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INFLUENCE OF CUTTING TYPE ON THE PROPAGATION OF MARJORAM PLANTS

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Abstract

The present work was carried out to study the effect of the types of Marjoram cuttings (apical and basal) and the length (15, 20 ,and 25 cms) on their stand percentage, some growth characters, herb, yield, oil percentage and oil yield of marjoram plants. The obtained results showed that, apical and basal cuttings in 20 and 25 cms, length, mostly produced higher values of vegetative growth characters and stand cuttings percentage. Furthermore oil percentage and oil yield per plant and per plot increased as a result of using the long cuttings (20 and 25 cms), when compared with the shorter once (15 cms) in both apical and basal cuttings.

INTRODUCTION

Marjoram, (*Origanum majorana* L.), (*Marjorana hortinsis* MOENCH), is an annual to biennial herbaceous plant which grows in cool climates. In the Mediterranean region, where it has been cultivated since ancient times, it has become naturalized as a perennial herbaceous to semi-shrubby plant.

The active principles of marjoram herb, and its volatile oil are used in treated of digestive upsets, flatulence, intenstinal colic and diarrhoea. Marjoram herb is a popular flavouring in food industry, (Stary and Jirasek 1982).

Marjoram plants propagated by seed as well as by cuttings, but the seeds are very slow to germinate(Rosetta E. Clarkson 1970).

The possibility of many plants to propagate by stem cutting, and to increase their rooting percentage were studied, (Bioarczuk and Jankiewi 1975), on *Syringa vulgaris* (Cupta and Chandra 1979), on *Pinus (Roxburghii* and Jajapal *et al.* 1980), on *Jasminum grandiflorum*, who mentioned that, apical cuttings and the youngest physiologically cuttings produced more roots that the basal and wood matured cuttings.

The aim of this investigation is to study the effect of cutting types and length on some growth characters and essential oil yield of marjoram plants.

MATERIALS AND METHODS

This work was carried out at the Medicinal and Aromatic Plants Research Section at El-Kanater El-Khairia Station, Egypt, during the two successive seasons of 1989-1990 and 1990-1991.

Two types of stem cuttings, apical and basal, were prepared in different lengths (15, 20 and 25 cms in length) of the two types. These cuttings were cut on October 20th in each of the two seasons of growth and were planted at the same time in the field of experiment.

The experimental unit area consisted of a plot 4.8 m^2 containing 32 cuttings, cultivated in rows 60 cms apart at a distance of 25 cms, in between. The plants were fertilized as in case of a normal herbaceous plants. The experiment was designed as a complete randomized blocks in 4 replicates.

Apical and basal cuttings in different length, 15, 20 and 25 cms were analysed chemically to study the nutritional status of marjoram cuttings parents. These determination were:

1. Total carbohydrate according to Dubios *et al.* (1956),
2. Total nitrogen according to method described in A.O.A.C. (1980).

Stand cuttings, plant height, number of branches per plant, fresh and dry weight plant, dry weight of herb yield per plot were recorded, as well as volatile oil percentage, oil yield per plant and per plot. The percentage was determined according to the British Pharmacopeia (1963). The data were statistically analysed according to Snedecor (1966).

RESULTS AND DISCUSSION

I. Vegetative Growth:

A. Stand Cuttings:

Data presented in Table 1 show that, the three lengthes of the selected apical cuttings exhibited some differences in degree of rooting (stand), the cutting 15 cms long was lowest in rooting capacity when compared with the three lengthes studied, while a long apical cuttings, especially 20 cms in length had a long apical cuttings, especially 20 cms in length had a significantly greater stand percentage. The highest values were 74% and 87% for the two successive seasons, the lowest number for successful cuttings was 60.3% obtained by the basal cuttings of 15 cms in length. These results showed that, the best values were obtained by using the apical long cuttings (20 and 25 cms). This may be explained by the presence of more leaves and developing buds on the long cuttings and active merestimic tissues which supply the bases of shootings with the hormones and other substances, that the cutting needs for rooting and growing. The definite relationship between the presence of leaves on a cutting and its capacity to root, were the fact of the formation of a specific rooting substances in leaves. This work was subsequently extended to show that leaves also were a source of this hormone, (Audus 1963). Similar results were shown by Nambisan *et al.* (1977) on *Nerium indicum*, Shoushan *et al.* (1979) on *Araucaria excelsa*, and Obdralek (1985), on *Cornus ploridal* reported that semi-hardwood cutting rooted than softwood ones.

B. Plant height:

During the periods of growth seasons of marjoram plants in Table 1, the data reveal that, using apical and basal cuttings in 20 and 25 cms in length did result in a

Table 1. *majorana* L. plants in (1990 - 1991) seasons.

Plant age days	Plant hieght in cm. cutting type				Number of branches /plant cutting type			Stand cutting % Cutting typte		
	Length in cm.	Apical	Basel	Means	Apical	Basel	Means	Apical	Basel	Means
				1990 season						
135	15	17.08	14.08	15.58 B	11.25	9.33	10.29 B	-	9.33	-
	20	21.50	20.00	20.25 A	12.75	13.75	13.25 A	-	13.75	-
	25	21.67	21.67	21.67 A	12.67	13.50	13.09 A	-	13.50	-
	Means	19.75a	18.58a		12.22a	12.19a		-	21.19	-
150	15	26.17	23.50	24.84 B	15.15	13.83	14.49 B	-	13.83	-
	20	28.75	28.07	28.41 A	17.14	23.33	20.24 A	-	23.33	-
	25	27.83	28.83	28.33 A	20.99	26.42	23.71 A	-	26.42	-
	Means	27.58a	26.80a		17.76b	21.19a		-	21.19	-
165	15	34.35	33.75	34.05 B	25.58	24.73	25.16 B	70.31	24.73	65.31
	20	41.00	39.16	40.08 A	25.73	31.81	28.77 A	74.22	31.81	72.66
	25	24.50	40.08	41.29 A	29.15	35.17	32.16 A	72.91	35.17	71.52
	Means	39.28a	37.66a		26.82b	30.57a		72.48a	30.57	
				1991 season						
135	15	19.00	16.17	17.59 B	5.59	5.67	5.63 B	-	5.67	-
	20	23.25	23.21	23.23 A	11.30	8.96	10.13 A	-	8.96	-
	25	23.59	23.92	23.76 A	7.67	8.83	8.25 A	-	8.83	-
	Means	21.95a	21.10a		8.19b	7.82a		-	7.82	-
150	15	28.42	23.08	25.75 B	11.50					
	20	33.08	29.92	31.50 A	20.50	8.68	10.09 B	-	8.68	-
	25	30.09	31.34	30.72 A	15.42	13.92	17.21 A	-	13.92	-
	Means	30.53a	28.11a		15.81a	14.42	14.92 A	-	14.42	-
155	15	36.09	28.21	32.15 B	14.42	12.34a		-	12.34	-
	20	41.25	36.75	39.00 A	21.42	16.29	15.36 B	70.93	16.29	7.97
	25	36.17	36.58	36.38 A	20.50	21.63	21.53 A	87.01	21.63	80.08
	Means	37.84a	33.85a		18.78a	23.08	21.76 A	81.78	23.08	78.86
						20.33a		79.91a	20.33	

Means within a column followed by the same letter are not significantly different (p=0.05) using Duncan's New Multiple Range Test.

significant increase in height compared with the two types of cuttings in 15 cms in length. The highest values were 42.5 and 41.0 cms for 25 and 20 cms apical cuttings respectively, while lowest values were 9.33 and 11.25 cms in height for basal and apical cuttings 15 cms length respectively. The same trend was obtained in both seasons of growth.

C. Branches number per plant:

Data in Table 1 indicate that, the mean number of branches per plant increased significantly by using the long cuttings (20 and 25 cms) compared to the shorter one (15 cms), in both apical and basal cuttings. The basal cutting by the length of 25 cms, was the superior one in this concern, which produced the highest value, 35.17 branches per plant, while the lowest value was 24.73 branches obtained by using the basal cutting at 15 cms. Similar trend resulted in both seasons of growth.

Increasing plant height and branches number may be attributed to the ability of the long cuttings which have more leaves and developing buds, moreover, the meristimatic cells which play a major role to root better than the shorter one, and thus to give a vigorous plant. In this respect Hartmann and Kester (1978), mentioned that the differences in rooting for terminal and basal cuttings may be attributed to several factors, such as the moisture content and maturity of the wood.

D. Fresh and dry weight per plant and per plot:

Generally, the long cuttings (20 and 25 cms length), increased fresh and dry weight of marjoram aerial parts compared to the short cuttings 15 cms in length in both apical and basal cuttings, (Table 2). This increase was significant in most cases in both seasons of growth. The highest values were 151.1 and 45.61 gms fresh and dry weight/plant respectively for the long apical cutting of 20 cm and the lowest values were 109.42 gms fresh weight for apical cutting 15 cms and 39.92 dry weight for basal cutting 15 cms length. The greater values in fresh and dry weight per-plant as a result of using long cuttings, may be attributed to the increase in plant height and number of branches.

Data in Table 2 show clearly that using long cuttings (20 and 25 cms) resulted in a significant increase in herb dry weight compared to the short cuttings (15 cms) during the two seasons of growth. The lowest value of yield per plot (0.51 kgs) was obtained by the shortest basal cuttings (15 cms). No significant differences resulted by using apical or basal cuttings in any length. In this respect, the increase in the

Table 2. Effect of cutting types on the yield of *Origanum majorana* L. plants in 1990 - 1991 season.

Plant age days	Plant hieght in cm. cutting type			Number of branches /plant cutting type				Stand cutting % Cutting typte		
	Length in cm.	Apical	Basel	Means	Apical	Basel	Means	Apical	Basel	Means
				1990 season						
	15	109.42	125.86	117.64	41.12	39.92	40.52	0.69	0.51	0.60
	20	141.01	139.98	140.49	45.61	44.25	44.93	1.02	0.95	0.99
	25	143.29	135.35	139.35	44.65	43.22	43.94	0.19	0.93	0.92
	Means	131.24a	133.73a		43.79a	42.46a		0.87a	0.80a	
				1991 season						
	15	103.87	117.77	10.82B	36.54	39.04	37.79	0.88	0.88	0.90
	20	128.86	135.41	132.14A	44.39	50.01	47.20	1.05	1.02	1.04
	25	138.59	142.46	140.53A	45.89	51.65	48.77	1.09	1.08	1.09
	Means	23.77a	131.88a		42.27a	46.90a		1.02a	0.99a	

Means within a column followed by the same letter are not significantly different (p=0.05) using Duncan's New Multiple Range Test.

dry weight of herb per plot may be due to the increase of the sucessful number of cuttings per plot, subsequently the progress of the vegetative growth. These results are in harmony with the finding of El-Keltawi and Croteau (1986), on mint plants, and they stated that fresh and dry weights of developing tissues of mint were highly dependent on the type of cuttings.

II. Chemical Studies:

The presented data in Table 3, indicate that total carbohydrate percentage was relatively high in both basal cuttings at 20 and 25 cms length, whereas adverse trend was obtained for total nitrogen in the same cuttings, while the high total nitrogen percentage obtained in different length of apical cuttings. The low concentration of total carbohydrate was recorded by the short cuttings (15 cms, length) in both apical and basal cuttings. No major differences were obtained among total carbohydrates percentage and total nitrogen percentage in both 20 and 25 cms long cuttings of the apical ones.

Table 3. Chemical analysis of cutting parents of *Origanum majorana* plant.

Cutting type	Cutting length in cms.	Total Carbohydrate C %	Total nitrogen N %	C/N ratio
Apical cutting	15	12.78	3.35	3.8/1
	20	13.55	3.46	3.9/1
	25	13.58	3.43	4.0/1
Basal Cutting	15	10.67	3.13	3/1
	20	15.50	2.98	5/1
	25	15.38	2.74	6/1

The ratio of total carbohydrates/total nitrogen showed higher values in the basal cuttings of 20 and 25 cms in length. Also data showed the low C/N ratio of terminal cuttings of 15 cms, length as compared to the other cuttings. Such result may explain the high rooting efficiency of a long basal cuttings of 20 and 25 cms length. In this respect, Reuveni and Adato (1974) reported that, carbohydrate are such an important source of the energy for rooting, it seems

that large reserves of carbohydrates and little composition from vegetative growth are factors which increase the ability of certain off shoots to roots, also Hartmann and Kester (1978), found that the nutritional status, especially carbohydrate and nitrogen content of the mother plants or the cutting at the time of cuttings propagation had been considered for a long time to exert a strong influence on root formation and development in such cuttings.

III. Oil percentage and yield:

As shown in Table 4 oil percentage in marjoram herb was not affected by using the different cuttings, although there was a slight increase resulting from the long cuttings of 20 and 25 cms length in both the apical and basal cuttings but this increase was not significant. Some results were observed during the two seasons of growth. The oil percent increases may be due to the metabolic activity of the vigorous plants produce. In this respect, Fazecas *et al.* (1981), on *Pimpinella anisum* reported that the oil percentage was a genetic character and thus was unaffected by N fertilizers.

Regarding oil yield per plant in Table 4, shows that the long cuttings gave the best values of oil yield but this increase was not significant in both seasons of growth.

Generally, oil yield per plot increased significantly by increasing the cuttings length (20 and 25 cms) compared to the shorter one (15 cms) in all cutting types.

The increase in the oil yield per plot may be attributed to the increase in number of stand cuttings per plot and the vigorous of plant growth, which induce more herb yield required for the production of more quantity of volatile oil.

From the forementioned results, cuttings of marjoram plants can be propagated by using apical or basal cutting especially with a length of 20 and 25 cms.

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Table 4. Effect of cutting type on the oil yield of *Origanum majorana* plants in 1990 and 1991 seasons.

Cutting type	Cutting length in cms	Oil %	Oil yield plant (cc)	Oil yield plant (cc)	Oil %	Oil yield plant (cc)	Oil yield Plot (cc)
Apical Cutting	15	1.28	0.37	11.60 A	0.88	0.37	6.10 A
	20	1.30	0.43	13.70 AB	0.90	0.46	9.20 B
	25	1.18	0.62	15.30 B	1.14	0.49	10.4 BC
Basal Cutting	15	0.93	0.39	8.20 C	1.07	0.46	5.50 A
	20	1.19	0.58	12.10 A.	1.17	0.58	11.2 BC
	25	1.26	0.58	13.60 AB	1.21	0.61	11.3 B

Means within a column followed by the same letter are not significantly different (p=0.05) using Duncan's New Multiple Range Test.

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تأثير نوع العقلة على إكثار نبات البردقوش

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أجريت هذه الدراسة بفرع بحوث النباتات الطبية والعطرية بالقناطر الخيرية خلال موسمى ١٩٩٠ ، ١٩٩١. وتهدف الى دراسة إستخدام العقل الطرفية والقاعدية لطول ١٥ ، ٢٠ ، ٢٥سم لكل منها وتأثير ذلك على النمو الخضرى ومحصول الزيت.

وقد توصلت النتائج الى أن إستخدام العقل سواء الطرفية او القاعدية بطول ٢٠ ، ٢٥سم للعقلة أعطى أعلى محصول خضرى من حيث طول النبات وعدد الأفرع والوزن الجاف والطازج للنبات الواحد وكذلك محصول القطعة التجريبية كما أعطت أعلى نسبة من عدد العقل الناجحة.

لم تتأثر نسبة الزيت بإستخدام العقل المختلفة فى النوع والطول بينما زاد محصول الزيت الكلى بزيادة العشب الناتج.

ويوصى البحث بامكانية إكثار نباتات البردقوش بإستخدام العقل الطرفية او القاعدية خاصة بطول ٢٠ او ٢٥سم للعقلة.