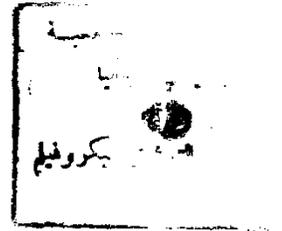


# Physiological Studies On Ripening And Storage Of Dates



By

*Elham Linhoum Abd El-Motly Daoud*

A thesis submitted in partial fulfillment

Of

The requirements for the degree of

Master of Science

In

Agriculture  
(Pomology)

634.62  
E.2

51633

Department of Horticulture  
Faculty of Agriculture  
Ain Shams University

1995

# Approval Sheet

## Physiological Studies On Ripening And Storage of dates

By  
Elham Zinhoum Abd -El-Motty Daood  
B.Sc. Horticulture, Cairo, University, 1983

*This thesis for M.Sc. Degree Has Been Approved By:*

Prof. Dr. Ahmed, S . Khalifa  
Research Chief Hort. Research. Instit

Prof. Dr. Ibrahim, M. Desouky *Ibrahim Desouky*  
Prof. of Pomology, Fac. of Agric., Ain Shams Univ.

Prof. Dr. Ahmed, S. Montasser *A-S. Montasser*  
Prof. of Pomology, Fac. of Agric., Ain Shams Univ. (Supervisor).

Date of Examination 23/ 1 /1995



# PHYSIOLOGICAL STUDIES ON RIPENING AND STORAGE OF DATES

BY

ELHAM ZINHOUM ABD EL-MOTTY DAOOD

Under the supervision of:

**Prof. Dr. Abd El-Azeem El-Hammady**

Prof. of Pomology, Horticulture Dept.,  
Faculty of Agriculture, Ain Shams Univ.

**Prof. Dr. Ahmed Sayed Montasser**

Prof. of Pomology, Horticulture Dept.  
Faculty of Agriculture, Ain Shams Univ.

**Prof. Dr. Mamdouh Nageib**

Prof. of Pomology, Horticulture Dept.  
National Research Center, Dokki, Egypt.

## ABSTRACT

Three experiments were carried out during the 1990, 1991 and 1992 seasons on "Zaghloul", "Hayany" and "Seewi" dates. The first experiment was performed to investigate the possibility of increasing the storage period and hence, marketing period of "Zaghloul" dates, while the second and third experiments were designed to improve the ripening methods of both "Hayany" and "Seewi" dates, respectively.

Results of the first experiment indicated that dipping "Zaghloul" dates in  $GA_3$  and/or  $CaCl_2$  solution at different concentrations was effective in increasing total sugars, and decreasing both tannins %, and titratable acidity. These results also indicated that the usage of  $GA_3$  with  $CaCl_2$  as supplementary treatment to cold storage at  $0^\circ C$  was of beneficial effect on prolonging the

storage period of "Zaghloul" dates with respect to the fruit quality. Storing treated Zaghloul dates at 5°C ranked second in this respect.

As for the second and third experiments results of this work showed that all tested treatments either for ethrel or for calcium carbide were effective in hastening ripening of both "Hayany" and "Seewi" dates. These treatments particularly for calcium carbide increased in general "rutab %", and total sugars while such treatments, on the other hand, decreased weight loss % and fruit decay percentages.

Therefore, it could be generally concluded that using both  $GA_3$  and  $CaCl_2$  treatments was effective in increasing storage ability of "Zaghloul" dates when stored at 0°C or 5°C whereas storage at 10°C is not recommended for "Zaghloul" dates under the condition of this experiment. Also, it could be concluded that calcium carbide was more suitable agent for artificial ripening of both "Hayany" and "Seewi" dates than ethrel.

Key words: Date fruits, "Zaghloul", "Hayany", "Seewi", cold storage, supplementary treatments, growth regulators, fruit quality, calcium chloride, Gibberlic acid, calcium carbide.

## ACKNOWLEDGEMENT

I wish to express my deep gratitude and sincere thanks to Dr. Abd El-Azeem El Hammady, Prof. of Pomology, Department of Horticulture, Faculty of Agric., Ain Shams University, for his supervision, encouragement, sincere help during the preparation and reviewing of this manuscript.

Sincere appreciation is due to Dr. Ahmed Sayed Montasser, Prof. of Pomology, Department of Horticulture, Faculty of Agric., Ain Shams University, for his supervision, continuous guidance, kind support and fruitful encouragement during the whole work and preparing of this manuscript.

Special thanks are due to Dr. Mamdouh Nageib, Prof. of Pomology, Department of Horticulture, National Research Center, for his supervision and constructive suggestions which are cordially appreciated.

I'm also greatly indebted to Dr. Malaka Abdel-Fatah Saleh, Assistant professor of Pomology, Horticulture Dept., National Research Centre, for sincere help and advice during this work.

My deep thanks are to Dr. Nazmy Abd El-Hamid, Lecturer of Pomology, Hort. Dept., Fac. of Agric. Ain Shams Univ. for his sincere help during the whole work and preparing of this manuscript.

Thanks are also due to the staff members of Hort. Dept. Fac. Agric. Ain Shams Univ. and of National Research Center, for the great helps offered by them.

# CONTENTS

	Page
<b>1. INTRODUCTION</b> .....	1
<b>2. REVIEW OF LITERATURE</b> .....	3
<b>3. MATERIALS AND METHODS</b> .....	18
<b>4. RESULTS AND DISCUSSION</b> .....	28
<b>4.1. First Experiment (Zaghloul date)</b> .....	28
4.1.1. Physical properties .....	28
4.1.2. Chemical properties .....	47
<b>4.2. Second Experiment (Hayany date)</b> .....	66
4.2.1. Physical properties .....	66
4.2.2. Chemical properties .....	83
<b>4.3. Third Experiment (Seewi date)</b> .....	102
4.3.1. Physical properties .....	102
4.3.2. Chemical properties .....	114
<b>5. SUMMARY AND CONCLUSION</b> .....	130
<b>6. REFERENCES</b> .....	136
<b>7. ARABIC SUMMARY</b>	

\* \* \*

## LIST OF TABLES

No. of Table	Page
1 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on decay% of "Zaghloul" dates stored at 0.5°C and 10°C, 1990 season.....	29
2 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on decay% of "Zaghloul" dates stored at 0°C or 5°C, 1991 season. ....	30
3 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on decay% of "Zaghloul" dates stored at 0°C or 5°C, 1992 season.....	31
4 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on rutab% of "Zaghloul" dates stored at 0°C or 5°C and 10°C, 1990 season. ...	35
5 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on rutab% of "Zaghloul" dates stored at 0°C or 5°C, 1991 season .....	36
6 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on rutab% of "Zaghloul" dates stored at 0 or 5°C, 1992 season.....	37
7 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on weight loss% of weight% of "Zaghloul" dates stored at 5°C and 10°C, 1990 season. .	39
8 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on weight loss % of "Zaghloul" dates stored at 0°C or 5°C, 1991 season. ....	40
9 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on weight loss % of "Zaghloul" dates stored at 0°C or 5°C, 1992 season. ....	41
10 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on pannel taste of "Zaghloul" dates stored at 5°C and 10°C, 1990 season.....	44
11 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on pannel taste of "Zaghloul" dates stored at 0°C or 5°C, 1991 season.....	45
12 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on pannel taste of "Zaghloul" dates stored at 5°C, 1992 season. ....	46

No. of Table	Page
13 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on titratable acidity% (as g as ethyl acetate soluble polyphenols/100 g fresh weight) of "Zaghloul" dates stored at 0,5°C and 10°C, 1990 season. .	48
14 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on titratable acidity% (as g ethyl acetate soluble polyphenols/100 g fresh weight) of "Zaghloul" dates stored at 0,5 °C, 1991 season. ....	49
15 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on titratable acidity% (as g ethyl acetate soluble polyphenols/100 g fresh weight) of "Zaghloul" dates stored at 0,5°C, 1992 season. ....	50
16 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on tannins% of "Zaghloul" dates stored at 0,5°C and 10°C 1990 season. ....	52
17 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on tannins% of "Zaghloul" dates stored at 0,5°C 1991 season.....	53
18 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on tannins% of "Zaghloul" dates stored at 0,5°C 1992 season. ....	54
19 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on total sugars % of "Zaghloul" dates stored at 0,5°C and 10°C 1990 season. ....	56
20 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on total sugars% of "Zaghloul" dates stored at 0,5°C 1991 season. ....	57
21 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on total sugars% of "Zaghloul" dates stored at 0,5°C 1992 season.....	58
22 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on reducing sugars % of "Zaghloul" dates stored at 0,5 and 10°C 1990 season.....	59
23 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on reducing sugars% of "Zaghloul" dates stored at 0, 5°C 1991 season. ....	60

No. of Table	Page
24 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on reducing sugars% of "Zaghloul" dates stored at 0, 5°C, 1992 season. ....	61
25 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on non-reducing sugars % of "Zaghloul" dates stored at 0,5°C and 10°C, 1990 season. ....	62
26 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on non-reducing sugars % of "Zaghloul" dates stored at 0, 5°C, 1991 season.....	63
27 Effect of dipping in $\text{CaCl}_2$ and/or $\text{GA}_3$ solutions on non-reducing sugars % of "Zaghloul" dates at 0, 5°C, 1992 season. ....	64
28 Effect of ethrel, $\text{CaCl}_2$ and calcium carbide as an artificial ripening agents materials on decay % of "Hayany" dates held at room temperature,during the season of 1990.....	67
29 Effect of ethrel, $\text{CaCl}_2$ and calcium carbide as an artificial ripening agents materials on decay % of "Hayany" dates held at room temperature,during the season of 1991.....	68
30 Effect of ethrel, $\text{CaCl}_2$ and calcium carbide as an artificial ripening agents materials on decay % of "Hayany" dates held at room temperature,during the season of 1992. ....	69
31 Effect of ethrel, $\text{CaCl}_2$ and calcium carbide as an artificial ripening agents materials on rutab % of "Hayany" dates held at room temperature,during the season of 1990 .....	71
32 Effect of ethrel, $\text{CaCl}_2$ and calcium carbide as an artificial ripening agents materials on rutab % of "Hayany" dates held at room temperature,during the season of 1991.....	72
33 Effect of ethrel, $\text{CaCl}_2$ and calcium carbide as an artificial ripening agents materials on rutab % of "Hayany" dates held at room temperature,during the season of 1992.....	73

No. of Table	Page
34 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on loss of weight % of "Hayany" dates held at room temperature,during the season of 1990.....	75
35 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on loss of weight % of "Hayany" dates held at room temperature,during the season of 1991.....	76
36 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on loss of weight % of "Hayany" dates held at room temperature,during the season of 1992.....	77
37 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on pannel taste of "Hayany" dates held at room temperature,during the season of 1990.....	79
38 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide on pannel taste of"Hayany" dates held at room temperature,during the seaon of 1991	80
39 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide on pannel taste of "Hayany" dates held at room temperature,during the season of 1992 .	81
40 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents aterials on titratable acidity% of"Hayany" dates, held at room temperature,during the season of 1990 .....	84
41 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on titratable acidity% of"Hayany" dates, held at room temperature,during the season of 1991.....	85
42 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agent materials on titratable acidity% of"Hayany" dates, held at room temperature,during the season of 1992 .....	86

No. of Table	Page
43 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on tannins% of "Hayany" dates, held at room temperature,during the season of 1990.....	88
44 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on tannins% of "Hayany" dates, held at room temperature,during the season of 1991.....	89
45 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on tannins% of "Hayany" dates, held at room temperature,during the season of 1992.....	90
46 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on Total sugars% of "Hayany" dates, held at room temperature,during the season of 1990.....	92
47 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on total sugars% of "Hayany" dates held at room temperature , during the season of 1991.....	93
48 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on total sugars% of "Hayany" dates held at room temperature , during the season of 1992. ....	94
49 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on non reducing sugars% of "Hayany" dates held at room temperature,during the season of 1990.....	95
50 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on non reducing sugars% of "Hayany" dates held at room temperature,during the season of 1991.....	96

No. of Table	Page
51 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on non reducing sugars% of "Hayany" dates held at room temperature,during the season of 1992.....	97
52 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on reducing sugars% of "Hayany" dates held at room temperature,during the season of 1990.....	98
53 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials on reducing sugars% of "Hayany" dates held at room temperature,during the season of 1991.....	99
54 Effect of ethrel, CaCl <sub>2</sub> and calcium carbide as an artificial ripening agents materials non reducing sugars% of "Hayany" dates held at room temperature,during the season of 1992.....	100
55 Effect of ethrel, and calcium carbide as an artificial ripening agents materials on decay % of "Seewi" dates during ripening period in both 1991 and 1992 seasons .....	103
56 Effect of ethrel, and calcium carbide as an artificial ripening agents materials on loss of weight% "Seewi" dates during ripening period in both 1991 and 1992 seasons. ....	106
57 Effect of ethrel and calcium carbide as an artificial ripening agents materials on Rutab % of "Seewi" dates during ripening period in both 1991 and 1992 seasons .....	109
58 Effect of ethrel and calcium carbide as an artificial ripening agents materials on Pannel taste of "Seewi" dates during ripening period in both 1991 and 1992 seasons .....	112

No. of Table	Page
59 Effect of ethrel and calcium carbide as an artificial ripening agents materials on titratable acidity% of "Seewi" dates during ripening period in both 1991 and 1992 seasons. ....	115
60 Effect of ethrel and calcium carbide as an artificial ripening agents materials on Tannins% of "Seewi" dates during ripening period in both 1991 and 1992 seasons. ....	119
61 Effect of ethrel and calcium carbide as an artificial ripening agents materials on Total sugars% of "Seewi" dates during ripening period in both 1991 and 1992 seasons. ....	122
62 Effect of ethrel and calcium carbide as an artificial ripening agents materials on Reducing sugars % of "Seewi" dates during ripening period in both 1991 and 1992 seasons. ....	123
63 Effect of ethrel and calcium carbide as an artificial ripening agents materials on non-reducing sugars%of Seewi"dates during ripening period in both 1991 and 1992 seasons ....	124

## LIST OF FIGURES

Fig .No.	Page
1 Effect of ethrel and calcium carbide as artificial ripening agents on decay % of "Seewi" dates, during 1991 and 1992 seasons. . . . .	104
2 Effect of ethrel and calcium carbide as artificial ripening agents on weight loss% of "Seewi" dates, during 1991 and 1992 seasons. . . . .	107
3 Effect of ethrel and calcium carbide as artificial ripening agents on Rutab% of "Seewi" dates, during the season of 1991 and 1992. . . . .	110
4 Effect of ethrel and calcium carbide as artificial ripening agents on pannel taste of "Seewi" dates, during 1991 and 1992 seasons. . . . .	113
5 Effect of ethrel and calcium carbide as artificial ripening agents on titratable acidity% of "Seewi" dates, during 1991 and 1992 seasons. . . . .	116
6 Effect of ethrel and calcium carbide as artificial ripening agents on tannins% of "Seewi" dates, during 1991 and 1992 seasons. . . . .	120
7 Effect of ethrel and calcium carbide as artificial ripening agents on total sugars % of "Seewi" dates, during 1991 and 1992 seasons . . . . .	125
8 Effect of ethrel and calcium carbide as artificial ripening agents on reducing sugars % of "Seewi" dates, during 1991 and 1992 seasons. . . . .	126
9 Effect of ethrel and calcium carbide as artificial ripening agents on non-reducing sugars% of "Seewi" dates, during 1991 and 1992 seasons. . . . .	127