	Total annual revenue/ha of date palm	Total annual revenue/ha date palm and mango
First	-	-	-
The second	-	-	-
The third	6000	-	6000
The fourth	12000	-	12000
Fifth	24000	30000	54,000
Sixth	48000	36000	84,000
Seventh	60000	54000	114,000
Eighth	72000	66000	138,000
The ninth	72000	96000	168,000
Tenth	72000	108000	180,000
Eleventh	72000	72000	144,000

4.2. Table.4 gives an estimation of the net revenues after deducting the costs of horticultural care, whereas table.5 gives the annual net profit after deducting depreciation and operating costs.

It is clear from the table.3 that the total annual revenues of the project are constantly increasing, starting from the fifth year until it reaches its maximum in the tenth year and then increases from the eleventh year for the following reasons:

- 1- The mango crop begins to produce from the third year, and the date palm from the fifth year.

2-There is another product, the date palm shoots, whose value is, added with the fruit production of the date palm until the tenth year, then this product ends up from the date palm and therefore is not added in the eleventh year.

Estimate the net annual revenue of one hectare for palm and mango Trees combined.

Table.4: The estimated net revenues after deducting the costs of horticultural care.

YEAR	Total annual revenue/ha date palm and mango	Total annual horticultural care costs/ha	The net annual revenue of one hectare
First	-	2500	2500-
The second	-	2000	2000-
The third	6000	4000	2000
The fourth	12000	5500	6500
Fifth	54,000	8000	46,000
Sixth	84,000	8500	75,500
Seventh	114,000	10500	103,500
Eighth	138,000	10500	127,500
The ninth	168,000	11000	157,000
Tenth	180,000	11000	169,000
Eleventh	144,000	11000	133,000

Table.5: The annual net profit after deducting depreciation and operating costs (Egyptian pound) / hectare

YEAR	The net annual revenue of one hectare	Depreciation and operating costs / ha	Total annual net profit/ha
First	2500-	8,366	10,866-
The second	2000-	8,366	10,366-
The third	2000	8,366	6,366-
The fourth	6500	8,366	1,866-
Fifth	46,000	8,366	36,634
Sixth	75,500	8,366	67,134
Seventh	103,500	8,366	95,134
Eighth	127,500	8,366	119,134
The ninth	157,000	8,366	148,634
Tenth	169,000	8,366	160,634
Eleventh	133,000	8,366	124,634

4.3. Study Conclusions

The schedule of net profits and returns from the project shows the following:

4.3.1 A net profit is achieved starting from the fifth year of the start of agriculture at an amount of 36,634 Egyptian pounds, where the return is approximate to the volume of investments 49% and becomes higher than the interest of the Central Bank on the pound, which confirms the economic feasibility of the project.

4.3.2. The net profit increases until it reaches stability in the eleventh year from the start of the project by an amount of 124,634 Egyptian pounds with a return of up to 116%, exceeding the interest of the Central Bank on saving in ten years.

4.3.3. The results indicate the growing profitability of the project and show the extent of its economic efficiency with its diversity and flexibility that helps it to continue and grow well.

4.3.4. The net profit increases at high rates and takes great strides towards recovering the entire invested capital and investment costs.

4.3.5. We find that the project recovers the total capital and investment costs after 6 years from the start of the project despite the large invested capital, which is a record time for agricultural projects, especially since most of the cultivated crops are perennial crops producing after 3-5 years from the beginning of cultivation.

4.3.6. The project allows obtaining net profits for a long period and for a period of more than fifty years due to the old age of crops such as date palms, which represent the main agriculture in the project.

Thus, it can be concluded that the guaranteed profit of cultivation of date palms strongly supports the sustainability of the date palm as supporting tree coverage to compensate the current and future losses in forest coverage.

5. Date Palm Plantations: A Future Sustainable Support to Forests

Well managed date palm plantations can be considered as a future sustainable support to forests enjoying the following advantages:-

5.1.Safety from fire accidents, insects, pests, diseases and severe weather events [2].

5.2.Realization of food security. The fruits of date palms are rich in carbohydrates, vitamins and minerals. Date fruits are high- energy food sources with 72% to 88% sugar content at maturity. During the Khalal stage, nearly all (80-85%) of sugar is sucrose. As ripening progresses, the sucrose is hydrolyzed into reduced sugars such as glucose and fructose. Date fruits are good sources of iron and potassium; a fair source of calcium, chlorine, copper, magnesium and sulfur; and a minor source of phosphorus. In addition, dates are a source of 16 amino acids and vitamins A, B₁ and B₂ [2].

5.3.A date palm can absorb 200 kg of carbon dioxide per year [1]. Thus, it can be estimated that the date palms will be capable of absorbing carbon dioxide (million tons) with quantities:

112.85	280	525.95	850.65
In 2050	2100	2150	2200

5.4.The date palm byproducts including: leaves (midribs and leaflets), spathes, petioles, empty fruit bunches, leaf sheaths fibers, date kernels and trunks represent a sustainable material base for a wide spectrum of industries for the satisfaction of human needs on the world level.

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