

Evaluation and development of spraying application
used for controlling certain citrus mites

By

Nabila Saad Ahmed Haikal

B. Sc. Agricultural Sciences (General), Cairo University, 1985 and M.Sc. in Environmental
Sciences, Department of Agricultural Sciences- Institute of Environmental Studies and Research,
Ain Shams University 2006

A Thesis Submitted in Partial Fulfillment of

The Requirements of the degree of

DOCTOR OF PHILOSOPHY

In Environmental Sciences

Department of Agricultural Sciences

Institute of Environmental Studies & Research

Ain Shams University

2011

**Evaluation and development of spraying application
used for controlling certain citrus mites**

By

Nabila Saad Ahmad Haikal

**B. Sc. Agricultural Sciences (General), Cairo University, 1985 and M.Sc. in
Environmental Sciences, Department of Agricultural Sciences- Institute of
Environmental Studies and Research, Ain Shams University 2006**

A Thesis Submitted in Partial Fulfillment of

The Requirements of the degree of

DOCTOR OF PHILOSOPHY

In Environmental Sciences

Under The Supervision of:

Prof. Dr Ibrahim Gabir Professor of pesticides (Application Techniques). Department of Plant
Protection, Faculty of Agriculture, Ain Shams University

Prof. Dr. Sherif M. Hafez Professor of Agricultural Zoology, Department of Plant Protection,
Faculty of Agriculture, Ain Shams University

Prof. Dr. Mohamed Abd El-Aziz Hindy Professor of Spraying Technology, Head of the
Department of Spraying Technology, Institute of Plant Protection
Research, Ministry of Agriculture

2011

APPROVAL SHEET

**Evaluation and development of spraying application
used for controlling certain citrus mites**

By

Nabila Saad Ahmed Haikal

B. Sc. Agricultural Sciences (General), Cairo University, 1985 and M.Sc. in Environmental Sciences, Department of Agricultural Sciences- Institute of Environmental Studies and Research, Ain Shams University 2006

This Thesis Towards a Ph.D. Degree in Environmental Science has been approved by:

Name:

Signature

Prof. Dr. Ezzat farag Elkhayatt,.....

**Professor of plant protection, Department of Plant Protection, Faculty of Agriculture,
Banha University**

Prof. Dr. Abdallh Shehata Kassab,

**Professor Of Agricultural, Zoology, Department of Plant Protection, Faculty of Agriculture,
Ain Shams University**

Prof. Dr. Ibrahim Gabir ,

**Professor of Pesticides (Application Techniques), Department of Plant Protection, Faculty of
Agriculture, Ain Shams University**

تقويم و تطوير تطبيقات الرش المستخدمة فى مكافحة بعض أكاروسات الموالح

رسالة مقدمة من الطالبة

نبيلة سعد احمد هيكل

بكالوريوس فى العلوم الزراعية (شعبة عامة) جامعة القاهرة 1985

ماجستير فى العلوم البيئية من معهد الدراسات و البحوث جامعة عين شمس 2006

لاستكمال متطلبات الحصول على درجة الدكتوراه فى العلوم البيئية-قسم العلوم الزراعية

معهد الدراسات و البحوث البيئية

جامعة عين شمس

2011

تقويم و تطوير تطبيقات الرش المستخدمة

فى مكافحة بعض أكاروسات الموالح

رسالة مقدمة من الطالبة

نبيلة سعدأحمد هيكل

بكالوريوس فى العلوم الزراعية (شعبة عامة) جامعة القاهرة 1985

ماجستير فى العلوم البيئية من معهد الدراسات و البحوث البيئية جامعة عين شمس 2006

لاستكمال متطلبات الحصول على درجة الدكتوراه فى العلوم البيئية -قسم العلوم الزراعية

معهد الدراسات و البحوث البيئية - جامعة عين شمس

تحت اشراف

1-أ-د/ابراهيم جابر عبد الخالق

أستاذ تطبيقات استخدام المبيدات-كلية الزراعة جامعة عين شمس (المشرف الرئيس)

2- أ-د/شريف مصطفى حافظ

أستاذ الحيوان الزراعى -قسم وقاية النبات-كلية الزراعة جامعة عين شمس

3-أ-د/ محمد عبد العزيز هندى

استاذ تطبيقات الرش و رئيس قسم تكنولوجيا الرش - معهد بحوث وقاية النباتات -
مركز البحوث الزراعية- وزارة الزراعة

ختم الاجازة

اجيزت الرسالة بتاريخ / / 2011

موافقة الجامعة / / 2011

موافقة مجلس المعهد / / 2011

صفحة الموافقة على الرسالة

تقويم و تطوير تطبيقات الرش المستخدمة

فى مكافحة بعض أكاروسات الموالح

رسالة مقدمة من الطالبة

نبيلة سعد أحمد هيكل

بكالوريوس فى العلوم الزراعية (شعبة عامة) جامعة القاهرة 1985

ماجستير فى العلوم البيئية من معهد الدراسات و البحوث البيئية جامعة عين شمس 2006

لاستكمال متطلبات الحصول على درجة الدكتوراه فى العلوم البيئية

قسم العلوم الزراعية

و قد تمت مناقشة الرسالة والموافقة عليها

اللجنة :

التوقيع

أ.د عزت فرج الخياط / استاذ بقسم وقاية النبات - كلية الزراعة جامعة بنها

أ.د عبد الله شحاتة كساب / أستاذ الحيوان الزراعى بقسم وقاية النبات كلية الزراعة

جامعة عين شمس

أ.د إبراهيم جابر عبد الخالق / أستاذ تطبيقات استخدام المبيدات جامعة عين شمس

CONTENTS

ACKNOWLEDGEMENT-----	
ABSTRACT-----	
1- INTRODUCTION-----	1-2
2- REVIEW OF LITERATURE-----	3-12
3- METHODS AND TECHNIQUES-----	
A- LABORATORY TESTS-----	13-15
B- EXPERIMENTAL FILD-----	16-21
C- MATERIALS AND METHODS (BIOASSAY)-----	22-25
4 - DROPLETS TABLES (COVERAGE)-----	
EXPERIMENT :1-----	26-35
EXPERIMENT :2-----	36-47
EXPERIMENT :3-----	48-57
EXPERIMENT :4-----	58-66
EXPERIMENT :5-----	67-77
EXPERIMENT :6-----	78-82
EXPERIMENT :7-----	83-86
EXPERIMENT :8-----	87-97
EXPERIMENT :9-----	98-
110	
EXPERIMENT :10-----	111-
118	
EQUATIONS -----	119
5-RESULTS AND DESCUSSION-----	120-
150	
6-CONCLUSION.....	151
7-SUMMARY-----	152-156
7-REFERENCES-----	157-
163	

LIST OF TABLES

Page	NO
1 .	Laboratory data of true dyed water droplets collected in oil both, under various heights and operating pressures. 15
2.	Operational data of spray..... 18
3 .	Average dead numbers and mortality percentages of the citrus brown mite, <i>E. orientalis</i> (Klein) under laboratory 121
	conditions when treated with Ortus after different intervals

4. LC values and slopes of Ortus on the citrus brown mite, E. orientalis (Klein) after different intervals under laboratory conditions. 123
- 5 Average dead numbers and mortality percentages of the citrus brown mite, *Eutetranychus orientalis* (Klein) under laboratory conditions when treated with Micronized Sulfur after different intervals. 124
- 6 LC values and slopes of Micronized Sulfur on the citrus brown mite, E. orientalis (Klein) after different intervals under laboratory conditions. 126
- 7 . % Infested leaves by the citrus brown mite, E. orientalis (Klein) before and after spraying with Conventional Motor and Knapsack Sprayers on citrus trees in Seminud Gharbeya , Governorate during 2008 season. 128
- 8 % Infested leaves by the citrus brown mite, E. orientalis (Klein) before and after spraying with Conventional Motor and Knapsack Sprayers on citrus trees in Seminud, Gharbeya Governorate during 2009 season. 131
- 9 Average number of the citrus brown mite, E. orientalis (Klein) on citrus trees after application of Ortus and Micronized sulfur during 2008 season. 134
- 10 _Reduction percent induced by application of Ortus 5% SC and Micronized sulfur for management citrus brown mite, E. orientalis (Klein) on citrus trees in Seminud , Gharbeya, Governorate during 2008 season. 140
- 11 Average number of the citrus brown mite, E. orientalis (Klein) on citrus trees after application of Ortus and

Micronized sulfur during 2009 season.

- 12. Reduction percent induced by application of Ortus 5% SC and
Micronized sulfur 80% WP for management 141**
- citrus brown mite, *E. orientalis* (Klein) on citrus trees in Seminud
Gharbeya, Governorate during 2009 season.**

- 13 . Techno Operational data of conventional ground motor and Knapsack
motor sprayers. 143**

- 14 Distribution of Fenpyroximate watery spray acaricide sprayed by
means of certain ground application 144**
- techniques on orange trees.**

- 15 ..Simple correlation and partial regression value of the size of droplets
of Ortus 5% SC, Micronized sulfur 80% WP 147**

and mortality percentage of the citrus brown mite, *Eutetranychus
orientalis* (Klein) on citrus trees in Seminud, Gharbeya
governorate during 2008 season.

- 16 . Simple correlation and partial regression value of the size of
droplets of Ortus 5% SC, Micronized sulfur 80% WP 149**

and mortality percentage of the citrus brown mite, *Eutetranychus
orientalis* (Klein) on citrus trees in Seminoud,
Gharbeya governorate during 2009 season.

LIST OF FIGURES

1. Distribution the water sensitive cards on the tree
- 2,3. Shows droplet spots on water sensitive cards sprayed by knapsack sprayer and motor sprayer. 21
4. The citrus brown mite, *Eutetranychus orientalis*
25
5. Conventional Motor Sprayer
25
6. Knapsack Motor sprayer
25
7. LC₅₀ values of Ortus on the citrus brown mite, *Eutetranychus orientalis* (Klein) after differential laboratory conditions. 122
8. LC₅₀ values of Micronized Sulfur on the citrus brown mite, *E. orientalis* (Klein) after different intervals under laboratory conditions. 125
9. % Infested leaves by the citrus brown mite, *E. Orientalis* (Klein) before and after spraying with conventional motor and knapsack sprayers on citrus trees in Semrud Gharbeya governorate during 2008 season 129
10. % Infested leaves by the citrus brown mite, *Eutetranychus orientalis* (Klein) before and after 132

spraying with Conventional Motor and Knapsack Sprayers
on citrus trees in Seminud Gharbeya

, governorat during 2009 season.

11 . eduction percent induced by application of Ortus 5% SC and
Micronized sulfur 80% WP for 136

management citrus brown mite, E. Orientalis (Klein) on
citrus trees in Seminud

Gharbeya governorate during 2008 season.

12 . Reduction percent induced by application of Ortus 5% SC
and Micronized sulfur 80% WP 142

for management citrus brown mite, Eutetranychus orientalis
(Klein) on citrus trees in Seminud,

Gharbeya governorate during 2009 season.

2- REVIEW OF LITERATURE

2-1. Spray application .

Selection of the best chemical and technique to control the fruit leaf roller on citrus. Orchard sprayers. Spray-duster, hale boom spray rig, speed sprayer, spray rig. No description was given to the a/m types ... atomizers, ... etc. HV: 150-500 gal. /acre with the use of all sprayer. Spray-duster (600 lit. /acre) spray rig (50 lit. /tree). The speed sprayer affords the most uniform tree coverage followed closely (**Atkins, 1951**).

Hough and Mason (1951) found that the suitable methods used to spray orchards should depend on the local conditions, like the surface of the treated area, labor costs, and the type of sprayers used.

The main factors affecting the pest control application efficiency was indicated by **Yeoman and Rogers (1953)** who obtained a maximum deposit and coverage when the equipment should atomize the spray liquid to the proper particle-size and release it with sufficient velocity and momentum to deposit as many droplets as possible on the treated target. He recorded that small droplets had to move fast to have sufficient momentum to penetrate the air cushion formed when the air stream was defeated in front of subject. Practically ,all droplets were deposited from sprays directed downward. From sprays directed horizontally toward a vertical surface, however the amount of deposit was inverse proportion to the distance between the nozzle and the surface. The deposit decreased gradually with the increased spray height until a point of about 75% deposit was reached, and then dropped off rapidly. He also observed that the deposit was greater when adequate spray was released to penetrate an air stream in the direction of the spray.

Brown (1956) described and recommended the platforms and spray towers for orchard spraying, which enable the operator to spray adequately the top of the trees with less effort than spraying from the ground. He stated that the platform should be fixed at 2.5-3m above the top of the trees for efficient service result. Efficient spraying was made also when the operator's head was as high as the general level of the tree tops using spray towers.

Brown (1956) and **Himel (1969)** found that , the efficiency of chemical control application depends generally on its ability to distribute the spray material as evenly as possible on the target and to kill the maximum ecosystem contamination .They found that, in all types of atomizers, the decrease of flow-rate under given technical conditions increased the liquid atomization and gave narrow spectrum of droplets. However, the increase in the flow rate gave better coverage. The same authors added that, from the physical point of view, minimizing the liquid viscosity and surface tension increased the liquid atomization proportionally. Wetting agents were ineffective, to some extent, in reducing evaporation. On the contrary, it increased atomization processes. Increasing the liquid viscosity was also found to decrease the spray angle of hydraulic nozzles.

Martin (1958) found that the biological efficiency of the application depended on the mean level, distribution of the deposit, and the coverage of plant surface achieved. A leaf surface may be completely covered by the deposit that was evenly distributed, such as might result from the impact of droplets in small spraying volume. Adequate coverage, which implied the sufficient distribution of certain minimum levels of deposit, was the chief aim. The degree of coverage needed, however, depended on the nature of the pest to be controlled and the mode of action of the chemical pesticide. A mobile insect might be affected by coming into contact with a poison scattered at intervals over a surface. The same authors added that in the control of fungi and scale insects, the coverage required would depend upon the extent to which the pesticide could exert its action at a given spray height. The **same author (1958)** defined the low-volume spraying (LV) as an application with spraying fluid insufficient to cause run-off the target being spotted by discrete droplets, which may or may not coalesce. **Kearns (1958)** recommended LV spraying volume for orchards as 100 gal/acre instead of 500 gal. in HV. **Stapley (1958)** found that with LV spraying, the loss of pesticides was less than with high-volume, because of the absence of dripping. Compared with high-volume spraying, LV spraying gave equal biological results in the control of apple pests, and the two techniques produced equal fruit quality. He advocated the use of liquid formulations in LV spraying.