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EFFECT OF VARIETIES, SOIL SALINITY AND THEIR INTERACTION TREATMENTS ON SEED GERMINATION, SURVIVAL PERCENTAGE, VEGETATIVE GROWTH AND ESSENTIAL OIL OF *Ocimum basilicum L.* PLANTS.

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ABSTRACT

Laboratory and pot experiment were conducted Through two successive seasons,(1995 –1996), to study the effect of four levels of salinity(0,1500,3000and 4500 ppm) on seed germination and survival percentage, growth characters and essential oil percentage of four varieties of *Ocimum basilicum* plants (*Ocimum basilicm* var. *Odoratus*(v_1), var. *Alba*(v_2), var. *Thyrsiflorum* (V3) and var.*Purpurascens*(v_4)). The highest seed germination percentage was noticed with variety purpurascen on the level 1500 ppm of salinity during first and second season,while maximum survival Percentage resulted with *Thyrsiflorum*(v_3) with the same previously level of salinity in the first season, but was with *purpurascen* (V4) in the second one. Meanwhile, the vegetative growth of various varieties recorded very widely variation by salinity treatments. V4 gave the highest volatile oil percentage in the two cuts during both seasons, and there were insignificant differences between the other varieties. Regarding to salinity effect found that both of 3000 and 4500 ppm decreased essential oil percentage, but 1500 ppm increased it significantly in comparison with control, and locking for the interaction between salinity and varieties, noticed that V4 with 1500 ppm level resulted the highest essential oil percentage, during first and second cut in both seasons.

The highest level of oil yield (ml)/plant was noticed at V3 during the two seasons of first cut, but it was resulted by V3 in the first season, and by V4 in second of second cut. All of used salinity levels caused a decrease in oil yield, meanwhile the lowest one was observed with highest applied level (4500ppm). According to interaction between variety and salinity, the largest amount of oil yield/plant was resulted with V4 and applied level of 1500ppm during the successive two season of first and second cut.

Keywords: *Ocimum basilicum*, salinity, varieties, and essential oil.

INTRODUCTION

The sweet French basil is represented by the plant *Ocimum basilicum L*.which. Belonging to the family Lamiaceae. The oil is extensively employed in several European countries and U.S.A. for flavouring of food stupps. It also, finds a prominent place in the flavouring of foods, such as spiced meets, sausages, tomato pastes, various kinds of sauces, fancy vinegar, pichles, ketchup and beverages. In Egypt, most of the suitable lands are situated either near the Mediterranean Sea or in the western desert. In the farmer region, saline water is generally used for irrigation, whereas, in the latter, it is mostly saline soils. In the same time under the arid climatic conditions prevailing in Egypt and association with the prennial irrigation practices,

imperfect draining system, continuous increase of water table levels and the relatively high salinity levels of water sources particularly in the new reclaimed land, the salnization of Egyptian soils is rapidly going to be an acute problem. Therefor it is very important to find some varieties, which must be more tolerance against salinity, to keep on the basil in Egypt. Many investigators have studied the effect of salinity on some of medicinal and aromatic plants, such as Simoens and Damme (1988) on *Hibiscus sabdariffa*, Palma *et al.* (1996) on *Capsicum annum* and El- Moursy (1996) on guar.

The aim of the present investigation is to evaluate the tolerance of four varieties to four levels of salinity and their interaction on seed germination, survival percentage, growth characters and essential oil yield and percentage of *Ocimum basilicum L*. plants.

MATERIAL AND METHODS

Four varieties of *Ocimum basilicum L.viz. Ocimum basilicm var. Odoratus* (V1), *Ocimum basilicum var. Alba* (V2), *Ocimum basilicum var. Thyrsiflorum* (V3) and *Ocimum basilicum var. Purpurascens* (V4) seeds were introduced directly from Saudia Arabia and identified botanically by Uerbarum Royal Botanic Gardens, Kew, Richmond, Surrey TW 93 AF. England. Four levels of soil salinity 0, 1500, 3000 and 4500 ppm., and their interaction with the previously four varieties were applied as follow.

Laboratory experiment:

Germination- Screening tests was recorded for individual basil variety under saline conditions in the laboratory. The seeds were germinated in petri dishes (1 cm.in diameter) using 2 layers of filter paper, whatman, No. 1. Each petridish contained 50 seeds equally spaced. Each variety was replicated in 16 plates and randomized with each salinity treatments by using the salt crust of seawater. Salinity treatments included four levels, control (distilled water), 1500, 3000 and 4500 ppm. The filter papers were moistened with the corresponding solution where 5 ml of each solution was added to the indicated dish. The petri dishes were placed in the dark at room temperature. Seeds considered germinated when the radical protrusion reached 1 mm. Counting of germinated seeds were conducted at 24 hr intervals. The experiment of germination test was repeated as a second block in times.

$$\text{Germination percentage} = \frac{\text{Germinated seeds number}}{\text{Total seeds number}} \text{ x100}$$

Pots experiment:

Earthenware pots No.30 were used and painted with three layers of tar (bitumine) and their bottom holes were completely blocked to prevent water loss. Each pot was then filled with 7.0 kg of air-dried soil, which its physical and chemical properties are shown in table (A). The seeds of basil varieties were individually sown in nursery on March 6th through out the two successive seasons 1995 and 1996. One and half month later after seed

sowing, uniform seedlings were transplanted into clay-pots. Each pot contained five plants.

The salt was obtained from El-Nasr for Salines Co.The plants were continuously irrigated when they had been needed to maintain soil moisture at 65-70 % of the field capacity, the chemical analysis of the used salt crust of sea water are shown in table (B).

Table (A): Physical and chemical properties of experimental soil.

Sand	50.80%
Silt	26.00%
Clay	23.20%
Organic matter	00.58%
Total nitrogen	00.05%
Water soluble phosphorus	00.65 ml/100 g
Available potassium	18.92 ml/100 g
PH	8.40

Table (B); Chemical analysis of seawater salt crust (water, salt at 5:1)

E.C. mmhos/cm at	Cations (mg/L)				Anions (mg/L)			
25%	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Hco_3^{-}	Co_3^{-}	So_4^{--}	cl^{-}
171.30	9.28	8.45	3000	2.880	4.86	-	80.76	29.35

The experimental design was factorial experiment between varieties (four varieties) and soil salinity (four levels) in complete randomized block design with three replicate. Each replicate contained seven pots. All treatments received normal agricultural practices whenever they needed.

Data for germination percentage, as mentioned before, survival percentage at the end of each season, growth characters including plant height (cm.), number of branches and leaves, fresh and dry weights of leaves, stem as well as root were carried out during two cuts, the first after 60 and the second one after 120 days from transplanting respectively, for both successive seasons. Leaf area (cm^2) was measured by the disc method according to Bremner and Taha (1966),essential oil was determined according to Guenther,1961. Data were statistically analyzed and the differences between the means of the treatments were considered significant if they are more than least significant differences (LSD) at the 5 % or 1% levels according to Steel and Toorie (1980).

RESULTS AND DISCUSSION

Seed germination and survival percentage:

Data concerning the seed germination and survived percentage are given in Table (1). It showed that increasing salinity of the germination medium had a harmful effect on seed germination. All salinity treatments caused a highly significant reduction in seed germination percentage compared with control, the highest one (4500 ppm) gave the lowest germination compared to the other levels.

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The lowest seed germination percentage (43.08-42.91) was recorded with variety (V1), meanwhile the highest one (62.16-63.08) was resulted by (V4). Such results hold true in the two seasons. The reduction in seed germination under salinity conditions was in agreement with finding of Vinizky and Ray (1988) on guar; Palma *et al.* (1996) on Capsicum annum and El-Moursy (1996) on guar.

However, this inhibition of seed germination under salinity conditions might be mainly attributed to decreasing rate and total of water absorbed and by increasing the entry of certain elements into the seed which are toxic in high concentration (Stone *et al*., 1979) on alfalfa.

Regarding survival percentage, it is noticed that the different salinity levels gave the same trend of seed germination, so (V4) had the highest values (66.66-71.81) and (V1) resulted the lowest values (59.51-66.66) in the first and second season, respectively. Similar reduction in survival percentage under salinity conditions was obtained by Singh *et al.*. (1982) on Capsicum annum, El-Sherif *et al.* (1993) on tomato and Fiad (1997) on Nigella sativa.

The reduction in survival percentage under high salinity conditions might be due to three probabilities, osmotic inhibition of water absorption, toxicity of one or more specific ions and the combination of the two factors, according to Eaton (1942); Seats *et al.*. (1958) and Lapina (1967).

Plant height and number of branches:

As shown in Table (2), the growing basil plants in salinized soil showed highly significant decrease in plant height at the two cuts during both seasons compared to the control. The reduction of plant height was increased as soil salinity concentrations increase up to that of 4500 ppm, (V4) cleared the tallest plant height (69.38-64.38) followed by V2 (61.15-62.34) and V3 (58.10-55.16) then V1 (46.98-47.26) in the second cut of both seasons, respectively. Present results are in harmony with those obtained by Manture *et al.* (1996) on Callistephus chinesis cv. ; Fiad(1997) on Nigella sativa L. and Amer (1996) on guar.

Such decrease in plant height might be due to that salinity decreased cell division of plant as reported by Bolus *et al.* (1972) on castor bean.

The data in the same table, showed that number of branches recorded a similar result of plant height. However under 3000 ppm.salinity level, number of branches/plant was mostly increased from V1 followed by V3, V2 and V4, generally such results were recorded in the two cuts of both growing seasons. Furthermore the plants of V1, V2 and V3 tolerated soil salinity up to 4500 ppm concentration in the second cut of two seasons, whereas those of V4 showed tolerance in this respect at that of 3000 ppm concentration. The reduction in number of branches by using salinity treatments was also found by EL-Sherbeny (1989) on Origanum majorana and Dwivedi *et al.*. (1996) on Tamarindus indicial.

Number of leaves and leaf area:

Data of Table (3) indicated that all salinity applied treatments caused highly significant reduction in leaves number/ plant compared to control at the first and second cuts in both seasons.

The highest number of leaves / plant was noticed with V4 followed by V3 then V2 and V1. However the four varieties plant tolerated soil salinity condition up to 4500 ppm level regarding number of leaves per plant. Nooh *et al.* (1992) on gazania and Fiad (1997) in line with that state these results on Nigella sativa. Such decrement of leaves number might be due to inhibition of water absorption which affected greatly on the metabolic processes, according to Beranstein and Ayers (1951), or to suppressed both meristematic activity and /or cell enlargement.

The applied soil salinity levels caused significant decrease in leaf area compared to the untreated plants of each variety. The largest leaf area was obtained by planting V2 under the lowest soil salinity level (1500-ppm). Generally, these results hold true in the two cuts of the two seasons in most cases. In addition, under high soil salinity levels (at 1500 up to 4500 ppm.) V4 or V3 beard leaves with large areas more than those of V1 or V2 do during the two growing seasons at the second cut. These results are in agreement with those obtained by Dahiya and Dhankhar (1984) on Zizphus mauritiana and El-Keltawi and Croteau (1987) on Mentha spicata and Majorana hortensis.

The mechanism of salt which caused the reduced leaf area expansion during seedling growth had not been satisfactorily resolved. One possible mechanism revealed that the reduction in water potential in root zone was transmitted via the xylem to the leaves, where cell target was correspondly reduced (Peter *et al.*, 1988).

Fresh and dry weight of leaves:

In Table (4), the results show that there are significantly differences between fresh and dry weight for sweet basil varieties under this study. In this respect, Thyrsiflorum variety had the highest mean value of fresh or dry weight of leaves compared with other varieties. On the other hand, salinity treatments had a significant effect on both fresh and dry leaves weight. Salinity treatments inhibited leaves weight during both seasons, this decrement was decreased gradually with icreasing salinity levels.The decrement in basil leaves fresh weight per plant under saline conditions was previously reported by El-Shafey *et al.* (1991) on Ocimum basilicum L., Ahmed and El-Gamal (1991) on Nigella sativa L. and Ramadan (1996) on guar.

With regard to dry weight of leaves, showed the same trend of fresh weight, under the soil salinity levels of 1500 and 3000 ppm, V3 gave the highest leaves dry weight/plant at the first and second cut during two growing seasons, compared to the other varieties in most cases. The heaviest dry weight of leaves/plant was noticed under the lowest salinity level (1500-ppm) during the two seasons by using V3 an V2 in the first and second cuts, respectively, this decrement may be due to inhibition effect of salinity on leaves number or/ and leaf area.. The decrease in leaves dry weight due to saline treatments might be attributed to that salinity reduced the synthesis of organic matter in leaves of plants as mentioned by Kabanov *et al.*. (1973) on pea.

Fresh and dry weight of stem:

Data tabulated in Table (5) show that the interaction treatments between the different varieties and soil salinity levels reduced stem fresh weight/plant in comparison with the control of each variety alone. The maximum values of stem fresh weight per plant were obtained with V3 under two salinity levels 1500 and 3000 ppm, comparing to control. These results were recorded in both seasons. The dry weight of stem cleared the same trends of fresh weight, the heaviest dry weight of stem/plant obtained by using V3 at the first and second cuts under soil salinity level of 1500 ppm condition compared to the other interaction ones, these results were clear in the two seasons. These results are in harmony with those obtained by Ahmed and El-Gamal (1991) on Nigella sativa and El-Morsy (1996) on guar.

Fresh and dry weight of root:

Results in Table (6) indicated that interaction treatments between applied levels of salinity and four used varieties caused a decrease in root fresh weight per plant if compared to control plants of each variety alone in most cases. The lowest level (1500-ppm) gave the highest value with V2 followed by V3 then V4. V1which gave the lowest quantity of root fresh weight/plant. These results were recorded in the two cuts of both growing seasons.

Regarding dry weight, it was noticed that increasing salinity levels resulted in more reduction in root dry weight. The lowest decrement in root dry weight was obtained with V4 in second cut during growing two seasons, comparing to other varieties. However all applied salinity treatments showed highly significant decrement in root dry weight/plant of basil plants in comparison with control at the first cut, or with those of 3000 an 4500 ppm in the second one during both seasons. Similar finding were recorded by Awad and Kamel (1983) on Datura anoxia, Ahmed (1988) on Pelargonium graveolenus and Fiad (1997) on Nigella sativa.

In this regard, Hayward and Spurr (1943) stated that subtracted of high osmotic pressure inhibited the meristematic activity and elongation of corn root. However, the decrease in root fresh and dry weights due to salinity might be due to the reduction in water and minerals absorption and / or the reduction in above ground growth, as found in the present study.

Essential oil percentage:

Data presented in Table (7) indicate that the oil percentage of V4 was higher than the other varieties, whereas V2 was lower in this respect in the two cuts during both seasons. In the mean time, oil percentage of V4 was highly significant increased compared to that of V2 at the two cuts in both years. In addition, there were significant differences between V2 and V1 or V3 in this regard in the first cut during the two seasons. Also, there were insignificant differences between V3 and V1 or V4.

Table (7) explain that soil salinity treatment of 1500 ppm, caused highly significant increase of oil percentage within the fresh leaves of basil varieties compared to control.

On the contrary, the highest concentration (4500 ppm) had highly significant reduction of oil percentage at the first cut of both seasons. Meanwhile, at the second cut, the concentration of 1500 ppm and 3000 ppm showed highly significant and insignificant increase in this respect, respectively. Moreover, as salinity concentrations increased the oil percentage was decreased to reach its minimum at the highest one of 4500 ppm. These results were similar in both of the two seasons. The inhibitory effect of high levels of salinity was also found by El-Shafey *et al.* (1991) on sweet basil; Hussein (1986) on lemon grass. Dawh *et al.* (1988) on Pelargonium graveolenus; Kamal (1989) on chamomile; El-Sherbeny (1989) on Origanum majorana and Fiad (1997) on Nigella sativa. But the increase in oil percentage due to the lower concentrations of salinity was also found by El-Shafey *et al.*. (1991) on sweet basil.

It could be concluded that the interaction treatments between the used varieties (V1,V2,V3 and V4) and soil salinity level 1500 ppm mostly increased oil percentage, whereas, those at 3000 and 4500 ppm decreased it comparing with the control of every variety alone. The highest value of oil percentage was obtained when V4 was used under level 1500 ppm of soil salinity compared to the other interaction ones between soil salinity levels (1500, 3000 and 4500 ppm) and the used varieties. But, under each level of soil salinity (1500 up to 4500 ppm) V2 gave the lowest values in this respect in most cases. However, the plants of the used four varieties tolerated soil salinity conditions up to 4500 ppm concentrations regarding oil percentage. These results hold true in the two seasons.

Essential oil yield/plant:

From data presented in Table (8), the results indicated a variation in oil yield/plant (ml) between the four used varieties, V3 gave the highest significant value in comparing with the other varieties during first and second cut of first season, meanwhile V4 resulted the highest one in this respect at first and second cut for second season. All applied salinity levels decreased essential oil yield/plant with the exception of 1500 ppm which increased it significantly. The interaction between V4 and 1500 ppm revealed the largest value in first and second cut during both seasons, and V2 gave the lowest one. The increase in oil yield that repacks to the lower concentrations of salinity was also obtained by El-Shfey *et al.* (1991) on sweet basil. Morales *et al.* (1993) suggested that increase in oil content with some of salinity levels, might be attributed to decline the primary metabolites due to the effect of salinity, which causes an intermediary products to become available for secondary metabolites synthesis.

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تأثير أصناف الريحان، الملوحة الأرضية والتداخل فيما بينهما على نسبة الإنبات والبقاء والصفات الخضرية و الزيوت العطرية لنباتات الريحان.

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يعتبر نبات الريحان من أهم النباتات الطبية والعطرية فى البلدان المحيطة بالبحر الأبيض المتوسط ومصر. ويستخدم نبات الريحان فى الطب الشعبى والأغراض الطبية،كما يضاف إلى الأغذية، وقد زاد الطلب على عشب وزيت الريحان فى السنوات اللأخيرة.

يهدف هذا البحث إلى تقييم أصناف من الريحان وهى (Odoratus (V1)), (Alba (V2)), (Thyrisflorum (V3)), (Purpurascens (V4)).

وأربع مستويات من الملوحة الأرضية(بإستخدام المجروش الملحى لماء البحر) و هى كنترول ،١٥٠٠،٣٠٠٠ و٤٥٠٠ جزء/مليون. كانت معاملات التفاعل عبارة عن تفاعل كل صنف أو أصناف الريحان مع كل مستوى من مستويات الملوحة الأرضية بجانب الكونترول.

وقد أظهر الصنف الرابع أعلى نسبة للإنبات عند مستوى (١٥٠٠ جزء/مليون) كما تحملت أصناف الريحان الثانى والثالث ظروف الملوحة عند المستوى المذكور، بينما كان الصنف الأول حساسا، كما أعطى الصنف الثالث والرابع أفضل نسبة مئوية للبقاء مقارنة بباقى الأصناف وذلك عند مستوى (١٥٠٠جزء/مليون) عدا الكونترول، كما تحمل الصنف الأول الملوحة الأرضية حتى تركيز ١٥٠٠ جزء/مليون، بينما تحملت الأصناف الثانى والثالث والرابع حتى تركيز ٣٠٠٠ جزء/مليون من الملوحة الأرضية. أظهر الصنف الرابع أعلى قيمة لكل من طول النبات،عدد الأوراق/نبات والوزن الطازج والجاف للأوراق والساق/نبات وذلك عند أقل مستوى من الملوحة الأرضية (١٥٠٠ جزء/مليون) مقارنة بمعاملات التفاعل الأخرى (عدا الكونترول)، كما أظهرت جميع الأصناف المستخدمة تحملا للملوحة الأرضية حتى تركيز ٤٥٠٠ جزء/مليون فى هذا الخصوص.

وقد أعطى كلا من الصنفين الثالث والرابع أعلىقيم لكل من عدد الأفرع/نبات والوزن الطازج والجاف للجذر/نبات عند مستوى (١٥٠٠ جزء/مليون) مقارنة بالمعاملات الأخرى (عدا الكونترول) ، وقد سجل الصنف الثالث أكبر قيمة لمساحة الورقة عند المستوى المنخفض السالف الذكر، وقد تحملت أصناف الريحان الأربعة الملوحة الأرضية حتى تركيز ٤٥٠٠ جزء/مليون فى هذا الصدد.

وقد أعطى الصنف الرابع أعلى قيمة بالنسبة للنسبة المئوية من الزيت العطرى مقارنة بباقى الأصناف الأخرى، بينما كان الصنف الثانى الأقل فى هذا الصدد وذلك فى الحشتين فى كلا العامين. كما كان هناك أيضا إختلافات معنوية بين الأصناف الثلاثة الأخرى.كما أعطى التركيز ١٥٠٠ جزء/مليون أعلى نسبة للزيت فى أوراق الريحان مقارنة بالكونترول. وعلى العكس من ذلك فقد أعطى التركيز الأعلى من الملوحة (٤٥٠٠ جزء/مليون) اقل نسبة من الزيت العطرى.كما أعطى الصنف الرابع أعلى نسبة مئوية للزيت العطرى عند مستوى ملوحة ١٥٠٠ جزء/مليون. وعموما فإنه كلما زاد مستوى الملوحة كلما قابل هذه الزيادة نقص فى النسبة المئوية للزيت العطرى بأوراق الريحان.كما أعطى الصنف الثالث V_3 أعلى كمية بالنسبة لإنتاج النبات للزيت العطرى(مل) مقارنة مع باقى الأصناف، وقد تسببت جميع المستويات المستخدمة للملوحة فى نقص كمية الزيت فيما عدا تركيز ١٥٠٠ جزء فى المليون والذى أنتج أعلى زيادة معنوية.أما بالنسبة للتداخل بين الأصناف والملوحة فإن الصنف الرابع بالتداخل مع المستوى ١٥٠٠ جزء فى المليون هو الذى اعطى اعلى زيادة معنوية لكمية الزيت/نبات.

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Table (1):Effect of varieties, salinity and their interaction treatments on seed germination percentage and survival percentage of basil during two seasons

Seed germination						**Survival**				
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)	0.00	1500	3000	4500	X (V)
Varieties (V)										
First season										
Odoratus (V1)	100.00	34.33	22.66	15.33	15.33	100.00	65.07	44.43	28.56	59.51
Alba (V2)	100.00	50.66	29.00	28.00	28.00	100.00	73.01	50.79	39.67	65.86
Thyrsiflorum (V3)	100.00	66.00	42.00	24.33	24.33	100.00	67.18	53.96	36.50	66.66
Purpurascens (V4)	100.00	75.33	49.33	24.00	24.00	100.00	73.01	52.37	41.26	66.66
X (S)	100.00	56.58	35.74	22.91	22.91	100.00	71.81	50.38	39.49	-
L.S.D.5%For(S)=2.99For(V)=2.99For(S)x(V)=5.99				For(S)=4.00 For(V)4.00 For(S)x(V)=N.S						
L.S.D.at1%For(S)=4.04For(V)=4.04For(S)x(V)=8.08						For(S)=5.39 For(V)=5.39 For(S)x(V)=N.S				
Second season										
Odoratus (V1)	100.00	36.00	21.00	14.66	42.91	100.00	63.48	57.14	46.02	66.66
Alba (V2)	100.00	52.00	30.33	27.33	52.41	100.00	65.07	61.90	46.02	68.24
Thyrsiflorum (V3)	100.00	67.66	40.66	2566	58.49	100.00	66.66	57.14	44.44	67.06
Purpurascens (V4)	100.00	78.00	49.33	25.00	63.08	100.00	80.94	58.72	47.61	71.81
X (S)		58.41	35.33	23.16	-	100.00	69.03	58.72	46.02	-
L.S.D.at5%For(S)=3.63For(V)=3.63For(S)x(V)=7.26						For(S)=5.12 For(V)=5.12 For(S)x(V)=10.24				
L.S.D.at1%For(S)=4.90For(V)=4.90For(S)x(V)=9.80						For(S)=6.90 For(V)=6.90 For(S)x(V)=13.80				

Table (2): Effect of varieties, salinity and their interaction treatments on plant height (cm) and number of branches of basil during the two seasons.

Plant height (cm.) First cut						**Number of branches First cut**				
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)	0.00	1500	3000	4500	X (V)
Varieties (V)										
First season										
Odoratus (V1)	40.63	29.41	25.15	24.67	29.96	3.33	2.33	2.33	2.00	2.49
Alba (V2)	49.78	41.17	40.79	38.29	42.5	4.33	4.00	3.66	3.66	3.91
Thyrsiflorum (V3)	49.77	40.52	39.73	34.79	41.24	4.33	4.33	3.66	3.00	3.83
Purpurascens (V4)	49.56	44.31	43.74	41.18	44.69	4.33	4.00	3.66	3.66	3.91
X (S)	47.43	38.85	37.74	34.77		4.08	3.66	3.32	3.08	
L.S.D.at5%For(S)=4.23For(V)=4.23For(S)x(V)=5.26				For(S)=0.58 For(V)0.58 For(S)x(V)=N.S						
L.S.D.at1%For(S)=5.27For(V)=5.27For(S)x(V)=N.S				For(S)=0.78 For(V)=0.78 For(S)x(V)=N.S						
Second season										
Odoratus (V1)	38.85	35.20	28.72	24.20	31.74	3.33	2.86	2.00	1.50	2.42
Alba (V2)	46.32	42.05	38.41	36.71	40.87	4.40	3.66	3.41	3.16	3.65
Thyrsiflorum (V3)	44.49	37.94	35.52	32.37	37.58	4.66	2.80	2.25	3.50	3.30
Purpurascens (V4)	48.77	42.35	39.08	38.07	44.06	5.60	4.20	3.41	2.66	3.96
X (S)	44.60	39.38	35.43	32.83	_	4.49	3.38	2.76	2.70	_
L.S.D.at5%For(S)=1.00For(V)=1.00For(S)x(V)=2.00				For(S)=0.66 For(V)=0.66 For(S)x(V)=N.S						
L.S.D.at1%For(S)=1.35For(V)=1.35For(S)x(V)=2.70				For(S)=0.89 For(V)=0.89 For(S)x(V)=N.S						
Plant height (cm.) Second cut				**Number of branches Second cut**						
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)	0	1500	3000	4500	X (V)
Varieties (V)										
First season										
Odoratus (V1)	60.35	48.58	41.04	37.96	46.98	7.66	5.00	4.33	4.00	5.24
Alba (V2)	71.56	60.09	57.90	55.07	61.15	10.00	8.40	5.83	5.66	7.47
Thyrsiflorum (V3)	71.22	57.81	54.51	48.88	58.10	9.33	8.33	4.66	4.00	6.58
Purpurascens (V4)	82.34	70.26	64.35	60.59	69.38	10.33	8.00	6.00	6.00	7.58
X (S)	71.36	59.18	54.45	50.62		9.33	7.43	5.20	4.91	
L.S.D.at5%For(S)=2.93For(V)=2.93For(S)x(V)=N.S				For(S)=1.20 For(V)=1.20 For(S)x(V)=N.S						
L.S.D.at1%For(S)=3.95For(V)=3.95For(S)x(V)=N.S				For(S)=1.63 For(V)=1.63 For(S)x(V)=N.S						
Second season										
Odoratus (V1)	58.46	53.36	43.41	33.83	47.26	7.73	5.53	3.50	3.00	4.94
Alba (V2)	72.11	66.38	56.90	53.97	62.34	9.73	8.00	5.50	5.16	7.09
Thyrsiflorum (V3)	64.12	58.18	51.29	47.07	55.16	9.80	8.33	5.16	4.50	6.94
Purpurascens (V4)	76.9	66.70	58.29	55.66	64.38	10.53	8.26	6.16	5.66	7.65
X (S)	67.89	61.15	52.47	47.63		9.44	7.53	5.08	4.58	
L.S.D.at5%For(S)=1.95For(V)=1.95For(S)x(V)=3.90				For(S)=0.60 For(V)=0.60 For(S)x(V)=N.S						
L.S.D.at1%For(S)=2.63For(V)=2.63For(S)x(V)=N.S				L.S.D.at1%For(S)=0.80For(V)=0.80For(S)x(V)=N.S						

Table (3): Effect of varieties, salinity and their interaction treatments on number of leaves per plant and leaf area of basil during the two seasons.

Number of leaves First cut						**Leaf area First cut**				
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)	0.00	1500	3000	4500	X (V)
Varieties (V)										
First season										
Odoratus (V1)	159.26	125.33	115.33	96.00	123.98	9.19	7.44	6.64	4.27	6.88
Alba (V2)	183.33	136.6	125.46	105.00	137.59	9.04	7.52	6.09	4.59	6.81
Thyrsiflorum (V3)	184.53	134.93	127.60	.105.00	138.01	9.64	9.18	6.26	4.97	7.51
Purpurascens (V4)	188.66	139.26	127.33	108.88	141.03	10.12	8.08	6.94	4.77	7.47
X (S)	178.94	134.03	123.93	103.72		9.49	8.05	6.48	4.65	
L.S.D.at5%For(S)=9.32For(V)=9.32For(S)x(V)=N.S				For(S)=0.78 For(V)=N.S For(S)x(V)=N.S						
L.S.D.at1% For(S)=12.36For(V)=12.36For(S)x(V)=N.S				For(S)=1.05 For(V)=N.S For(S)x(V)=N.S						
Second season										
Odoratus (V1)	169.20	104.46	89.08	70.00	108.18	9.60	7.22	4.83	3.82	6.36
Alba (V2)	182.40	125.80	124.16	86.83	129.79	10.42	7.51	5.58	4.03	6.88
Thyrsiflorum (V3)	194.06	113.53	102.00	84.66	123.56	10.58	7.82	5.77	4.49	7.16
Purpurascens (V4)	198.53	138.00	125.08	107.66	142.31	11.04	7.43	5.29	4.18	6.98
X (S)	186.04	120.44	110.08	87.28		10.41	7.49	5.36	4.13	_
L.S.D.5%For(S)=16.42For(V)=16.42For(S)x(V)=N.S				For(S)=0.78 For(V)=0.78 For(S)x(V)=N.S						
L.S.D1%For(S)=22.14For(V)=22.14For(S)x(V)=N.S.				For(S)=1.05 For(V)=1.05 For(S)x(V)=N.S						
Number of leaves Second cut						**Leaf area Second cut**				
soil salinity(S) (ppm.)		1500	3000	4500	X(V)	0.00	1500	3000	4500	X (V)
Varieties (V)										
First season										
Odoratus (V1)	178.33	156.33	149.16	177.59	9.97	7.42	6.22	4.06	6.91	
Alba (V2)	237.33	198.00	161.16	213.95	9.15	7.50	6.54	3.96	6.78	
Thyrsiflorum (V3)	227.33	179.33	162.00	204.33	11.58	8.46	6.24	4.73	7.45	
Purpurascens (V4)	238.66	201.00	175.00	219.91	11.07	8.19	6.44	5.10	7.70	
X (S)	220.41	183.66	161.83		10.44	4.89	6.36	4.46		
L.S.D.5%For(S)=18.79For(V)=18.79For(S)x(V)=N.S				For(S)=0.75 For(V)=0.75 For(S)x(V)=N.S						
L.S.D.1%For(S)=25.83For(V)=25.83For(S)x(V)=N.S				For(S)=1.01 For(V)=1.01 For(S)x(V)=N.S						
Second season										
Odoratus (V1)	271.53	194.80	159.00	133.66	177.24	10.68	7.19	5.15	4.27	6.82
Alba (V2)	259.06	228.86	206.16	170.50	216.14	11.18	7.85	5.56	3.21	6.95
Thyrsiflorum (V3)	256.80	232.86	203.66	159.16	213.12	11.35	8.24	5.74	4.36	7.42
Purpurascens (V4)	285.13	235.00	221.33	174.66	229.03	10.84	8.10	5.96	4.73	7.40
X (S)	255.63	222.88	197.53	159.49		11.01	7.84	5.60	4.14	
L.S.D5%For(S)=12.28For(V)=12.28For(S)x(V)=N.S.				For(S)=0.69 For(V)=0.69 For(S)x(V)=N.S						
L.S.D1%For(S)=16.56For(V)=16.56For(S)x(V)=N.S.				For(S)=0.93 For(V)=0.93 For(S)x(V)=N.S						

Table (4):Effect of varieties, salinity and their interaction treatments on fresh and dry weight of basil leaves per plant during the two seasons.

Fresh weight(g)/plant				**First cut**		**Dry weight(g)/plant**			**First cut**	
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)	0.00	1500	3000	4500	X (V)
Varieties (V)										
First season										
Odoratus (V1)	32.16	28.16	16.73	12.23	22.22	3.90	3.60	3.43	1.80	3.18
Alba (V2)	26.83	26.13	20.50	18.96	2310	3.66	3.53	3.16	2.63	3.24
Thyrsiflorum (V3)	31.66	31.50	20.30	18.70	25.54	4.53	4.56	4.16	2.66	3.97
Purpurascens (V4)	29.40	28.03	19.26	17.83	23.63	4.30	4.13	3.16	2.33	3.48
X (S)	30.01	28.54	19.19	16.93		4.09	3.95	3.74	2.35	
L.S.D.5%For(S)=0.76For(V)=N.SFor(S)x(V)=N.S				For(S)=0.47 For(V)=0.47 For(S)x(V)=N.S						
L.S.D.at 1% For(S)=5.07 For(V)=N.S For(S)x(V)=N.S				For(S)=0.63 For(V)=0.63 For(S)x(V)=N.S						
Second season										
Odoratus (V1)	23.76	22.16	15.23	9.33	17.62	3.03	2.33	1.66	2.56	
Alba (V2)	24.50	22.30	14.90	12.00	18.42	3.30	2.43	1.93	2.74	
Thyrsiflorum (V3)	29.33	25.50	17.76	12.23	21.20	4.53	3.16	1.73	3.39	
Purpurascens (V4)	31.70	25.56	14.66	12.40	21.08	4.63	2.36	1.66	3.14	
X (S)	27.32	23.88	15.63	11.49		3.92	2.57	1.74	_	
L.S.D.5%For(S)=2.5For(V)=2.5For(S)x(V)=5.01				For(S)=0.41 For(V)=0.41 For(S)x(V)=N.S						
L.S.D1%For(S)=3.37For(V)=3.37For(S)x(V)=6.75.				For(S)=0.56 For(V)=0.56 For(S)x(V)=N.S						
Fresh weight(g)/plant			**Second cut**			**Dry weight(g)/plant**			**Second cut**	
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)	0	1500	3000	4500	X (V)
Varieties (V)										
First season										
Odoratus (V1)	40.66	36.70	36.60	29.16	35.78	6.70	6.23	5.46	4.33	5.68
Alba (V2)	38.86	36.33	38.40	30.46	36.01	6.63	6.36	5.26	4.43	5.67
Thyrsiflorum (V3)	44.33	42.66	41.3	31.66	40.00	6.40	5.40	5.50	5.36	5.66
Purpurascens (V4)	46.00	45.50	43.60	28.70	4095	8.06	5.73	5.86	4.86	6.12
X (S)	42.46	40.29	39.99	29.99		6.94	5.93	5.52	4.74	
L.S.D5%For(S)=2.01For(V)=2.01For(S)x(V)=5.11.				For(S)=0.62 For(V)=N.S For(S)x(V)=N.S						
L.S.D.at 1%For(S)=2.71For(V)=2.71For(S)x(V)=N.S				For(S)=0.84 For(V)=N.S For(S)x(V)=N.S						
Second season										
Odoratus (V1)	38.73	37.46	31.05	27.10	33.58	5.94	5.76	4.25	3.87	4.95
Alba (V2)	43.66	37.66	34.55	28.72	36.14	7.51	6.67	5.64	4.22	6.01
Thyrsiflorum (V3)	40.14	39.46	34.62	28.88	35.77	7.04	6.19	4.84	4.64	5.67
Purpurascens (V4)	43.68	41.03	40.05	33.55	39.57	7.86	6.05	5.78	5.47	6.29
X (S)	41.55	38.90	35.06	29.56		7.08	6.16	5.12	4.55	
L.S.D.5%For(S)=3.12For(V)=3.12For(S)x(V)=N.S				For(S)=0.60 For(V)=0.60 For(S)x(V)=N.S						
L.S.D1%For(S)=4.20For(V)=4.20For(S)x(V)=N.S.				For(S)=0.80 For(V)=0.80 For(S)x(V)=N.S						

Table (6):Effect of varieties, salinity and their interaction treatments on fresh and dry weight of basil root(g) per plant during two seasons.

Fresh weight (g)/plant			**First cut**			**Dry weight (g)/plant**			**First cut**	
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)	0	1500	3000	4500	X (V)
Varieties (V)										
First season										
Odoratus (V1)	4.10	4.83	3.06	2.83	3.70	2.40	1.76	0.50	0.50	1.29
Alba (V2)	4.86	4.66	4.10	4.06	4.42	2.30	2.43	1.66	1.30	1.67
Thyrsiflorum (V3)	6..40	4.83	3.96	3.56	4.68	2.93	2.03	1.60	1.00	1.89
Purpurascens (V4)	6.80	3.93	4.66	4.66	5.01	1.96	1.40	1.46	1.20	1.50
X (S)	5.54	4.56	3.94	3.77		2.39	1.90	1.05	1.00	
L.S.D.5%For(S)=0.65For(V)=0.65For(S)x(V)=1.30				For(S)=0.28 For(V)=0.28 For(S)x(V)=0.56						
L.S.D.at1%For(S)=0.87For(V)=0.87For(S)x(V)=N.S				For(S)=0.38 For(V)=0.38 For(S)x(V)=0.76						
Second season										
Odoratus (V1)	3.90	3.83	3.30	2.63	3.41	1.96	1.46	0.83	0.66	1.22
Alba (V2)	4.86	4.36	2.96	2.90	3.77	2.26	1.76	1.50	1.16	1.76
Thyrsiflorum (V3)	6.53	5.96	4.16	3.70	5.08	3.00	2.30	1.96	1.06	2.08
Purpurascens (V4)	5.50	4.53	3.80	3.76	4.39	1.73	1.80	1.70	1.33	1.64
X (S)	5.19	4.67	3.55	3.24		2.23	1.83	1.49	1.05	
L.S.Dat5%For(S)=0.07For(V)=0.07For(S)x(V)=N.S				For(S)=0.20 For(V)=0.20 For(S)x(V)=0.40						
L.S.D.at1%For(S)=0.87For(V)=0.87For(S)x(V)=N.S				For(S)=0.27 For(V)=0.27 For(S)x(V)=0.55						
Fresh weight (g)/plant			**Second cut**			**Dry weight (g)/plant**			**Second cut**	
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)	0.00	1500	3000	4500	X (V)
Varieties (V)										
First season										
Odoratus (V1)	3.83	3.76	4.03	3.96	3.89	2.46	2.40	2.30	2.03	2.29
Alba (V2)	6.96	5.83	4.16	3.96	5.22	3.20	3.50	2.13	2.03	2.71
Thyrsiflorum (V3)	5.96	4.50	4.40	4.30	4.79	2.93	2.76	2.70	2.46	2.71
Purpurascens (V4)	8.06	4.16	5.40	3.36	5.26	4.66	2.50	2.66	1.63	2.86
X (S)	6.20	4.56	4.49	3.89		3.31	2.79	2.19	1.89	
L.S.D.5%For(S)=1.06For(V)=1.06For(S)x(V)=N.S				For(S)=.59 For(V)=.N.S For(S)x(V)=1.17						
L.S.D.at 1%For(S)=1.44For(V)=1.44For(S)x(V)=N.S				For(S)=0.79 For(V)=N.S For(S)x(V)=N.S						
Second season										
Odoratus (V1)	7.18	5.50	3.08	2.05	4.45	4.39	3.37	1.66	1.09	2.62
Alba (V2)	7.67	5.13	4.83	4.38	5.50	3.80	2.98	2.25	2.15	2.79
Thyrsiflorum (V3)	7.80	5.20	5.21	4.83	5.76	4.05	3.07	2.58	2.52	3.05
Purpurascens (V4)	9.10	7.36	4.88	3.97	6.32	5.07	4.17	2.30	1.82	3.34
X (S)	7.93	5.79	4.50	3.80		4.32	3.39	2.19	1.89	
L.S.D.5%For(S)=0.83For(V)=0.83For(S)x(V)=N.S				For(S)=0.19 For(V)=0.19 For(S)x(V)=0.37						
L.S.D.1%For(S)=1.12For(V)=1.12For(S)x(V)=N.S				For(S)=0.25 For(V)=0.25 For(S)x(V)=0.50						

Table (7): Effect of varieties, salinity and their interaction treatments on oil percentage of basil during the two seasons.

Oil percentage first cut					
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)
Varieties (V)					
First season					
Odoratus (V1)	0.2000	0.2333	0.2583	0.175	0.2166
Alba (V2)	0.1830	0.2083	0.2000	0.1666	0.1895
Thyrsiflorum (V3)	0.2333	0.2083	0.2500	0.1666	0.3145
Purpurascens (V4)	0.2000	0.3583	0.1833	0.1666	0.227
X (S)	0.2041	0.2520	0.2229	0.1687	
L.S.D. at 5%For(S)=0.0213For(V)=0.0213For(S)x(V)=0.0427					
L.S.D.at 1%For(S)=0.0288For(V)=0.0288For(S)x(V)=0.0576					
Second season					
Odoratus (V1)	0.2080	0.2250	0.2083	0.1750	0.2040
Alba (V2)	0.1750	0.2083	0.1666	0.1500	0.1749
Thyrsiflorum (V3)	0.2160	0.2333	0.2250	0.1716	0.2114
Purpurascens (V4)	0.2000	0.3333	0.1833	0.1466	0.2158
X (S)	0.1997	0.2499	0.1958	0.1608	_
L.S.D. at 5% For(S)=0.0210For(V)=0.0210For(S)x(V)=0.0421					
L.S.D.at 1%For(S)=0.0284For(V)=0.0284For(S)x(V)=0.0568					
Oil percentage Second cut					
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)
Varieties (V)					
First season					
Odoratus (V1)	0.1833	0.1833	0.2583	0.1750	0.1999
Alba (V2)	0.1583	0.1666	0.1583	0.1500	0.1583
Thyrsiflorum (V3)	0.1750	0.1833	0.1666	0.1666	0.1728
Purpurascens (V4)	0.1583	0.3250	0.1833	0.1500	0.2041
X (S)	0.1687	0.2145	0.1916	0.1604	
L.S.D. at 5% For(S)=0.0204For(V)=0.0204For(S)x(V)=0.0408					
L.S.D.at 1%For(S)=0.0275For(V)=0.0275For(S)x(V)=0.0550					
Second season					
Odoratus (V1)	0.1333	0.2000	0.2333	0.1583	0.1812
Alba (V2)	0.1583	0.1833	0.1833	0.1416	0.1666
Thyrsiflorum (V3)	0.1500	0.2166	0.1916	0.1500	0.1770
Purpurascens (V4)	0.1916	0.2783	0.1833	0.1333	0.1966
X (S)	0.1583	0.2195	0.1978	0.1458	
L.S.D. at 5%For(S)=0.0158For(V)=0.0158For(S)x(V)=0.0316					
L.S.D. at1%For(S)=0.0213For(V)=0.0213For(S)x(V)=0.0426					

Table (8):Effect of varieties, salinity and their interaction treatments on oil yield (ml)/plant of basil during the two seasons.

first cut Oil yield / plant(ml)					
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)
Varieties (V)					
First season					
Odoratus (V1)	0.0642	0.0653	0.0441	0.0213	0.0487
Alba (V2)	0.0491	0.0536	0.0408	0.0315	0.0437
Thyrsiflorum (V3)	0.0741	0.0665	0.0506	0.0312	0.0555
Purpurascens (V4)	0.0585	0.1016	0.042	0.0298	0.0597
X (S)	0.0614	0.0717	0.0443	0.0284	
L.S.D. at 5%For(S)=0.0105 For(V)=0.0105 For(S)x(V)=0.0210					
L.S.D.at 1%For(S)=0.0142 For(V)=0.0142 For(S)x(V)=N.S					
Second season					
Odoratus (V1)	0.0496	0.0498	0.0326	0.0163	0.0370
Alba (V2)	0.0431	0.0462	0.0242	0.0184	0.0329
Thyrsiflorum (V3)	0.0639	0.0594	0.0398	0.0210	0.0459
Purpurascens (V4)	0.0637	0.0862	0.0266	0.0182	0.0486
X (S)	0.0549	0.0604	0.0308	0.0184	
L.S.D. at 1%For(S)=0.0081 For(V)=0.0081For(S)x(V)= 0.0163					
L.S.D. at 1%For(S)=0.0110 For(V)=0.0110For(S)x(V)= N.S					
Oil yield/plant(ml) second cut					
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)
Varieties (V)					
First season					
Odoratus (V1)	0.0739	0.0670	0.0940	0.0510	0.0714
Alba (V2)	0.0619	0.0610	0.0601	0.0445	0.06
Thyrsiflorum (V3)	0.0775	0.0782	0.0686	0.0526	0.0692
Purpurascens (V4)	0.0718	0.1452	0.0788	0.0438	0.0849
X (S)	0.0712	0.0878	0.0753	0.0479	
L.S.D. at 5% For(S)=0.0094 ForV)=0.0094 For(S)x(V)=0.0189					
L.S.D. at 1% For(S)=0.0128 ForV)=0.0128For(S)x(V)=0.0256					
Second season					
Odoratus (V1)	0.0533	0.0749	0.0721	0.0431	0.0608
Alba (V2)	0.0693	0.0682	0.0633	0.0408	0.0604
Thyrsiflorum (V3)	0.0601	0.0856	0.0663	0.0431	0.0637
Purpurascens (V4)	0.0838	0.1147	0.0732	0.0441	0.0789
X (S)	0.0666	0.0858	0.0687	0.0427	
L.S.D. at 5% For(S)=0.0087 ForV)=0.0087 For(S)x(V)=0.0174					
L.S.D. at 1% For(S)=0.0117 ForV)=0.0117 For(S)x(V)= N.S					

Table (5):Effect of varieties, salinity and their interaction treatments on fresh and dry weight of basil steam (g) per plant during the two seasons.

Fresh weight(g)/plant				**First cut**		**Dry weight(g)/plant**			**First cut**	
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)	0.00	1500	3000	4500	X (V)
Varieties (V)										
First season										
Odoratus (V1)	14.93	13.60	9.90	5.66	11.02	4.16	4.56	1.83	1.16	2.92
Alba (V2)	14.70	13.06	12.76	11.80	13.08	4.00	3.46	3.43	3.40	3.57
Thyrsiflorum (V3)	20.66	18.36	14.50	10.40	15.98	6.56	6.86	6.83	3.50	5.93
Purpurascens (V4)	18.90	16.93	13.16	11.00	14.99	5.13	4.23	3.96	2.33	3.91
X (S)	17.29	15.48	12.58	9.71	_	4.96	4.77	4.01	2.59	_
L.S.D.at5%For(S)=2.77For(V)=2.77For(S)x(V)=N.S				For(S)=0.88 For(V)=0.88 For(S)x(V)=N.S						
L.S.D.at 1%For(S)=3.74For(V)=3.74For(S)x(V)=N.S				For(S)=1.19 For(V)=1.19 For(S)x(V)=N.S						
Second season										
Odoratus (V1)	12.40	11.16	8.53	7.3	9.84	3.20	3.50	1.90	1.46	2.51
Alba (V2)	13.16	11.73	9.13	8.30	10.58	3.80	3.03	3.03	2.46	3.08
Thyrsiflorum (V3)	16.70	15.83	12.06	12.50	14.27	4.96	5.53	4.66	3.73	4.72
Purpurascens (V4)	16.00	14.30	11.50	9.96	12.94	4.46	3.50	3.33	2.03	3.33
X (S)	14.56	13.25	10.30	9.51	_	4.10	3.89	3.23	2.42	_
L.S.D.at 5%For(S)=1.32 For(V)=1.32For(S)x(V)=N.S				For(S)=0.49 For(V)=0.49 For(S)x(V)=N.S						
L.S.D.at1%For(S)=1.78 For(V)=1.78For(S)x(V)=N.S				For(S)=0.66 For(V)=0.66 For(S)x(V)=N.S						
Fresh weight (g)/plant			**Second cut**			**Dry weight (g)/plant**			**Second cut**	
soil salinity(S) (ppm.)	0.00	1500	3000	4500	X(V)	0.00	1500	3000	4500	X (V)
Varieties (V)										
First season										
Odoratus (V1)	32.56	26.43	25.10	20.73	26.20	13.16	9.80	9.00	6.30	9.56
Alba (V2)	40.76	34.66	25.06	24.86	31.33	15.90	14.86	10.10	9.20	12.51
Thyrsiflorum (V3)	45.60	35.16	33.76	31.66	36.54	18.46	13.16	10.30	10.06	12.99
Purpurascens (V4)	50.73	37.10	38.96	20.83	39.90	19.40	12.10	12.66	8.00	13.04
X (S)	42.41	33.33	30.72	24.52	_	16.73	12.48	10.51	8.39	_
L.S.D.5%For(S)=4.55For(V)=4.55For(S)x(V)=N.S				For(S)=1.90 For(V)=1.90 For(S)x(V)=N.S						
L.S.D.at 1%For(S)=6.14For(V)=6.14For(S)x(V)=N.S				For(S)=2.56 For(V)=2.56 For(S)x(V)=N.S						
Second season										
Odoratus (V1)	27.24	25.26	24.38	18.28	23.79	10.65	9.03	8.62	5.70	8.50
Alba (V2)	29.30	26.16	24.27	17.90	32.06	11.73	1078	10.57	6.26	9.83
Thyrsiflorum (V3)	40.46	35.46	28.44	23.90	29.36	15.93	12.56	9.35	7.67	11.37
Purpurascens (V4)	32.93	31.80	30.26	22.10	_	12.99	10.39	10.28	7.65	10.32
X (S)	32.48	29.67	26.92	20.54	_	12.82	10.69	9.70	6.82	_
L.S.D.at5%For(S)=2.67For(V)=2.67For(S)x(V)=N.S				For(S)=1.13 For(V)=1.1 3For(S)x(V)=N.S						
L.S.D.at1%For(S)=3.59For(V)=3.59For(S)x(V)=N.S				For(S)=1.53 For(V)=1.53 For(S)x(V)=N.S						