

ABSTRACT

The aim of this investigation is to develop a planter for plant three different medical and aromatic coated seeds. To achieve that aim two group of experiments were carried out the first was deduced laboratory to develop and indentify the optimum condition of a proper coating machine. While the second was carried out in the field to develop and evaluate the performance of a proper planter for planting the coated seeds. Field experiments were carried out to find the effect of forward-speeds of 1.82, 2.97, 3.84 and 4.79 km/h. (metering device speeds of 8, 12, 16 and 20 rpm and ground wheel speeds of 21, 34, 44 and 55 rpm) on longitudinal seed-uniformity, plant emergence, ground-wheel slip, fuel consumption, power, specific energy, actual field-capacity, crop yield, operation and production cost.

The main results can be summarized in the following:

- * The optimum conditions of coating machine were: coating-unit speed of 28 rpm, coating temperature of 30C°, coating time 15 min and coating with (Fe + Zn + Arasan) The results at optimum conditions were: germinations of 93, 96 and 96.5 %, for marjoram, basil and thyme coated seeds respectively.
- * The optimum forward and metering-device speed of the developed planter for marjoram, basil and thyme coated seeds were 2.97 km/h, and 12 rpm. The results at optimum conditions were: missing hills of 1.25, 2.5 and 2.5 %, double plants of 7.5, 5 and 5 %, total crop yield of 2.65, 2.35 and 1.80 Mg/fed., actual field capacity of 0.59 fed/h, specific energy of 5.25 kW.h/fed., operation cost of 91.49 LE/fed and production cost of 34.52, 38.93 and 50.88 LE/Mg for marjoram, basil and thyme coated seeds respectively.

CONTENTS

Titles	Page
1. INTRODUCTION	1
2. REVIEW OF LITERATURE	4
2-1. Mechanical seed-coating	4
2-1.1. The advantages of seed coating.....	4
2.1.2. Seed coating methods.....	6
2.1.3 Effect of seed-coating materials on germination	10
2.1.4. Effect of coating temperature and time on seed germination.....	11
2.2. Mechanical planting.....	13
2.2.1. Physical and mechanical properties of medical and aromatic seeds.....	13
2.2.2. Methods of seeds planting.....	15
2.2.3. Studies concerning the design and development of planters.....	19
2.2.4. Design considerations of planter components...	20
2.2.4.1. Seed box.....	20
2.2.4.2. Metering devices.....	21
2.2.5. Metering device performance.....	21
2.2.5.1. Effect of some factors on seed discharge.....	22
2.2.5.1.1. Seeding rate-shaft speed.....	22
2.2.5.1.2. Agitator.....	23
2.2.5.1.3. Gate opening.....	23

2.2.5.1.4. Seed size.....	23
2.2.5.2. Seed damage.....	24
2.2.5.3. Seed distribution.....	25
2.2.6. Some operating parameters affecting on seed yield.....	26
2.2.7. Power, specific energy and cost for mechanical planting.....	28
3. MATERIALS AND METHODS.....	30
3.1. MATERIALS.....	30
3.1.1. The used crop	30
3-1-2. The coating machine.....	30
3.1.3. Developed planter.....	34
3.1.3.1. Tool bar and three hitching-points.....	36
3.1.3.2. Planting unit	38
3.1.3.3. Frame of the planting unit	42
3.1.3.4. Furrow opener.....	45
3.1.3.5. Covering device.....	45
3.1.3.6. Transmission system.....	45
3.1.4. Tractor	45
3.1.5. Instruments	49
3.1.5.1. Balance.....	49
3.1.5.2. Stop watch.....	49
3.1.5.3. Repose-angle meter.....	49
3.1.5.4. Friction-angle device.....	49

3.2. METHODS	50
3.2.1. Mechanical seed-coating	50
3.2.1.1 Germination test	50
3.2.2. Mechanical planting.....	50
3.2.2.1. Laboratory tests.....	50
3.2.2.1.1.Physical properties of medical and aromatic seed.....	51
3.2.2.1.2. Mechanical properties.....	51
3.2.2.1.3. Studied factors in laboratory planting tests	51
3.2.2.1.4. Measurements of laboratorial tests	52
3.2.2.2. Field experiments.....	53
3.2.2.2.1. Experimental variables	53
3.2.2.2.2. Field measurements.....	53
4. RESULTS AND DISCUSSION	59
4.1. Results of laboratorial experiments.....	59
4.1.1. Effect of metering-device speed on coated-seed seeding rate.....	59
4.1.2. Effect of metering-device speed on coated-seed damage.....	60
4.1.3. Effect of metering-device speed on coated-seed germination.....	61
4.2. Results of field experiments.....	63
4.2.1. Effect of forward speed on planter performance	63
4.2.1.1. Plant emergence.....	63

4.2.1.2. Longitudinal plants-distribution and plant scattering.....	64
4.2.1.3. Missing hills and double plants index.....	66
4.2.2.1.4. Effect of forward speed on total crop-yield.....	68
4.2.2.1.5. Effect of forward speed on effective field-capacity and efficiency.....	68
4.2.2.1.6. Effect of forward speed on ground-wheel slip percentage.....	70
4.2.2.1.7. Effect of forward speed on fuel consumption, required power and specific energy.....	70
4.2.2.1.8 Effect of forward speed on cost of using the developed planter.....	72
5. SUMMARY AND CONCLUSION.....	73
6. REFERENCES.....	79
7. APPENDICES.....	89
ARABIC SUMMARY.....	

LIST OF TABLES

No.	Titles	Page
3-1	Mechanical analysis of the experimental soil	31
3-2	Show some physical properties of marjoram, basil and thyme seeds before and after coating.....	31
3-3	Seed rate, row spacing, and distance between seeds of tested medical and aromatic-crops.....	32
3-4	Specifications of digital instrument for measuring friction and repose angels.....	49
3-5	Metering-device speed and ground wheel speeds...	52
3-6	The constants used in Awady equation.....	58
A-1	Effect of metering-device speed on coated-seeding rate of marjoram, basil and thyme crops.....	89
A-2	Effect of metering-device speed on average coated-seed damage for marjoram, basil and thyme crops...	89
A-3	Effect of metering-device speed on coated-seed germination for marjoram, basil and thyme crops	90
A-4	Effect of forward speed on plant emergence of marjoram, basil and thyme coated-seeds.....	90
A-5	Average, minimum, maximum and C.V. of plant spacing for marjoram, basil and thyme coated-seeds at different forward speeds.....	91
A-6	Effect of forward speed on missing hills and double plants for marjoram, basil and thyme coated-seeds...	92

No.	Titles	Page
A-7	Effect of forward speed on total crop-yield of marjoram, basil and thyme coated-seeds.....	92
A-8	Effect of forward speed on effective field-capacity and field efficiency.....	93
A-9	Effect of forward speed on ground-wheel slip percentage.....	94
A-10	Effect of forward speed on fuel consumption, required power and specific energy for mechanical planting.....	94
A-11	Effect of forward speed on operation and production cost for different tested medical and aromatic coated-seeds.....	95

LIST OF FIGURES

No.	Titles	Page
3-1	Isometric of the seed-coating machine (Abd-Al Fattah <i>et al.</i>, 2015 and Abd-Al Fattah, 2016).	32
3-2	Photo of the seed-coating machine.....	33
3-3	Photo of marjoram, basil and thyme seed before coat.....	33
3-4	Photo of marjoram, basil and thyme crop	33
3-5	Elevation, side view and photo of the developed planter.....	34
3-6	Isometric details of the developed planter.....	35
3-7	Photo of the developed planter.....	36
3-8	Tool bar and three hitching-points.	37
3-9	Views of seed box.....	38
3-10	Views and isometric of metering device, cutoff and housing.....	39
3-11	Views and isometric of the cutoff.....	40
3-12	Views of the housing of metering device.....	42
3-13	The metering device.....	43
3-14	The frame of planter unit.....	44
3-15	Double disc furrow-opener.....	46
3-16	The covering device (press wheel).....	47

3-17	Transmission system of the developed planter.....	48
4-1	Effect of metering-device speed on seeding rate of marjoram, basil and thyme coated-seeds.....	60
4-2	Effect of metering-device speed on coated-seed damage of marjoram, basil and thyme coated seeds.....	61
4-3	Effect of metering-device speed on coated seed germination of marjoram, basil and thyme coated seeds.....	62
4-4	Effect of forward speed on plant emergence. of marjoram, basil and thyme coated-seeds.....	64
4-5	Effect of forward speed on average of plant spacing of marjoram, basil and thyme coated-seeds.....	65
4-6	Effect of forward speed on coefficient of variation of marjoram, basil and thyme plant pacing.....	65
4-7	Effect of forward speed on missing hills and double plants of marjoram, basil and thyme coated-seeds...	67
4-8	Effect of forward speed on total crop-yield of marjoram, basil and thyme coated-seeds.....	69
4-9	Effect of forward speed on effective field-capacity and field efficiency.....	69
4-10	Effect of forward speed on ground-wheel slip percentage.....	71
4-11	Effect of forward speed on fuel consumption, power and specific energy.....	71