

ABSTRACT

This field work was carried out at the Experimental Farm of Horticultural Research Station, at El-Quassassin, Ismailia, Egypt, during the two seasons of 2005-2006 and 2006-2007. The present work aimed to study the effects of plant spacing, cattle manure and NPK fertilization as well as their interaction treatments on vegetative growth, flowering and chemical constituents of leaves and flowers of common mullein (*Verbascum thapsus* L.) plants under sandy soil conditions. Three spacings at 20, 30 and 40 cm between the plants in row, three rates of cattle manure at 0.0, 30 and 45 m³/fed. and four levels of NPK at 0.0:0.0:0.0, 20.5:15.5:24, 41:31:48, and 61.5:46.5:72 kg/fed. of N: P₂O₅: K₂O, respectively were used. Data were recorded on mullein growth, dry leaves and flowers yield as well as chemical constituents. Generally, the highest yield of dry leaves and dry flowers as well as the highest content of the active components in leaves and flowers (total iridoid glycosides, total saponins and total mucilages)/plant were obtained from using the highest levels of each of plant spacing, cattle manure and NPK fertilization alone and their combination treatments. Whereas, the highest yields of dry leaves and dry flowers as well as the active components/fed. were produced with the narrow spacing 20 cm alone or its interactions with the highest levels of the two types of fertilization in both seasons.

الموجز العربى

تم إجراء هذا البحث فى المزرعة البحثية لمحطة بحوث البساتين بالقصاصين, محافظة الإسماعيلية ، مصر خلال موسمي 2005-2006 و 2006-2007 بهدف دراسة تأثير مسافات الزراعة وسماد الماشية (كسماد عضوى) والتسميد المعدنى (النيتروجين و الفوسفور و البوتاسيوم) بالإضافة إلى التفاعل بينهم على النمو الخضرى والإزهار والتركيب الكيماوى لنباتات أذان الدُّب (الفرباسكم) النامية تحت ظروف الأراضى الرملية. وقد تم استخدام ثلاث مسافات زراعة بين النباتات داخل الخط هى 20 و 30 و 40 سم وثلاث معدلات من سماد الماشية صفر و 30 و 45 م³/فدان وأربعة مستويات من التسميد المعدنى (NPK) هى صفر : صفر : صفر و 5, 20 : 5, 15 : 24 و 41 : 31 : 48 و 5, 61 : 46,5 : 72 كجم/فدان من الجافة وكذلك المكونات الكيماوية لأوراق و أزهار الفرباسكم. و قد أوضحت النتائج أن أعلى إنتاجية من الأوراق والأزهار الجافة وكذلك أعلى محتوى من المواد الفعالة فى الأوراق والأزهار (الجليكوسيدات الايريديوية و السابونينات و المواد المخاطية) للنبات تم الحصول عليها باستخدام المستويات الأعلى من كل من مسافات الزراعة وسماد الماشية والتسميد المعدنى (NPK) منفردة وكذلك معاملات التفاعل بينها. فى حين أن أعلى محصول من الأوراق والأزهار الجافة وكذلك المواد الفعالة للفدان تم الحصول عليها عند الزراعة على المسافة الضيقة (20 سم) منفردة أو تفاعلاتها مع المستوى الأعلى من كلا نوعى التسميد فى الموسمين.

CONTENTS

	Page
1. INTRODUCTION.....	1
2. REVIEW OF LITERATURE.....	6
3. MATERIALS AND METHODS.....	45
4. RESULTS AND DISCUSSION.....	54
4.1. Effect of plant spacing treatments on vegetative growth, flowering and chemical constituents of common mullein (<i>Verbascum thapsus L.</i>).....	54
4.1.1. Effect on vegetative growth	54
4.1.1.1. Number of leaves/plant	54
4.1.1.2. Plant height (cm)	54
4.1.1.3. Fresh and dry weight of leaves/plant (g).....	56
4.1.1.4. Yield of dry leaves/feddan (ton).....	58
4.1.2. Effect on flowering	58
4.1.2.1. Fresh and dry weight of flowers/plant (g).....	58
4.1.2.2. Yield of dry flowers/feddan (ton).....	60
4.1.3. Effect on chemical constituents of leaves	60
4.1.3.1. Leaf pigments content.....	60
4.1.3.2. Total nitrogen, total phosphorus and potassium percentages.....	61
4.1.3.3. Total iridoid glycosides content, total saponins and total mucilages percentages.....	64
4.1.3.4. Total carbohydrates percentage.....	64
4.1.4. Effect on chemical constituents of flowers	65
4.1.4.1. Total iridoid glycosides content, total saponins and total mucilages percentages.....	65
4.1.4.2. Total carbohydrates percentage	67
4.2. Effect of cattle manure treatments on vegetative growth, flowering and chemical constituents of common mullein (<i>Verbascum thapsus L.</i>).....	68
4.2.1. Effect on vegetative growth	68
4.2.1.1. Number of leaves /plant	68

4.2.1.2.	Plant height (cm).....	68
4.2.1.3.	Fresh and dry weight of leaves/plant (g).....	70
4.2.1.4.	Yield of dry leaves/feddan (ton).....	70
4.2.2.	Effect on flowering	72
4.2.2.1.	Fresh and dry weight of flowers/plant (g).....	72
4.2.2.2.	Yield of dry flowers/feddan (ton).....	72
4.2.3.	Effect on chemical constituents of leaves	74
4.2.3.1.	Leaf pigments content	74
4.2.3.2.	Total nitrogen, total phosphorus and potassium percentages.....	75
4.2.3.3.	Total iridoid glycosides content, total saponins and total mucilages percentages.....	75
4.2.3.4.	Total carbohydrates percentage.....	78
4.2.4.	Effect on chemical constituents of flowers	78
4.2.4.1.	Total iridoid glycosides content, total saponins and total mucilages percentages.....	78
4.2.4.2.	Total carbohydrates percentage.....	80
4.3.	Effect of NPK fertilization treatments on vegetative growth, flowering and chemical constituents of common mullein (<i>Verbascum thapsus</i> L.)	81
4.3.1.	Effect on vegetative growth.....	81
4.3.1.1.	Number of leaves/plant	81
4.3.1.2.	Plant height (cm).....	81
4.3.1.3.	Fresh and dry weight of leaves/plant (g)	83
4.3.1.4.	Yield of dry leaves/feddan (ton).....	85
4.3.2.	Effect on flowering	85
4.3.2.1.	Fresh and dry weight of flowers/plant (g).....	85
4.3.2.2.	Yield of dry flowers/feddan (ton).....	87
4.3.3.	Effect on chemical constituents of leaves	87
4.3.3.1.	Leaf pigments content.....	87
4.3.3.2.	Total nitrogen, total phosphorus and potassium percentages.....	88
4.3.3.3.	Total iridoid glycosides content, total saponins and total mucilages percentages.....	88

4.3.3.4.	Total carbohydrates percentage.....	91
4.3.4.	Effect on chemical constituents of flowers	92
4.3.4.1.	Total iridoid glycosides content, total saponins and total mucilages percentages.....	92
4.3.4.2.	Total carbohydrates percentage.....	92
4.4.	Effect of the interaction between plant spacing and cattle manure treatments on vegetative growth, flowering and chemical constituents of common mullein (<i>Verbascum thapsus</i> L.)	95
4.4.1.	Effect on vegetative growth	95
4.4.1.1.	Number of leaves/plant	95
4.4.1.2.	Plant height (cm).....	95
4.4.1.3.	Fresh and dry weight of leaves/plant (g).....	97
4.4.1.4.	Yield of dry leaves/feddan (ton).....	97
4.4.2.	Effect on flowering	99
4.4.2.1.	Fresh and dry weight of flowers/plant (g).....	99
4.4.2.2.	Yield of dry flowers/feddan (ton).....	99
4.4.3.	Effect on chemical constituents of leaves	100
4.4.3.1.	Leaf pigments content	100
4.4.3.2.	Total nitrogen, total phosphorus and potassium percentages.....	100
4.4.3.3.	Total iridoid glycosides content, total saponins and total mucilages percentages.....	102
4.4.3.4.	Total carbohydrates percentage.....	102
4.4.4.	Effect on chemical constituents of flowers	104
4.4.4.1.	Total iridoid glycosides content, total saponins and total mucilages percentages.....	104
4.4.4.2.	Total carbohydrates percentage.....	104
4.5.	Effect of the interaction between plant spacing and NPK fertilization treatments on vegetative growth, flowering and chemical constituents of common mullein(<i>Verbascum thapsus</i> L.)	105
4.5.1.	Effect on vegetative growth	105
4.5.1.1.	Number of leaves/plant	105

4.5.1.2.	Plant height (cm).....	105
4.5.1.3.	Fresh and dry weight of leaves/plant (g).....	107
4.5.1.4.	Yield of dry leaves/feddan (ton).....	107
4.5.2.	Effect on flowering	109
4.5.2.1.	Fresh and dry weight of flowers/plant (g).....	109
4.5.2.2.	Yield of dry flowers/feddan (ton).....	109
4.5.3.	Effect on chemical constituents of leaves	110
4.5.3.1.	Leaf pigments content	110
4.5.3.2.	Total nitrogen, total phosphorus and potassium percentages.....	110
4.5.3.3.	Total iridoid glycosides content, total saponins and total mucilages percentages.....	112
4.5.3.4.	Total carbohydrates percentage.....	112
4.5.4.	Effect on chemical constituents of flowers	114
4.5.4.1.	Total iridoid glycosides content, total saponins and total mucilages percentages.....	114
4.5.4.2.	Total carbohydrates percentage.....	115
4.6.	Effect of the interaction between cattle manure and NPK fertilization treatments on vegetative growth, flowering and chemical constituents of common mullein (<i>Verbascum thapsus</i> L.)	116
4.6.1.	Effect on vegetative growth.....	116
4.6.1.1.	Number of leaves /plant	116
4.6.1.2.	Plant height (cm).....	116
4.6.1.3.	Fresh and dry weight of leaves/plant (g).....	118
4.6.1.4.	Yield of dry leaves/feddan (ton).....	118
4.6.2.	Effect on flowering	120
4.6.2.1.	Fresh and dry weight of flowers/plant (g).....	120
4.6.2.2.	Yield of dry flowers/feddan (ton).....	121
4.6.3.	Effect on chemical constituents of leaves	121
4.6.3.1.	Leaf pigments content	121
4.6.3.2.	Total nitrogen, total phosphorus and potassium percentages.....	123

4.6.3.3.	Total iridoid glycosides content, total saponins and total mucilages percentages.....	124
4.6.3.4.	Total carbohydrates percentage.....	126
4.6.4.	Effect on chemical constituents of flowers	126
4.6.4.1.	Total iridoid glycosides content, total saponins and total mucilages percentages.....	126
4.6.4.2.	Total carbohydrates percentage.....	127
4.7.	Effect of the interaction between plant spacing, cattle manure and NPK fertilization treatments on vegetative growth, flowering and chemical constituents of common mullein (<i>Verbascum thapsus</i> L.).....	128
4.7.1.	Effect on vegetative growth	128
4.7.1.1.	Number of leaves/plant.....	128
4.7.1.2.	Plant height (cm).....	128
4.7.1.3.	Fresh and dry weight of leaves/plant (g)	130
4.7.1.4.	Yield of dry leaves/feddan (ton).....	130
4.7.2.	Effect on flowering	132
4.7.2.1.	Fresh and dry weight of flowers/plant (g).....	132
4.7.2.2.	Yield of dry flowers/feddan (ton).....	132
4.7.3.	Effect on chemical constituents of leaves	134
4.7.3.1.	Leaf pigments content	134
4.7.3.2.	Total nitrogen, total phosphorus and potassium percentages.....	136
4.7.3.3.	Total iridoid glycosides content, total saponins and total mucilages percentages.....	138
4.7.3.4.	Total carbohydrates percentage	140
4.7.4.	Effect on chemical constituents of flowers.....	140
4.7.4.1.	Total iridoid glycosides content, total saponins and total mucilages percentages.....	140
4.7.4.2.	Total carbohydrates percentage.....	142
5.	SUMMARY AND CONCLUSION.....	143
6.	LITERATURE CITED.....	150
7.	ARABIC SUMMARY	

ABBREVIATIONS

C.F. : Cited from

C.M : Cattle manure

Fed. : Feddan (4200m²)

FYM : Farmyard manure

ha : hectare (10000 m²)

L.E. : Egyptian pound

M.L.S.D.: Modified least significant difference

Max. : Maximum

Min. : Minimum

NPK : nitrogen, phosphorus and potassium

t or ton : tone (1000 kg)

T.I.G : Total iridoid glycosides

T.M : Total mucilages

T.S : Total saponins