EFFECT OF GAMMA RAYS AND SALINITY ON GROWTH AND CHEMICAL COMPOSITION OF *Ambrosia maritima* L. PLANT

BY

AHMED MOHAMED EL-HEFNY MOEMEN
B.Sc. Agric. Sci. (Soil Science), Fac. Agric., Cairo Univ., 2002

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APPROVAL SHEET

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ABSTRACT

This work achieved to study the effects of, mixture of salt 2:2:1 (Na Cl-$CaCl_2$ and Mg SO_4), concentration of (0, 2000, 4000 and 6000 ppm). on growth characters, some chemical components and some active ingredients in shoots of *Ambrosia maritima* plants, at different stages of growth, during two seasons. Pots 30 cm in diameter were filled of sand-loamy soils in appropriate concentration, all pots were irrigated with tap water. The exposed damsisa seeds to gamma rays, doses (0, 20, 40, and 80 Gy) before sowing together with control non irradiated seeds were sown in saline soils (0, 2000, 4000 and 6000 ppm). Soil salinity treatments caused a decrease in plant height, number of leaves, content of damsin, and an increase in fresh weigh, dry weight, total sugars, total chlorophyll, amino acids and ambrosine content. Also, Gamma rays caused an increase in most of growth parameters and most of chemical composition. It was observed that 40 or 80 Gy was more effective. We investigated the combined effect of levels of salinity and doses of radiation used, this interference improve growth parameters and chemical composition in *ambrosia maritima* plants and caused ascertain the role of gamma irradiation in plants tolerance to soil salinity and alleviation their harmful effect on plants.

Key words: *Ambrosia maritima*, salinity,gamma ray,ambrosin, damsin, growth parameters, photosynthetic pigments, total sugars, total soluble phenols, protein, amino acids, minerals.

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LIST OF ABBREVIATIONS

Abbreviation	Meaning of abbreviation
Cm	Centimeter
Cv	Cultivar
g	Gram
mg	milligram
Kr	Kilo rad = 1000 rad
r	Rad
γ-rays	Gamma rays
Gy	Gray = 100 rad
^{60}Co	Cobalt 60
O.M	Organic matter
Ec	Electrical conductivity
LSD	Least significant difference
Chl	Chlorophyll

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INTRODUCTION

Damsisa (*Ambrosia maritima* L), is a perennial plant richly branched, gray herb with finely dissected fragrant leaves, (Tuckholm, 1974). Damsisa in Egypt is considered wild herb growing all over the season, on the banks, canals and river Nile as a common weed (Bedevian, 1936). Damsisa is used in Egyptian folk medicine in many purposes, as a remedy of rheumatic pains, decoction of plant for asthma bilharzias, in diabetes and to expel kidney stones. From the active ingredients of this plant, ambrosin and damsin that shown to be toxic to the snails representing the intermediate host of schistosomiasis and fascioliasis found in canals, (Piceman *et al*., 1986).

Soil salinity is one of the main problems for world agriculture Ahloowalia *et al*. (2004). Reduction in the crop productivity under the salt stress has been revealed in various plant species and often associated with a decrease in the photosynthetic capacity, Baek *et al*. (2005). Agricultural productivity is severely affected by soil salinity because salt levels that are harmful to plant growth affect large terrestrial areas of the world. The damaging effects of salt accumulation in agricultural soils had influenced ancient and modern civilizations. It is estimated that 20% of the irrigated land in the world is presently affected by salinity, Yeo (1999).

The main two effects of salt stress on plant growth and development are osmotic (water stress) and ionic effects. Osmotic influence of salinity results as a consequence of salt-induced decrease in soil water potential. Also, the growth habits and physiological properties of plant may different markedly under different condition such as drought, salinity, light deficiency and irradiation (Miflin, 2000). In plants, the antioxidant enzymes activity and the photosynthetic capacity are known to positively affected by the low dose of γ –irradiation (Lee *et al*., 2002 and 2003), which can improve the stress tolerance in plants subjected to salt stress. Also, Chinusamy *et al*. (2005) reported that soil type and environmental factors, such as vapor pressure deficit, radiation, and temperature might further alter salt tolerance. Reduction in the crop productivity under the salt stress has been revealed in various plant species and often associated with a decrease in the photosynthetic capacity.

Gamma rays belong to ionizing radiation and interact with atoms or molecules to produce free radicals in cell. These radicals can damage or modify important components of plant cells. γ- rays have been reported to affect differentially the morphology; anatomy, biochemistry, and physiology of plant depending on the irradiation level. This effect include change in plant cellular structure and metabolism, e.g. dilution of thylakoid membranes, alteration in photosynthesis, modulation of antioxidant system, and accumulation of phenolic compounds (Kim *et al*., 2004, Kovacs and Keresztes, 2002 and Wi *et al*., 2005). This work was assigned to investigate: -

1- Improve of *Ambrosia maritima* L plant growth by using low doses of γ- radiation and evaluating their stimulatory response on plants.

2- Alleviate salt stress and improve plant growth through interaction of γ- radiation with salinity.

3-Estimate the active ingredients (ambrosin and damsin) in damsisa plants during flowering stage as affected by radiation treatments, salinity levels and both of them.

REVIEW OF LITERATURE

The results of some previous investigations concerning different levels of salinity, as well as different doses of radiation and their interactions are summarized in the following:

1. Effect of salinity

a. Growth parameters

Many researchers were studied the effect of salinity on vegetative growth of several plant species. Everardo *et al*. (1974) proposed three theories for explanation the effect of salinity on plants: First, soluble salts in soil decrease the free energy of the soil water, thereby, decreasing the availability of water to plants. The second is that growth is inhibited by an excess of salts taken up by plants from saline media as energy spent by plants to maintain turgor pressure in an expense of the growth, finally, salts may exert detrimental effects on plant growth through toxicity of one or more specific ions present in higher relative concentration. On the other hand, Marschner, (1995) reported that there are three major constraints for plant growth on saline substrates:

1. Water deficit "drought stress" arising form low (more negative) water potential of the rooting medium.

2. Ion toxicity associated with the excessive uptake mainly of Cl^- and Na^+.

3. Nutrient imbalance by depression in uptake and/or shoot transport and impaired internal distribution of mineral nutrients, and calcium in particular. It is often not possible to assess the relative

contribution of these three major constraints to growth inhibition at high salinity, as many factors are involved.

Zidan and Alzahrani (1994) stated that in seed and seedling of *Ocimum basilicum* L. exposed to salinity of up to 120 mM NaCl, germination was affected at salinities 60 mM NaCl, however, seedling growth and dry matters (DM) production were reduced by NaCl concentration 40 mM NaCl.

Kotb and El-Gamal. (1994) stated that the fresh and dry weights of *Nigella sativa* L plant organs were highly significant decreased by increasing salinity levels up to 0.3%, such decrease might be attributed, either to the decrease in plant height or the decrease in branching.

EL-Sherbeny (1995) concluded that, using saline water containing sodium and calcium chloride (1:1) in different levels as 1000, 2000, or 3000ppm caused reduction in plant height and fresh and dry weight of leaves, stems and roots of *Tagetes erecta* plant.

Khan and Ahmed (1998) established that *Indigofolia forsk* seed germination and shoot growth were reduced by increasing salinity using 10-30% sea water for irrigation (EC-iw: 4.5-14.0 dS.m-1).

Morales *et al*. (1998) found that in *Argyranthemum coronopifolium* plant exposed to 70 mM NaCl nutrient solution at 45 days after sowing for, 15 days, salinity reduced the relative growth rate, net assimilation rate and leaf area ratio. Leaf water potential deceased significantly in treated plant while leaf turgor potential increased due to osmotic adjustment.

Marcelis and Van, (1999) studied the effect of five salinity levels 1, 2, 4, 9 and 13 dSm-1 on growth of radish (*Raphinus sativus*

.L). It was found that the reduction in plant weight by an increase in ECs level was more pronounced in terms of fresh weight than of dry weight.

El-Mogy (1999) showed that, soil salinity treatments significantly decreased the number of branches / plant in *Ambrosia maritima* L. plants comparing to control. The lowest number of branches was obtained from plants grown in soil salinity (0.4%) followed by (0.2%).While the highest number was observed from soil salinity (0.1%) over the control at different stages of growth during two seasons. Also, the increasing in the levels of salinity reduced plant height, number of leaves / plant, and dry weight of herb *Ambrosia maritima* significantly except the lowest level of salinity.

In addition, Khan *et al*. (1999) reported that when *Halopyrum mucronatum* (a perennial grass found on the coastal dunes of Karachi, Pakistan) is treated with 0, 90, 180, and 360 mM NaCl in sand culture, fresh and dry mass of roots and shoots reach the peaks at 90mM NaCl, a further increase in salinity inhibits plant growth, ultimately resulting in plant death at 360mM NaCl, and maximum succulence is noted at 90mM NaCl.

Also, El-Makawy (1999) stated that, vegetative characters of three medicinal plants (*Calotropis procera* R, *Peganum harmala*,L, and *Marrubium vulgare* L.) were significantly decreased with increasing saline water irrigation. Number of leaves, fresh and dry weight of roots, stem and leaves and seeds/ plant were obtained with low saline water irrigation level of 4000 ppm, followed with 5000,6000 and 7000 ppm which gave the minimum values in this respect on plants.

Chartzoulakis and Klapaki (2000) investigated the effect of salt tolerance of two green house bell pepper hybrids. Salinity treatments were imposed by irrigating with half-strength Hoagland solution containing 0, 10, 25, 50, 100and 150 mM/1 of NaCl. They noticed that salinities up to 50 mM delayed germination but did not reduce the final germination percentage. It was reduced significantly at 100 and 150 mM NaCl in both hybrids. Plant growth parameters such as plant height, and dry weight were significantly reduced at salinities higher than 25 mM NaCl in both hybrids.

El-Sanafawy (2000) studied the effect of different levels of sodium chloride, calcium chloride (1500, 3000 and 4500 ppm) and their mixtures in the irrigation water on *Ambrosia maritima* L plants.

The author observed that increasing the level of salinity in irrigation water had an inhibitory effect on plant height, and significantly decreased number of shoot/plant as compared to the control. Also, fresh and dry weights of herb decreased with increasing salinity level of irrigation water. At the high salts levels the injurious effect was more pronounced.

Takemura *et al*. (2000) examined the effect of different salt levels (0, 125, 250 and 500 mM NaCl) on mangrove plant growth. The results indicated that plant height was greatest in the 125 mM NaCl solution followed by 250 mM. Meanwhile data obtained by Parida *et al* (2003) on the same plant under the effects of salinity range (0, 100, 200 and 400 mM NaCl) indicated that plant height, fresh and dry weight were maximal in culture treated with 100 mM NaCl and decreased at higher concentrations.

Wang and Nil (2000) stated that in *Amaranthus tricolor*, 300 mM NaCl salt stress results in a considerable decrease in fresh and dry weights of leaves, stems and roots.

Aziz and Khan (2001) found that optimum growth of plants is obtained at 50% seawater and declines with further increases in salinity in *Rhizophora mucronata*.

Kotb *et al*.(2001) stated that salinity treatments significantly increased damsisa plant height and branch number up to 2000 ppm. But at 3000 ppm a significant decrease was observed.

Meloni *et al*. (2001) investigated the effect of salt stress (0, 50, 100, and 200 mol m-3) of NaCl, on plant growth of two cultivars of cotton (*Gossypium hirsutum* L).They found that increased NaCl levels resulted in a significant decrease in shoot and leaf growth biomass. Potassium level remained stable in the leaves.

El-Sharnoubi. (2002) studied the effect of gamma irradiation on survival percentage of propagated plants of *Hypericum perforatum* after two and three months of acclimatization, found that it decreased significantly by increasing gamma radiation doses, however, gamma rays at doses less than 40 Gy caused significant decrease in shoot length compared with the control.

Gulzar *et al*.(2003) stated that salinity treatments of *Aeluropus lagopoides* plants grown in non-saline and 200mM NaCl had the greatest fresh and dry weights. Increasing salinity (400 to 1000 mM^{-3} NaCl) caused a decrease in fresh and dry weights of plants.

Hebbara *et al*. (2003) attributed the effect of high salt concentration on plants to soil solution that bound, to create high osmotic pressure in the root zone and reduce availability of water and nutrients to sunflower plants.

Moghaieb *et al*. (2004) examined the effect of NaCl at levels (0, 85, 170, 340 and 510 mM) on *Salicornia europaea* and *Suaeda maritime*. They found that plant dry weight of both species increased under low NaCl concentration (85mM) and then decreased with increasing NaCl concentrations.

Plant growth, (i.e. shoot length, total leaf area, dry weight, root length and rooting ability) of olive cultivars were inhibited by moderate and high salinity (Chartzoulakis, 2005).

The extent of reduction showed significant variation according to the duration of salt exposure and the cultivar. Furthermore, the percentage of germination and the growth parameters (length, fresh and dry weight, number of leaves, leaf area, and relative water content) of maize plant (3-5 weeks old) decreased by increasing salinity (Kerrit, 2005).

Abd El-Wahab (2006) studied the effect of irrigation with fresh water (400 ppm), fresh water +saline water (3355 ppm), fresh water irrigation two times with saline water and all irrigation with only saline water (3355 ppm) on *Foeniculum vulgare*.It was found that the significant reduction of plant height and branches number per plant was obvious as the rate of alternate irrigation increased to 1:2 fresh: saline water.

Beltagei *et al*. (2006) were subjected dry common bean (*Phaseolus vulgaris* L.cv. 'Nebraska'' to salt stress treatments (0, 1000, 2000 and 3000 ppm)of NaCl. The shoot length of the plants was significantly reduced only at the highest level (3000ppm) of NaCl.

El-Raslan *et al*. (2007) studied the individual effect of salinity on lettuce plants. They proved that salinity reduced growth, fresh and dry weight significantly.

Razmjoo *et al*. (2008) conducted an experiment to determine the effect of salinity and drought stresses on growth and oil content of Chamomile (*Matricaria chamomile*) plant, irrigation water was with five different salinity levels (0, 84, 168, 252&336 mM l^{-1}NaCl). Results indicated that increased salinity caused reduction in the number of branches per plant.

Abdul Qados (2009) irrigated wheat cultivar (Sakha 61) with saline water at (2000,4000,6000 and 8000 ppm).It was found that the lowest salinity level used (2000 ppm) induced significant increases in all growth parameters (fresh and dry weight)while (4000 ppm) induced non-significant increases in fresh weight and non-significant reduction in dry weight / plant as compared with control plant .Increasing salinity levels up to 8000ppm resulted in gradual significant reduction in fresh and dry weights of plant .

Hussain *et al*. (2009b) studied the effect of three levels of NaCl salinity on growth of black seeds (*Nigella sativa* L.) 0 (control), 3 dS/m and 6 dS/m. All growth attributes such as fresh and dry shoot weight, shoot length decreased with increase in salinity levels, also, Hussain *et al*. (2009a) reported in other experiment that, all growth attributes such as shoot length, shoot fresh and dry weights were decreased with increasing salinity levels. They were conducted experiment to assess the growth and ion contents adjustment of chaksu (*Cassia absus* L.) under NaCl levels as 0 (control), 8 dS/m and 10 dS/m.

Yousif *et al*.(2010) subjected New Zealand spinach (*Tetragonia tetragonioides* L.) to four levels of salinity treatment through irrigation with a nutrient solution containing 0, 50, 100 and 200 mM NaCl twice (at 10:00 a.m.& 15:00 p.m.) it was found that the dry weights of leaves was higher on 100 and 200 mM treatment compared to the control. The dry weight of stems of New Zealand spinach was not affected by the salinity.

Helaly and El-Hosieny (2011) studied the effectiveness of salt tolerance at (0, 2000,4000,6000 and 8000 mg l^{-1}) on lemon .It was found that shoot fresh weight significantly inhibited due to NaCl salinity specially 8000 mg l^{-1} .

Abdul Qados (2011) studied the effect of sodium chloride (NaCl) concentrations (0, 60, 120, 240 mM) on growth of (*Vicia faba* L) .It was found that salinity significantly increased plant height with low and medium concentration and decrease with the highest concentration and a non-significant effect on leaf number with low and medium concentration but a decrease with the highest concentration.

b. Photosynthetic pigments

El-Nimer *et al*. (1992) reported that at high salinity levels significantly decrease total chlorophyll content in leaves of Datura seedling. Also, El-khateeb (1994) showed that potted *Murraya exotica* L. seedling irrigated with saline water (1500 or 3000 ppm) resulted in decreases in Chl a, Chl b and carotenoids contents of leaves.The same results were obtained by Rashad (1995) on *Tagest erecta* who found that Chl a and b were decreased to the minimum with the higher level of salinity.

While, Ali (1996) on henbane showed that using sea water irrigation up to 6000 ppm decreased total Chl contents.

Iyengar and Reddy (1996) reported that both chlorophylls and carotenoids content decreased by salinity in *Aegideras coniculatum*. The decrease in chlorophyll content at 250 mM NaCl might possibly due to changes in lipid protein ratio of pigment protein complexes or increased chlorophyllase activity.

On the other hand, photosynthesis is one of the major factors responsible for growth and dry matter production in green plants. Salt stress affects photosynthetic components such as enzymes, chlorophylls, and caroteniods in two rice cultivars. The changes in these parameters depend on the severity and duration of stress, Misra *et al*. (1997).

Khan and Ahmed (1998) established that *Indigofolia oblongifolia* fosk seed irrigated with saline water showed an increase in chlorophyll contents.

Orabi (1998) investigated the effect of salinity on cowpea plants. The results revealed that Chl a, b and (a+b) as well as total chlorophyll content of leaves were decreased markedly by increasing salinity levels up to 8000 ppm.

El-Makawy (1999) stated that increasing salinity levels caused a gradual decrease in the Chl a, b and total Chl of the leaves in *Calotropis procera* R, Pr, *Pegnum harmala*, L and *Marrubium vulgare*, L plants.

El-Sanafawy (2000) studied the effect of salinity levels (1500, 3000 and 4500 ppm) on *Ambrosia maritima* L plant. All salinity treatments decreased plant pigments content (chl a and b) in both seasons.

Salinity showed the reduction photosynthetic rate, transpiration rate and stomatal conductance in different plant species. (Khatkar and Kuhad ,2000).

Takemura *et al*. (2000) examined the effect of different salt levels (0, 125, 250 and 500 mM NaCl) on mangrove. Results indicated that chl a content in leaves increased with NaCl concentration in the culture, while chl b content did not change in any of the salt treatments.

Arshi and Abdin, (2002) reported that photosynthetic and total Chl contents in leaves of *Cassia angustifolia* plants decreased by increasing NaCl concentration (0,40,80, 120 and 160 mM) in tomato plants In addition, in *Bruguiera parviflora* photosynthetic rate increased at low salinity levels (100and 200 mM NaCl) and decreased at high salinity 400 mM NaCl

Parida *et al*. (2004) studied the effects of a range of salinity (0, 100, 200 and 400mM NaCl) on mangrove (*Bruguiera parviflora*).Data revealed that salinity decreased chlorophyll content. Total chlorophyll content decreased from 83.44 µg cm^{-2} in untreated plants to 46.56 µg cm^{-2} in plants treated with 400 mM NaCl, suggesting that NaCl has a limiting effect on photochemistry that ultimately affects photosynthesis by inhibiting chlorophyll synthesis.

Baek *et al*. (2005) investigated the effect of salt stress on growth, photosynthesis, and antioxidative ability of rice (*Oryza sativa*

L.), plants rising from γ-irradiated seeds investigated using two cultivars, Ilpumbyeo and Sanghaehyangh yella. The chlorophyll contents and the effective quantum yield of photosystem 2 (ΦPS2) were lower in the NaCl-treated plants than in the control ones, while the non-photochemical quenching was higher in the former ones.

Abd El-Wahab (2006) studied the effect of irrigation with fresh water (400 ppm), fresh water (400 ppm) +saline water (3355 ppm), fresh water (400 ppm) +two irrigation saline water (3355 ppm) and all irrigation with saline water (3355 ppm) on *Foeniculum vulgare*. It was found that chl a, b and total carotenoids decreased, gradually as the rate of saline irrigation increased, being in the least values as all irrigation was conducted with saline water (3355 ppm) all the times.

Al-Sobhi *et al*. (2006) examined the effect of salinity concentrations (0,5,10,20,40,80,160 and 320 mM NaCl) on *Calotropis procera* seedlings .It was found that the high levels of salinization (160 and 320 mM NaCl) induced a significant decrease in the contents of pigment fractions Chl a and b) and consequently of the total chlorophyll content as compared with control plants. The total chlorophyll content of the leaves of *Calotropis procera* seedlings exhibited a little increase when grown at 5 and 10 mM NaCl. While the pigment contents increased at the first three treatments (0, 5 and 10 mM NaCl) with increasing plant age and then decreased at the last five treatments. Generally, chlorophyll contents were reduced markedly at high salinity concentration treatments especially with aged plants.

Khalafallah *et al*. (2008) studied the effect of salts stress on faba bean.They found that salt stress (25 and 50 mM of NaCl) commonly reduced chlorophyll content but increased carotenoids levels. It was found that salt stress induced important alternation of the chloroplast structure such as swelling in thylakoids which might be related to sever drop in chlorophyll content.

Khidr *et al*.(2010) treated wheat (sakha-69) seedlings growing under natural conditions to NaCl or Na_2 SO_4 at the level of 15, 30 and 45 mM/l either alone or in combination with 15 and 30 mM of $CaCl_2$ or $CaSO_4$ in addition to a reference control. Increasing NaCl concentration decreased chl a concentration while carotenoids increased

Helaly and El-Hosieny (2011) studied the effectiveness of γ-irradiated protoplasts at 0, 5, 10 and 20 Kr on improving salt tolerance at (0, 2000, 4000, 6000 and 8000 mg l^{-1}) of lemon.It was found that γ-irradiation decreased Chl a , b and total Chl whereas increased carotenoids , chl a was found to be higher than chl b in both irradiated and non irradiated shoots under either salinized or non salinized media , whereas salinity levels increased chlo a, b and their total

c. Total sugars

Ali (1991) tested the effect of salinity (0, 1000, 3000, 5000 and 7000 ppm) of NaCl and $CaCl_2$ on Datura. It was found that salinity stress induces profound changes in the components of carbohydrates. It was capable to induce a general increase in insoluble and total carbohydrate contents while the soluble carbohydrate contents decreased with the rise of salinization level. Also, El-Nimer *et al*. (1992) found that elevated levels of salinity significantly increased reducing sugars and total soluble sugars of Datura seedling grown at high salinity levels, while that of non reducing sugars significantly decreased.

Kotb and El-Gamal (1994) stated that generally soluble sugars , non soluble sugars and total carbohydrates of *Nigella sativa* L. significantly decreased by increasing salinity levels up to 0.3%.

Zidan and Alzahrani (1994) found that soluble carbohydrate concentration increased with increasing salinity in seedling of *Ocimum basilicum* L. plant exposed to salinity up to 120 mM NaCl. But, when Rashad .(1995) irrigated plants with saline water at 1000 to 3000ppm, the author noticed that, total carbohydrate content was declined as salinity concentrations increased. Also, Ali (1996) worked on Egyptian henbane; found that, using sea water irrigation treatments at 2000, 4000 and 6000 ppm concentrations decreased total carbohydrate percentage and content of plant leaves compared to unsalinized plants.

Fiad (1997) investigated the, extent *Nigella sativa* plant, will tolerate soil salinity, using different levels of salt crust of sea water (0,500, 1000, 2000, 3000 and 5000 ppm.) and concluded that, the treatment of soil salinity decreased the percentage and the leaves contents of total carbohydrats. In the same time, the decrease in this respect was increased as soil salinity levels increased up to that of 3000 or 5000 ppm.

Nesiem and Ghallab (1998) reported that the increase in soluble sugars may indicate that starch and polysaccharides (non – active osmolytes) are converted to simple sugars which enable the plants to keep better water relations under salinity. On the other hand, the greater accumulation of sugars in leaves of stressed plant may be related to its reduced growth as a result of NaCl which inhibit carbohydrate translocation or may be related to the greater energetical cost of osmotic adjustment with sugars apposed to Na^+ or Cl^- ions.

Aldesuquy *et al*.(1998) stated that reducing sugar in tobacco tissues increased by increasing salinity levels. It is suggested that reducing sugar and other solutes contributed more to the solute potential and therefore maintained positive turgor leading to tolerance.

El-Mogy (1999) revealed that, using soil salinity treatments decreased total carbohydrate content per plant on *Ambrosia maritima* L. compared to unsalinized plant. Total carbohydrate content was increased under soil salinity at 0.1 % and decreased with increasing the concentrations of soil salinity to reach its minimum values by using those of 0.2 % and 0.4%.

Frost *et al*. (2003) reported that 250 mM NaCl significantly increased soluble sugar in the stem of *Beta vulgaris*. Total soluble sugar, reducing and non- reducing sugars also increased in maize plants by increasing salt concentration.

Parida *et al*. (2003) studied the effect of salt stress on *Aegiceras corniculatum*. They found that total sugar contents decreased to half in 250 mM NaCl, starch content increased by 174 %.

Tejera *et al*.(2005) reported the salt dose of 25 mM produced an increase of total soluble sugar on common bean plants.

Al-Sobhi *et al*. (2006) examined the effect of salinity concentrations (0,5,10,20,40,80,160 and 320 mM NaCl) on *Calotropis procera* seedlings .It was found that the total soluble and insoluble carbohydrates content in the shoot tended to increase with increasing salinity stress in the solution culture and also with plant age.

Abd El-Wahab (2006) studied the effect of irrigation with fresh water (400 ppm), fresh water (400 ppm) +saline water (3355 ppm), fresh water (400 ppm)+two irrigation saline water(3355 ppm) and all irrigation with saline water(3355 ppm) on *Foeniculum vulgare*. they found that the total carbohydrates percentages in the herb gradually decreased as the rate of saline irrigation increased being in the least values as all irrigation was conducted with saline water (3355 ppm) all the times.

Rejskova *et al*. (2007) found that salinity (100 mM NaCl) caused a decrease in total carbohydrate in olive (*Olea europaea* L.) plants.

Hussain *et al*. (2009a) studied the effect of NaCl on chaksu (*Cassia absus* L.); they found that total soluble carbohydrates increased sharply with increasing under NaCl levels as 0 (control), 8 dS/m and 10 dS/ml.

Khidr *et.al* (2010) treated wheat (Sakha -69) seedlings growing under natural conditions to NaCl or Na_2SO_4 at the level of 15, 30 and 45 mM/l either alone or in combination with 15 and 30 m M of $CaCl_2$ or $CaSO_4$ in addition to a reference control. It was found that the concentration of reducing sugars was significantly increased with increasing NaCl concentration.

d. Active ingredients (damsin and ambrosin)

Hussien (1986) stated on lemongrass that essential oil percentage and yield were decreased under salinity condition.

On geranium, Ahmed (1988), pointed out that, essential oil percentage was decreased by increasing salinity level up to 0.3% in the first cut while in the second one the oil percentage was significantly increased by increasing salinity levels up to 0.3% while the oil yield was highly significant decreased by increasing salinity level up to 0.3% in the two cuts.

Kotb and El-Gamal (1994) stated that fixed oil of *Nigella sativa* L. was significantly decreased by increasing salinity levels up to 0.3% and oil yield as affected by salinity treatments 1000 ppm.

Hussien and Abd El-Nabi (1996) studied the effect of slaine solution irrigation of 2560 ppm along with control 300 ppm on damsisa volatile oil. They found that damsisa volatile oil percentage increased by salinity level increasing most components of volatile oil especially cineol that significantly increased.

Fiad (1997) stated that the percentage of fixed oil in *Nigella sativa* L and fixed oil yield/plant were decreased by using soil salinity treatment.

El-Sanafawy (2000) studied the effect of different levels of sodium chloride, calcium chloride (1500, 3000 and 4500 ppm) and their mixture in the irrigation water on the amount of essential oil percentage of *Ambrosia maritima*, L. plants. It was observed that oil yield per plant were decreased with increasing the level of salinity in the irrigation water during the two seasons as compared by control.

In their study, Heuer *et al*. (2002) determined the influence of irrigation with saline water on oil yield and quality of *Salvia hispanica*, *Matthiola tricuspidata* and *Oenothera biennis* plant, and their treatments were (*salvia* :control, 2, 2.5and 3 dSm-1 of NaCl and $CaCl_2$) (*Matthiola* and *Oenothera*:control, 2, 4 and 6 dSm-1 of NaCl and $CaCl_2$). They found that salinity affected the oil content and composition of each plant differently. Salinity decreased the oil yield of Salvia plants, increased in *Oenothera* and had no affect on *Matthiola*.Changes were also found in oils composition which may have clinical implications.

Hendawy and Khalid (2005) established that essential oil increased with increasing salinity levels in *Salvia officinalis* L. (sage) plants.

Abd El-Wahab (2006) studied the effect of irrigation with fresh water (400 ppm), fresh water (400 ppm) +saline water (3355 ppm), fresh water (400 ppm) +two irrigation saline water(3355 ppm) and all irrigation with saline water(3355 ppm) on *Foeniculum vulgare*. It was found that irrigation all times with saline water (3355 ppm) reduced an ethole percentage to be 19.84 % against 25.85 % for fresh water irrigation. The other constituents appeared to not affect with saline irrigation, in the same time the alternate irrigation with the rate of 1:1 fresh: saline water did not affect an ethole percentage.

Razmjoo *et al*. (2008) conducted an experiment to determine the effect of salinity and drought stresses on growth and oil content of Chamomile (*Matricaria chamomile*) plant, irrigation water had five different salinity levels (0, 84, 168, 252&336 mM l^{-1} NaCl). Results indicated that increased salinity reduced the essential oil content. The highest values of essential oil content were observed under non-salinity stress (control). Chamomile can tolerate till 84mmol NaCl.

e. Minerals content

Ali (1991) tested the effect of salinity (0, 1000, 3000, 5000 and 7000 ppm) of NaCl and $CaCl_2$ on datura. It was found that mineral composition exhibited significant changes but the dominant features was the progressively increase of sodium content with the rise of salinity

Shimose *et al*.(1991) studied the effect of different concentration of NaCl (0, 20, 40, and 60) meq NaCl or $NaSO_4$/liter on *Amaranthus tricolor, Artemisia priceps, Aubergine* and *Perilla frutescens*. They found that in 4 species the absorption of K, Ca and Mg decreased with increasing salinity. The ratio of decrease in K absorption to increase in Na absorption was found to be good indicator of salt tolerance in these species.

Prasad *et al*. (1997) found that N, K, Ca and Mg deceased with increasing salinity 5ds/m in chamomile plant.

El-Makawy (1999) stated that, salinity levels (4000, 5000,6000 and 7000 ppm) decreased potassium percentages with increasing saline water irrigation while sodium and chloride percentages were increased with increasing levels of saline water irrigation on *Calotropis procera* R, *Peganum harmala* L, and *Marrubium vulgare* L.plant.

Chartzoulakis and Klapaki (2000) investigated the effect of salt tolerance of two green house bell pepper hybrids salinity treatments were imposed by irrigating with half-strength Hoagland solution containing 0, 10, 25, 50, 100and 150 mM/1 of NaCl. It was found Cl- in leaves was much higher than Na^+. K concentration of plant tissues was less affected than Na^+ and Cl^- by salinity increase.

Takemura *et al*. (2000) examined the effect of different salt levels (0, 125, 250 and 500 mM NaCl) on mangrove. Results indicated that sodium concentration in leaves increased rapidly, and reached a steady-state value in 3days. Sodium concentration in the sap of stem xylem, stem cortex and root xylem increased up to 350-380mM in 9 days.

Meloni *et al*. (2001) investigated the effect of salt stress (0, 50, 100, and 200 mol m-3) of NaCl on plant growth of two cultivars of cotton (*Gossypium hirsutum* L.).It was found that potassium level remained stable in the leaves and decreased in the roots with increasing salinity. Salinity decreased Ca^{2+} and Mg^{2+} concentrations in leaves. The K /Na selectivity ratio was much greater in the saline treated plants than in the control plants.

Parida *et al*. (2004) studied the effects of a range of salinity (0, 100, 200 and 400 Mm NaCl) on mangrove, (*Bruguiera parviflora*).Data indicated that a significant increase of Na^{+} content of leaves from 46.01mmol m-2 in the absence of NaCl to 140.55 mM in plants treated with 400 mM NaCl was recorded. The corresponding Cl- contents were 26, 92 mM and 97.89 mM. There was no significant alteration of the endogenous level of K^{+} and Fe^{2+} in leaves. A drop of Ca^{2+} and Mg^{2+} content of leaves upon salt accumulation suggests increasing membrane stability.

Moghaieb *et al*. (2004) examined the effect of NaCl at graded levels (0, 85, 170, 340 and 510 Mm) on *Salicornia europaea* and *Suaeda maritime*. They found that both species accumulated Na^{+} during salt treatment. The accumulation increased with increasing NaCl concentration, and the *S. europaea* leaves exhibited a higher Na^+ level than *S. europaea* under salt stress conditions. The accumulation of K^+ was promoted by a moderate concentration of NaCl but a decrease at higher salt concentrations was observed for both species. The Na^+/ K^+ and Na^+/ Ca^{2+} ratios increased with salinity in both species. This indicating ion transport mechanism exist for Na^+ against K^+ and Ca^{2+} accumulation in the two species.

Hussain *et al.* (2009b) studied the effect of three levels of NaCl salinity on growth of black seeds (*Nigella sativa* L.). They found that Na^+, Cl^- and K^+ concentrations increased with increase in salinity but Ca^{2+}concentration was lower as salinity levels increased.

Tuncturk *et al.*(2011)studied the effect of salinity level 150 mM of NaCl on canola cultivars. It was found that salinity generally decreased K/Na contents but Na and Cl decreasesd by salt stress in the roots, shoots and leaves. The highest concentration of K and Ca were found in the leaves compared to roots and shoots.Furthermore the highest concentration of Na and Cl was observed in the leaf and shoot.

Helaly and El-Hosieny (2011) studied the effectiveness of γ-irradiated protoplasts at 0, 5, 10 and 20 Kr on improving salt tolerance at (0, 2000, 4000, 6000 and 8000 mg l^{-1}) on K , Ca, Mg and K/Na on Lemon. It was found that the highest levels of Na and Cl compared to the control obtained at 8000 mg NaCl /l. γ- irradiation decreased the accumulation of Na , Cl whereas increased that of K , Ca and Mg .

f. Total nitrogen

Gouia *et al.* (1994) observed that NaCl not only involved in the transport of nitrate, but also in the reduction of nitrate in bean plants.

The effects of salinity on nitrogen metabolism are highly complicated, since they may reflect osmotic and/ or specific interaction of NaCl on several steps with nitrogen assimilation.

El- Sherbeny (1995) on *Tagetes erecta* plants, found that, total nitrogen percentage was reduced as increasing salinity level.

Also, Rashad (1995) using saline water in irrigation at (0, 1000, 2000and 3000 ppm) concentrations of on *Tagetes erecta* plants. It was concluded that total nitrogen percentage was significantly decreased as salinity levels increased up to3000 ppm in comparison with normal conditions (control).

Fiad (1997) expressed the treatments of soil salinity on black cumin, pointed out that, soil salinity levels decreased the percentage and the leaves content of total nitrogen. .

Prasad *et al*. (1997) found that in NO_3-N fertilization of German chamomile, both NH_4 and NO_3-N increased with increasing salinity up to 5 ds/m beyond which it decreased. Both NH_4 and NO_3-N decreased at low salinity (0.5 and 5 ds/m) and increased at high salinity (10.0 and 15.0 ds/m).

El-Mogy (1999) showed thae nitrogen percentage and content in leaves per plant in *Ambrosia maritima* L. plants. The moderate and higher treatments of soil salinity (0.2% and 0.4%) tended to decrease the nitrogen percentage and content of *Ambrosia maritima,* L. leaves compared to control. The nitrogen content per plant was significantly decreased by using the levels of 0.2% or 0.4%. Whereas, the maximum content of nitrogen was obtained when using soil salinity of 0.1 %, and that N % in the plant leaves decreased with increasing salinity levels.

El-Makawy (1999) stated that salinity levels (4000, 5000, 6000and 7000 ppm) decreased total nitrogen on *Calotropis procera* R, *Peganum harmala* L. and *Marrubium vulgare* L.plants. Also, El-Sanafawy (2000) observed that nitrogen percentage in of *Ambrosia maritima*, L. leaves decreased with increasing irrigation water salinity levels (3000and 4500ppm).

Munns (2002) found that salt dissolved in irrigated water could interfere with nitrogen use by plants, since salinity has been previously shown to be a major factor responsible of low nitrogen availability.

Abd El-Wahab (2006) found that total nitrogen percentages in the *Foeniculum vulgare* herb gradually decreased as the rate of saline irrigation increased being in the least values as all irrigation was conducted with saline water (3355 ppm) all the time.

g. Amino acids

Ali (1991) tested the effect of salinity (0, 1000, 3000, 5000 and 7000 ppm) of NaCl and $CaCl_2$on datura . It was found that, free amino acids other than proline increased significantly with the rise of salinization level.

Perez-Alfocea *et al.* (1993) stated that proline may accumulated as a general response to salinity stress, many investigators recorded an accumulation of amino acids especially proline in plant exposed to salt stress, proline may contribute to osmotic adjustment at the cellular level.

Rhodes and Hanson (1993) reported that betaine and proline are compatible solutes that accumulated in response to osmotic stress, and the accumulation of these osmolytes represent an important adaptive response to salt and drought stresses.

Zidan and Alzahrani (1994) found that proline concentration in seedling of *Ocimum basilicum* L. plant exposed to salinity up to 120 mM NaCl increased with increasing salinity.

Aziz and Larher (1995) established that in abiotic stress such as salinity, proline is assumed to intervene as osmprotactant.

Sudhakar *et al*. (1993) and Madan *et al*. (1995) established that proline oxidase and proline dehydrogenase was significantly inhibited in root and shoot of salt stressed mungbean seedlings, *Chlorella emersonii* and *Brassica juncea*. These enzymes convert free proline into glutamate with simultaneous increase in proline level occurred in drought-stressed barley leaves or following low temperature stressing wheat (Charest and Phan , 1990).

Chandrasekha and Sandhyarani (1996) found that proline act as major reservoir of energy and nitrogen for utilization up to salinity. Energy for growth and survival may help in tolerance of salt stress in barely.

Franco and Melo (2000) indicated that proline is regarded as source of energy, carbon and nitrogen for recovering tissue, so it increased under salt stress levels.

Hartzendorf and Rolletschek (2001) found that amino acid content of *Phragmites australis* L. increased significantly up to 4 fold from 0 to 10% salinity. This increase was caused by up to 200 fold increase of proline and 11 fold increase in glutamine, whilst the share of asparagine and glutamate decreased.

Girija *et al*.(2002) subjected seeds of peanut(*Arachis hypogaea* L. cv JL-24) to one of the following treatments: irrigation with distilled water,50 mM NaCl, 2mM $CaCl_2$, 50 mM NaCl plus 2mM $CaCl_2$.found that proline content was highest in the presence of NaCl in both cotyledons and the embryonic axis of peanut seedlings proline content was diminished somewhat by the addition of $CaCl_2$, while $CaCl_2$ alone was similar in effect to the control of the cotyledons decreased in all treatments.

Xiong and Zhu (2002) stated that under stress condition, plant not only produced antioxidant, but also accumulate compatible solutes such as proline that originally were thought to function as osmotic buffers. However, a part from osmotic adjustment they seem to play a role in maintaining the functional state of macromolecules, probably by scavenging the reactive oxygen species.

Moghaieb *et al*. (2004) examined the effect of NaCl at graded levels (0, 85, 170, 340 and 510 Mm) on *Salicornia europaea* and *Suaeda maritime*. They found that *S. europaea* plants accumulated higher levels of proline in their leaves under salt conditions than *S. europaea* plants. The accumulation of proline in both species increased with increasing NaCl concerntration.

El-Raslan (2007) studied the effect of salinity on lettuce plant and found that salinity induced oxidative stress on lettuce resulting in accumulation of proline in order to overcome NaCl-induced oxidative stress.

On the other hand, Rejskova *et al*. (2007) found that only a small (two-fold) increase of proline content in salinity stressed olive plants indicates that proline does not play a significant role in olive stress response.

h. Soluble phenols

Phenolic compound are stress related compounds produced under harsh environmental conditions.

Javanmardi *et al*. (2002) revealed that the potency of *Ocimum basilicum* L. as a natural antioxidant is due to high prevalence of phenolic compounds. Rosmiric acid, the main active component found in *Ocimum basilicum* L., has been proven to have medicinal value, and its superior antioxidant activity with vitamin E (α-tocopherol) confirms the impotence of *Ocimum basilicum* L as a culinary herb that frequently comes with our meals.

Petersen and Simmonds (2003) reported that basil is known to contain the antioxidant phenolic compounds, mainly rosmaric acid which is one of most common caffeic acid esters occurring in lamiaceae. Rosmarinic acid and some structurally related compounds have been proposed to be active principles in crude preparation which display a range of physiological or pharmacological activities.

Lee *et al*. (2005) established that major aroma compounds found in volatile extracts of basil and thyme exhibiting varying amount of antioxidant activity. In particular, eugenol, thymol, carvacol and 4-allylphenol, found in basil and thyme, exhibit potent antioxidant activity comparable to known antioxidants, butylated hydroxyl toluene (BHT) and α-tocopherol considering the abundance of these aroma chemicals in natural plant ,the total activity may be comparable, or more than these known antioxidants. Furthermore, ingestion of this aroma compound may help to prevent *in vivo* oxidative damage such as lipid peroxidation, which is associated with cancer premature aging, atherosclerosis, and diabetes.

i. Total protein

Ali (1991) tested the effect of salinity (0, 1000, 3000, 5000 and 7000 ppm) of NaCl and $CaCl_2$. It was found that insoluble protein increased significantly with the rise of salinization level, while total protein decreased with the rise of salinization level.

Khidr *et al*. (2010) treated wheat (sakha -69) seedlings growing under natural conditions to NaCl or Na_2SO_4 at the level of 15, 30 and 45 mM either alone or in combination with 15 and 30 mM of $CaCl_2$ or $CaSO_4$ in addition to a reference control. It was found that the concentration of soluble protein depressed.

Abdul Qados. (2011) studied the effect of sodium chloride (NaCl) concentrations (0, 60, 120, 240 mM) on protein content of (*Vicia faba* L) .It was found that the impact of salinity stress increased protein content and a directly proportional relationship was found between protein content and the increase in salt concentrations .

2. Effect of gamma rays

a. Plant growth

Hussein *et al*. (1995) studied the effect of γ- radiation 0, 1, 5, 10 and 15K r and manganese application on growth and chemical constituents of *Datura metal* L. found that irradiation treatments, especially lower doses, had stimulatory effect on plant height and number of leaves.

Kawther *et al*. (1996) established that γ- dose at 1, 2, and 4 Kr significantly increased germination percentage, seedling length and relative growth rate in faba bean. The same doses induced high yield and low pod shedding percentage. In contrast high doses of γ- ray (8,10 Kr) led to significant reduction in growth characters and yield concomitant with high shedding percentage, It is obvious that 4 Kr of γ- ray was the best treatment for less shedding percentage and high yield production.

Kumari and Singh (1996) treated seeds of *Pisum sativum*,L. with different doses of γ--rays ranged from 5 to 40kr.They noticed that seed germination and survival percentages were increased.

El-Sharnouby *et al*. (1997) established that *Hibiscus sabdariffia* seed exposed to γ- irradiation at (0, 1, 2, 4, or 8 Kr) increased plant height and number of branches per plant. However, only seed exposed to 1 Kr showed higher fruit fresh weight/plant than control treatment. Irradiation treatments generally increased fixed oil, carbohydrate and flavones.

Badr *et al*. (1997) irradiated seeds of two tomato cultivars (*Lycopersicon esculentum*, Mill) with six irradiation doses,i.e, 0,500,1000,2000,3000 and 4000 R. The heighest plant was associated with dose 1000 R, followed by the dose 2000 R, but the difference between them was not significant in the first season .However, such a stimulating effect did not follow a regular trend, the average plant height of the plants grown from the seeds that were irradiated with the dose 3000 R appeared to be approximately similar to that of 500 R treatment .Increasing the dose over 3000 R had an opposite effect. The average plant height of 4000 R was significantly lower than those in the other doses and the control in both seasons. Concerning shoot fresh weight, the highest dose (4000 R) gave significantly higher value than the control mean. With respect to leaf area, the influence of the radiation treatments seemed to follow the same above –mentioned trend noticed in case of plant height and fresh weight.

Hanna-alla. (1997) tested the effect of γ- radiation (50 and 100 kr.) on some quantitative and qualitative characters of onion. Results showed that treatments with γ-radiation 50 and 100 kr led to reduction in seedling height and number of green leaves per seedling.

Hassanein *et al*. (1998) studied the effect of γ- irradiation doses of 0, 5, 10, 20 and 40 Gray on growth and yield of faba bean seeds during their development and at harvest. They found that 40 Gray dose of irradiation was the only dose that caused a significant reduction in seed yield.

Mohamed *et al*. (1998) studied the physiological response of soybean "*Glycine max* L., cv. Clark" to γ- radiation .Soybean seeds were irradiated before planting with γ- rays at 0, 10, 20 and 40 Gy. The plant height was gradually and significantly increased by increasing γ-dose from 0 up to 20 Gy, thereafter it was decreased by raising the dose up to 40 Gy comparing to control plants. The dry weight of plant shoots was significantly increased as a result of γ- rays at 10 and 20 Gy, while it was decreased due to the dose of 40 Gy as compared with control plants

Orabi (1998) investigated the effect of γ- irradiation at doses 0, 10, 20 and 40 Gy and salinity on germination and growth of cowpea.

Results showed that the relatively low γ- irradiation doses increased plant height, number of leaves, number of branches and dry weight per plant .While irradiating with the dose of 40 Gy decreased these characters compared to un-irradiated control.

Youssef and Moussa (1998) indicated that exposing the chamomile seeds (*Chamomilla recutita* L.) to γ- radiation at 1, 5, 10, 15 and 20 Kr increased the plant height.

Dorgham (1999) studied the effect of low γ- rays 15, 25, 35 and 45 Gy on growth of lentils (*Lens culinaries*,Med.) at 30,60 and 90 days from sowing. Irradiation doses increased plant height at different plant growth stages and the increase was significant at 35 and 45 Gy doses. γ- irradiation gave marked increase in number of leaves and branches per plant at plant growth stage of 90 days from sowing. Dry weight was increased at doses of 35 and 45 Gy at growth stage of 90 days; however no clear differences were obtained among γ- doses at the growth stages of 30 and 60 days from sowing.

Hassan *et al*. (2000) examined the effect of 20, 40, 60 and 80 Kr γ- irradiation doses on growth of cowpea cv.Cream 7 plants under the green house conditions. Irradiation treatments caused decrease in shoot fresh weights of the parental population with the increase of γ- dose and *vice versa* with M1 and M2 generations.

Stoeva (2000) pointed out that the irradiation of dry bean seeds of cultivar Plovdiv10 with 150 and 200Gy inhibit the growth of the young bean plants by 23% and 50%, respectively. The decrease of the relation leaf area /dry mass was about 25% and was adequate to the decrease of the specific leaf area.

Irfaq and Nawab (2001) exposed wheat cultivars to irradiation with 10, 20, 30 and 40 Kr doses of γ- irradiation .They found that the cultivars exhibited significant reduction in plant height, survival percentage & 1000 grain weight under the influence of high γ- rays doses (30, 40 Kr). Germination of all cultivars was significantly delayed in response to all the γ- rays doses. The low dose (10 Kr) increased the plant height in case of Pirsabak-91. Higher γ- rays doses (30, 40 Kr) also created abnormalities in plant height.

Vaijapurkar *et al.* (2001) found that dose between 0.5 and 20 Gy induced morphological and cytological changes in onions type. The effect of γ- irradiation and phosphorus on chamomile growth and oil production was studied.

Chaudhri (2002) treated seeds of lentil with doses of 0.1, 0.2, 0.5, 1.0 and 2.0 KGy. The growth curves of lentil seeds at different doses, where the lengths of roots are bigger than shoots in every case. In 1.0 and 2.0 KGy sets the germination percentages were more or less nil, higher doses inhibit germination .For this reason, only 0.1 to 0.5 KGy doses have been undertaken for the consideration of germination test. Germination percentage is showing differences in response to different dose rates. In 0.5 KGy set the germination percentage is very less compared to control and 0.1 KGy sets. It indicates that in higher dose germination percentage reduced in addition to root and shoot lengths. In lower dose, i.e. 0.1 KGy, the germination percentage is not significantly different from control but root and shoot lengths are reduced markedly.

Badawy *et al*. (2003) cultured excised shoot tips of lavender in medium supplemented with benzyl adenine or NAA or irradiation with (0, 20, 40, 60 Gy).They found that by increasing rates of γ- ray reduced the percentage of callus+shoot. Shoot formation was highest (86%) with 40Gy irradiation. In general, irradiation inhibited shoot and root formation of the cultures.

Soliman and Abd-El Hamid (2003) investigated the effect of irradiation of dry seeds of kidney bean (*Phaseolsus vulgaris* cv.Giza 6) with different dosages (2.5-15.0 Kr). It was found that the shoot length, number of leaves, area of leaves, number of lateral branches, fresh and dry weights of kidney bean shoots were significantly increased in response to γ- irradiation of the seeds with 2.5 and 5.0 Kr when being compared with the corresponding controls .In addition, all preceding growth parameters showed significant reduction due to irradiating the seeds with 10.0 and 15.0 Kr when being compared with their respective controls.

Nassar *et al*. (2004) Chamomile seeds were irradiated with γ-rays at doses 0, 2, 4, 6, 8 or 10 Kr before sowing. Phosphorus was soil added at concentrations of 10 or 20 kg/ feddan as calcium super-phosphate. γ- irradiation enhanced plant height, branching capacity and shoot and root fresh and dry weights compared with plants produced from non-irradiated seeds. And, found that, on *Chamomilla recutita* the plant height and the number of branches were significantly increased with increasing the dose of γ- irradiation.

Zaka *et al*. (2004) studied the effect of range of γ- irradiation 0 to 60 Gy on 5 day seedling of pea plants. They found that dose higher than 6 Gy significantly inhibited the G1 plant growth and productivity. No survived seedlings were observed by irradiation with 40 Gy and above.

Ahmed *et al*. (2005) stated that maize grain treated with γ-radiation (60Gy) induced significantly enhanced total biomass in case of strain G4, under normal irrigation or drought condition, with higher performance by γ- rays.

Baek *et al*. (2005) were investigated the effects of salt stress on the growth, photosynthesis, and antioxidative ability of the rice (*Oryza sativa* L.) plants raising from γ-irradiated seeds using two cultivars, Ilpumbyeo and Sanghaehyanghyella. The salt stress-induced inhibition of the growth was significantly alleviated in the γ-irradiated plants.

Toker *et al*. (2005) investigated the effects of radiation on the shoot length of germinated seedling of irradiated seeds of Cicer species. The seeds were irradiated with a ^{60}Co γ- source using 0, 200, 300 and 400 Gy doses .At 200 Gy minor effects could be observed, but at 400 Gy an obvious depression of shoot length was observed.

Beltagi *et al*. (2006) subjected dry seeds of common bean (*Phaseolus vulgaris* L.cv.Nebraska) to 0,2and 32 Kr of γ- rays. Under highest dose (32Kr) of gamma irradiation the seedling emerged but it did not continue growth and indicated 100% lethality, the low dose (2 kr) significantly reduced the shoot length.

El–Ghareeb (2006) investigated the effect of gamma irradiation 1, 2, 3 and 4 Kr on growth characters of pea plants Master B and Lincolin cultivars. Results showed that 1kr gave the highest significant values for plant height, number of leaves and number of branches per plant, on the contrary 4 Kr dose gave sever reduction for the same characters.

El-Demerdash (2007) studied the effect of γ- irradiation doses 100, 150 and 200 Gy on soybean plants. It was found that plant height and number of branches per plant were deceased by γ- irradiation.

El-Sharnouby *et al*. (2007) studied the effect of γ- irradiation and additives production and chemical composition of sweet basil through tissue culture. They reported that irradiation induced changes in shoot propagation and leaf size. Irradiation at 1 and 1.5 Kr of γ- rays stimulated leaf shape and stem size. Shoot number, shoot length and essential oil were increased with increased γ- irradiation rate.

Guirgis *et al*. (2007) reported that seed of sweet basil (*Ocimun basilicum* L) exposed to different doses of γ- irradiation (10, 20, 30, 40, and 50) demonstrated that dose of 50 Kr completely inhibited seed viability, and several mutant were selected up on morphological aberration and show that mutants have 1.5 fold increase in rosmiric acid comparing with wild type.

Wi *et al*. (2006) found that the plants exposed to relatively low dose of γ- rays developed normally, while, the growth of plants irradiated with a high dose of γ- rays (50Gy) was significantly inhibited.

El-khateeb *et al*. (2007) studied the effect of low doses of γ- irradiation on Melissa plantlets found that gamma rays caused changed in shoot chemical and anatomical structure. Gamma irradiation at the level of 30 Gy affected the shape and size of stem.

Ellyfa *et al*. (2007) irradiated seeds of snap bean (*Phaseolus vulgaris*) with 0,300,400,500,600 and 800 Gy doses of gamma irradiation. They found that the lowest dosage of irradiation (300 Gy) reduced the plant growth characters compared to the control. In addition, increasing dosage of gamma irradiation was accompanied by decrease in height, root length, oven-dry weight of shoot and survival of snap bean

Norfadzrin *et al*.(2007) studied the effect of gamma ray on seed germination ,plant height ,and dry weight of seedlings derived from irradiated seeds of tomato (*Lycopersicon esculentum*) and okra(*Abelmoschus esculentus*) with 300,400,500,600 and 800 Gy .They found that germination percentage ,plant height , survival percentage and shoot dry weights of tomato and okra decreased with increasing dose of gamma ray.

Hameed *et al*. (2008) irradiated seeds of two varieties of chickpea (Desi 97086 and Kabuli 90395) with 10 doses of gamma rays ranging from 100 to 1000 Gy. They found that shoot length was decreased in both cvs Desi and Kabuli after all doses of gamma irradiation. Generally shoot length of seedling was decreased gradually with increasing dose. Maximum decrease in shoot length was observed in both chickpea types after irradiation dose of 800 Gy, seedling fresh weight was decreased in Desi as well as Kabuli chickpea as compared with non-irradiated control after almost all irradiation doses .Minimum seedling fresh weight was observed after 800 Gy dose in cv Kabuli while it was 1000 Gy dose in cv Desi .Seedling dry weight was decreased in cv Kabuli after all irradiation doses as compared to non-irradiated (control).

Omar *et al*. (2008) tested the effect of different dosages of gamma irradiation (300,400,500,600 and 800Gy) on germination, plant height and shoot dry weight of chili (*Capsicum annuum*).They found that the lower doses (300 and 400 Gy) in comparison with control (0Gy) did not affect germination regardless of time, but on the contrary, the higher doses (500,600 and 800Gy) inhibit seed germination. They observed that plant height, survival percentage and shoot dry weight decreased with increasing dose of gamma rays. The 800 Gy gamma ray dose had a profound effect on these variables perhaps due to injury the higher doses may have caused to the seeds of chili.

Shah *et al*.(2008) studied the effect of gamma irradiation doses 100,200,300,400,500,600,700,800,900,1000,1100 and 1200 Gy in M1 generation in 4 chickpea genotypes (Pb 2000,C44 , Pb-1 , and desi x *kabuli introgressin* line CH 40 /91). Germination showed highly significant negative correlation with gamma rays. The result was obtained by plotting the reduction percentage of germination due to radiation .It was clear that all the four genotypes showed negligible effect of lower doses of gamma irradiation .The desi genotype C44 gave maximum and desi x kabuli introgression line CH 40 / 91 showed minimum effect on the germination percentage. The germination percentage decreased gradually with increasing doses from 400-1200 Gy in Pb2000, from 700-1200 Gy in C44, from 300-1200 Gy in Pb-1 and Ch40 / 91. The shoot length in C44 and Pb 2000 stimulating effect was observed at 100 Gy while in Pb-1 and Ch40/91 this effect was not seen.

Girija and Dhanavel (2009) tested the effect of gamma irradiation on cowpea(*Vigna unguiculata* L.Walp) at 15,20,25,30 and 35 KR .They found that the germination percentage of cowpea decreased with the increase in the dose concentration and it was estimated that using 50% reduction in seed germination was observed at 25KR dose.

Abdul Majeed and Zahir (2010) conducted an experiment to study the effect of gamma rays on number of branches and leaves per plant ,and fresh and dry weight of *Lepidium sativum* L , dry seeds were irradiated with 20,30,40,50,60,70 and 80 Kr (kr) by 60Co.Results showed that gamma irradiation significantly affected all the above mentioned parameters except germination percentage .Mean germination time (MGT) was significantly affected and delayed at higher doses of gamma rays .

However ,increasing doses of gamma rays did not affects the seed germination percentage .The growth parameters showed declining tendency with increasing doses of radiation.

Hamideldin (2010) irradiated seeds of two cultivars of tomato (*Lycopersicon esculentum* Mill) Marm and Nima with 0, 20 and 40 Gy. There were no significant variations in germination percentage in cultivar Marm, but irradiation by 40 Gy decreased it significantly in cultivar Nima. The dose 20 Gy gave the highest increase with significant variation in shoot length , number of leaves and fresh weight in cultivar Marm, in cultivar Nima ,significant changes were found in shoot length , number of leaves , leaf area and fresh weight.

Hegazi and Hamideldin (2010) studied the effect of different doses of gamma irradiation (300,400 and 500Gray) on growth of two okra varieties. Results showed that 400 Gy gave the highest number of branches per plant, leaf area and fresh and dry weight per plant followed by 300, then 500Gy.

Hussein (2010) studied the effect of gamma rays (0-250 Gy) on mungbean (*Vigna radiate* L) .The results showed that the highest dose of radiation (250 Gy) caused stunted growth on mungbean seedlings while the lower doses (50&100 Gy) stimulated the growth of these seedlings significantly.

Helaly and El-Hosieny. (2011) studied the effectiveness of gamma irradiated protoplasts at 0 , 5, 10 and 20 Kr .It was found that shoot fresh weight was significantly inhibited due to Concerning gamma irradiation 10 and 20 Kr recorded the highest fresh weight .

Moussa and Abdul Jaleel(2011) studied the effect of gamma radiation doses (0,25,50,100 and 150 Gy) on (*Trigonella foenum-graecum* L.). It was found that gamma irradiation increased dry weight values from plants treated with 150 Gy.

b. Photosynthetic pigments

Orabi (1998) indicated on cowpea plants that the doses of 10 and 20 Gy of gamma radiation significantly increased Chl a, b and (a+b) as well as total Chl contents of leaves, while higher dose,40Gy, decreased it compared with the unirradiated control.

Farid *et al* (1999) found that gamma irradiation treatments (10, 20 and 40 Gray) increased the content of Chl a and b in sweet marjoram herb.

Said (2001) reported that exposing the peppermint to gamma rays at 10 and 30 Gray increased chl a, b and carotenoids content, while, the 70 Gray dose decreased them in comparison with control.

In contrast,El-Sharnoubi (2002) recorded that gamma irradiation reduced the pigments in *Hypericum perforatum* grown *in vitro*.

Lee *et al*. (2003) studied the effect of low gamma- irradiation doses on early growth and photosynthesis in radish plant. The seedling height of radish was stimulated in plants grown from seeds irradiated with γ- ray of 10 Gy. The O2 evolutions in the 10 Gy irradiation group was 1.2 times greater than that in the control. In the 10 Gy irradiation group ,catalase and peroxidase activities of radish leaves grown from seeds irradiation with γ-ray were increased as well as activity of superoxide dismutase.

Kim *et al*. (2004) also characterize stimulatory effects of low-dose gamma radiation on early plant growth; they investigated alterations in the photosynthesis and antioxidant capacity of red pepper (*Capsicum annuum* L.) seedlings produced from gamma-irradiated seeds. For two cultivars (Yeomyung and Joheung), three irradiation groups (2, 4, and 8 Gy, but not 16 Gy) showed enhanced development. They revealed that irradiation altered the compositions of photosynthetic pigments (chlorophylls and carotenoids) as well as the activities of antioxidant enzymes.

Beltagei *et al*.(2006) subjected dry common bean (*Phaseolus vulgaris* L.cv.Nebraska) to 0, 2 and 32 Kr of gamma rays form a ^{60}Co source the contents of Chl a and b did not change under all treatments. While carotenoids increased in response to gamma irradiation in non – stressed plants.

Kiong *et al*. (2008) studied the effect of different doses of gamma rays (0, 10, 20, 30, 40, 50, 60, and70 Gy) on shoot tip explants of *Orthosiphon stamineus*. Biochemical study revealed that total Chl content decreased notably as gamma dosage increased.

Hamideldine and Hussein (2009) studied the effect of different doses of gamma radiation (100, 200, 300 Gy) and two levels of irrigation (10 and 20 days) of *Trifolium alexandrinum*, L after germination. They reported that gamma irradiation treatments stimulate growth criteria in normal irrigation treatment. The most significant dose was 100Gy, which stimulates the growth, Chl a, b, total Chl and carotenoids in both irrigation treatments used.

Moussa and Abdul Jaleel (2011) studied the effect of gamma radiation doses (0.0,25,50,100 and 150 Gy) on (*Trigonella foenum-graecum* L.). It was found that gamma irradiation used were increased total chl values from plants treated with 150 Gy.

c. Total sugars

Concerning the effect of gamma radiation on carbohydrate content, El-Shafey *et al* .(1991) reported that seeds of sweet basil exposed to gamma rays at doses of 0.5, 1, 2 and 4 Kr increased the total carbohydrates content in the leaves. Furthermore, the dose of 2 Kr was more effective than the others in this respect.

Kandeel *et al* . (1991) studied the effect of gamma irradiation on *Ocmium basilicum* L. seeds and they found that gamma irradiation doses ranged between 1000 and 8000r slightly increased the carbohydrates content, while the higher dose of 12000 r caused a slight decrease in comparison with control.

Hassanein *et al* . (1998) stated that exposing faba bean seeds to gamma rays ranged from 5 to 20 Gray led to significant reduction in reducing sugars, sucrose, polysaccharides and total carbohydrates. On the other hand, applying more gamma rays doses up to 40 Gray caused high accumulations in all carbohydrate fractions.

Farid *et al* . (1999) found that exposing the sweet marjoram to low doses of gamma rays (10, 20 and 40 Gray) increased total carbohydrates content. The highest dose (40 Gray) gave the highest total carbohydrate concentration.

Also, Said (2001) reported that exposing peppermint plants to gamma rays at 10, 30 and 70 Gray increased total carbohydrates content.

Gaber *et al*. (2002) found that treatment of faba beans with gamma radiation increased their carbohydrate content significantly. Low (250r) and high (2500 and 5000 r) dosages of gamma irradiation.

Nassar *et al*.(2004) found that, on *Chamomilla recutita* the pre-sowing irradiation of chamomile seeds showed gradual increase in total carbohydrates and total soluble sugars with increasing the dose of gamma irradiation from 0.0 to 10 Kr.

Moussa (2006) examined the changes in growth parameters and certain metabolic activities in response to different doses of γ-irradiation (0.0, 20, 50, 100 and 200 Gy) in rocket seedlings. Total sugars, increased significantly at the 20 Gy dose.

Moussa and Abdul Jaleel(2011) studied the effect of gamma radiation doses (0.0,25,50,100 and 150 Gy) on (*Trigonella foenum-graecum* L.). It was found that gamma irradiation increased total soluble sugars values from plants treated with 150 Gy.

d. Active ingredient (damsin and ambrosin)

Concerning the essential oil content and composition, Masada. (1976) showed that the oil has quite different aromatic characteristics depending on growing site and preparing condition, and described four different forms of basil oil. The Mediterranean type, contained linalool and methyl chavicol as major constituents but did not contain camphor. This type of oil has affine odor and is considered superior in quality.

Antonelli *et al*.(1998) found that the linalool and estragol increased in dried basil leaves irradiated with γ - radiation and dropped with microwave. The composition of essential oil was different, except for few compounds which increased or decreased regardless of treatment, γ- ray caused the most evident changes in composition profiles.

Ayed *et al*.(1999) stated that Pomace was γ-irradiated at 0-9 K Gy. Low doses of irradiation (below 2K Gy) prevented the loss of anthocyanin while higher doses decreased the content of anthocyanin.

Johnson *et al*.(1999) studies the effect of supplementary UV-β radiation treatment on essential oil of glass house grown sweet basil, they found that UV-β enhanced the levels of the most major volatile.

Both phenyle-proponoids (eugenol-methyl eugenol), and terpenoids, notably linalool, 1, 8 cineole and trans β ocimene . The phenyle-proponoids was senestive to uv-β at an earlier developmental stage than terpenoid overall, the effect of uv-β was nearly four fold stimulation in oldest plant examined.

e. Minerals content and total nitrogen

The effect of gamma radiation doses (0, 10, 20 30, 40, 50, 60, 70 and 80) on ion accumulation (Na^+, K^+, Ca^{2+} and Mg^{2+}) caused decreasing in the content of ion by increasing gamma radiation doses in sweet potato(Mostafa ,2002).

Hassanein (2003) on *Foeniculum vulgare* indicated that gamma ray doses of 250, 500, 750, 1000, 1250 and 1500 r increased the content of K^+ compared with control.

Khodary (2004) investigated the effect of NaCl in presence or absence of gamma irradiation on seeds of *Lupinus termis*. He determined, potassium and phosphorus uptake. Were determined significant decreases in the contents were observed in seeds irradiated with gamma rays (10, 25, 50 and 100 Gy), these nitrogenous fractions were increased after NaCl treatments, particularly with 25Gy dose.

Moussa (2006) examined the changes in growth parameters and certain metabolic activities in response to different doses of γ-irradiation (0.0, 20, 50, 100 and 200 Gy) in rocket seedlings. It was noticed that potassium increased significantly at 20 Gy dose.

Abdel-Wahab (2009) irradiated lovage fruits before sowing with gamma rays at 0, 20, 40, 60 and 80 Gy. The results showed that low gamma doses markedly increased levels and total contents of N and K in shoots.

f. Amino acids

Khodary (2004) found that the, significant decrease in the amino acids content of lupine(*Lupinus termis* L) were observed in irradiation with gamma rays (10, 25, 50 and 100 GY) .The effect was more pronounced particularly with 25 Gy.

Moussa (2006) examined the changes in growth parameters and certain metabolic activities in response to different doses of γ-irradiation (0.0, 20, 50, 100 and 200 Gy) in rocket seedlings.It was noticed that total free amino acids, increased significantly at 20 Gy dose.

Hamideldine and Hussein (2009) studied the effect of different doses of gamma radiation (100, 200, 300 Gy) and two levels of irrigation (10 and 20 days) of *Trifolium alexandrinum*, L after germination. Gamma irradiation and drought stress increased amino acid content. The same authors concluded that low dose (100 Gy) of gamma irradiation, alleviated the effect of drought stress..

Hussein (2010) studied the effect of gamma radiation doses (50-100 Gy) on mungebean. The author found that total amino acids increased at all doses of gamma radiation used.

g. Total soluble phenols

Gamma irradiation could influence the levels of phenol compounds, in this respect. Arevalo *et al*. (2002) studied the effect of gamma radiation (100, 150, 250, and 350 Gray) followed by storage at room temperature on avocado fruit. They found that gamma rays at doses of 100 and 150 Gy increased the concentration of phenolic compounds.

Koseki *et al*. (2002) found that exposure artichoke (*Cynara scolymus* L.) and Sweet basil (*Ocimum basilicum* L.) to gamma irradiation doses (0, 10, 20 ,30KGy) did not induce any significant changes in flavonoids, tannins, phenolic contents while a slight decrease in β-carotene content was observed.

Breitfellner *et al*. (2003) reported that exposing the strawberry to gamma rays of 1 K Gray up to 6 K Gray had no effect on phenolic compounds content such as gallic acid, p-coumaric acid and caffeic acid, but the concentration of 4-hydroxybenzoic acid was increased by increasing the radiation dose.

Moussa (2006) examined the changes in growth parameters and certain metabolic activities in response to different doses of γ-irradiation (0.0, 20, 50, 100 and 200 Gy) in rocket seedlings. It was concluded that total soluble phenols, increased significantly at the 20 Gy dose.

Song *et al*.(2006) reported that the total phenol analyzed in irradiated Kalr juice immediately after irradiation, was signifcantly lower than the control. However, the phenolic compounds level of irradiated sample became higher after 1day than that of the control. This phenomenon was attributed to the immediate oxidation of the phenolic compounds, thus playing an antioxidant role by reducing the free radicals and the reactive oxygen species induced by irradiation. In this respect, Harrison and Were (2007) found that Gamma irradiation (0-16 k Gy) showed significant increase in the total phenolics and antioxidant activity in Almond skin. Erkan *et al*. (2008) found that UV-C treatment for different durations (1, 5, and 10 min) increased the antioxidant capacity and concentration of anthocyanins and phenolic compound in strawberries.

Khattak *et al*. (2008) found that in Nigger seed (*Nigella sativa* L.) irradiated with gamma dose (2-16K Gy) enhanced the DPPH free radical-scavenging activity and total phenolic content.

h. Total protein

Gaber *et al*. (2002) found that treatment of faba bean with gamma radiation increase protein content significantly. Low (250r) and high (2500 and 5000r) doses of gamma irradiation caused significant reduction in the protein content of the seeds; whereas doses of 500 and 1000 r led to an increase in the protein content of faba bean seeds.

Khodary (2004). found that the significant decrease in the contents protein of lupine(*Lupinus termis* L) were observed in seeds irradiated with gamma rays (10, 25, 50 and 100 GY) This effect was more pronounced particularly with 25 Gy dose.

Beltagi *et al.* (2006) subjected the salt stress treatments of gamma rays (0, 2, and 32 Kr) of common bean (*Phaseolus vulgaris* L.cv.Nebraska). It was found that low dose (2 Kr) of gamma irradiation induced stability in the total number of protein bands and continuing synthesis of certain polypeptides under the highest level(3000 ppm) of NaCl.

Moussa (2006) examined the changes in growth parameters and certain metabolic activities in response to different doses of γ-irradiation (0.0, 20, 50, 100 and 200 Gy) in rocket seedlings. Total protein increased significantly at 20 Gy dose.

El–Ghareeb (2006) investigated the effect of gamma irradiation (1, 2, 3 and 4kr) on seed protein of pea Master B and Lincoln cultivars.The obtained results showed that the lowest dose (1kr) of gamma rays increased seed protein content for cvs Master B and Lincoln.

Hussein (2010) studied the effect of gamma radiation doses (50-100 Gy) on mungebean . It was found that all gamma irradiation used were increase total protein contents.

Kiong *et al*. (2008) studies the effect of different does of gamma rays (0, 10, 20, 30, 40, 50, 60, and70 Gy) on shoot tip explants of *Orthosiphon stamineus*. Biochemical study revealed that total soluble protein content revealed that plantlet irradiated at 50Gy contain the highest amount of total soluble protein,21.03±1.82mg/g FW, whereas only 14.49±4.04mg/g FW of total soluble protein was detected in 10Gy.

Moussa and Abdul Jaleel(2011) studied the effect of gamma radiation doses (0.0,25,50,100 and 150 Gy) on (*Trigonella foenum-graecum* L.). It was found that gamma irradiation increased total protein of plants treated with 150 Gy.

MATERIALS AND METHODS

This experiment was carried out during the two successive seasons of 2007/2008 and 2008/2009.

Plant Material

Damsisa (*Ambrosia maritima* L) seeds, were obtained from the Agriculture Research Center, Ministry of Agriculture, Dokky,Giza, Egypt.

Radiation treatments

Seeds were irradiated with different doses of gamma rays (0, 20, 40 and 80 Gy). The irradiation facility was carried out at the National Center for Radiation Research and Technology (NCRRT) using Cesium 137 as source of gamma rays. The dose rate was 0.89 rad /sec and 0.87 rad/ sec respectively.

Soil analysis

The chemical, physical and mechanical analysis of soil was presented in Table (1).The chemical analysis was determined according to Jackson (1973). The organic matter content was determined according to Black (1982).

Salinity treatments

During the two successive seasons, three levels of salinity (2000, 4000 and 6000 ppm) were prepared by adding the mixture of sodium chloride (NaCl), calcium chloride ($CaCl_2$) and magnesium sulphate ($MgSO_4$) in a ratio of 2:2:1.

In the control group, pots (30cm in diameter) were filled with

Table1.Averages of some physico-chemical and mechanical analysis of experimental soil during two successive seasons of 2007/2008 and 2008/ 2009.

Properties	values	Properties	values
pH	7.40	Ca^{+2}(meq/l)	8.40
Ec ds/m	2.10	Mg^{+2}(meq/l)	2.70
HCO_3^-(meq/1)	1.65	O.M %	1.10
Cl^-(meq/l)	12.00	Clay %	12.80
SO^{--}_4(meq/1)	8.45	Sand %	60.00
Na^+(meq/l)	10.35	Silt %	27.20
K^+(meq/l)	0.36		

O.M = organic matter **Ec** = Electrical conductivity

5kg soil obtained from the experimental farm of NCRRT. The ratios of sand loamy soils were 3:2 mixed with recommended fertilizers. For salinity groups, the proper concentration for each group were mixed well with soil before sowing.

Agricultural practices

Fertilization

Plants were fertilized according to the recommendations of the Egyptian Ministry of Agriculture and Land Reclamation (150kg calcium super phosphate/fed, 100kg potassium sulphate/fed and 100kg ammonium sulphate/fed).fartilization rate at the time pot added 0.5g/kg potassium sulphate and ammonium sulphate, 0.75g/kg calcium super phosphate at the beginning of the experiment during the two seasons.

Planting

In the first of October, during the two successive seasons, four levels of salinity (0,2000,4000 and 6000 ppm) were obtained by adding the mixture of sodium chloride (NaCl), calcium chloride ($CaCl_2$) and magnesium sulphate ($MgSO_4$) at the ratio of 2:2:1 by weight and were mixed with soil in each pot. The pots were divided into four groups. The first group consists of , pots sown with ten seeds of untreated control and those exposed to γ-rays at doses of (20, 40 or 80 Gy). Twelve replication for each dose were carried out. All pots (48 pots) were serve as the control for other three salinity groups treated by (2000, 4000, 6000 ppm). The soil of control group (sandy loamy) contained the normal level of fertilizers as mentioned before. The second group cultivated in pots contained the soil as in control group and mixed with 2000 ppm level, while the third one contained soil with 4000 ppm level and the last one contained the soil mixed with 6000 ppm level. All groups were treated with (0, 20, 40 or 80 Gy) of gamma rays as mentioned in the first group. seeds were left to grow then plants were thinned to three plants per pot.

Irrigatation

All plastic pots were irrigated with tap water till 66% of field capacity weekly till January then, every ten days till March and weekly till the end of experiment.

Sampling

In both seasons, samples were collected from each treatment at February representing the vegetative growth sample (150 days after sowing). While, flowering stage at May (240 days after sowing) and the last one, at July (330 days after sowing) that represening fruiting stage of plant.

Ten plants were taken as samples for measureing growth parameters and estimation of chemical analysis.

Growth parameters

Shoot height/cm.

Shoot fresh weigh/g.

Shoot dry weigh/g.

Number of branch/plant

Number of leaves/plant.

Chemical analysis

Inorganic components

Samplas obtained from specimens of different stages of growth (vegetative, flowering and fruiting) during the two seasons were air dried and then milled for determination of minerals.

Minerals

0.5g of dry damsisa shoots were weight for digestion with sulphuric and perchloric acid as reported by Piper (1947). Samples diluted for estimation of elements (Na, K, Ca, and Mg).

a. Potassium and sodium concentrations were determined by using the flame photometer apparatus (CORNING M 410).

b. Calcium and magnesium concentrations were determined by using atomic absorption spectrophotometer (GBC, 932 AA).

Nitrogen concentration

The total nitrogen concentration was determined using micro kjeldahl method of (AOAC, 1990). A known weight of the dry powdered plant tissue was weight in to a digestion flask. The sulfate mixture (K_2SO_4+$CuSO_4$) were added to the flask followed by concentrated sulfuric acid and digested on flam. The sample then transferring quantitavely into kjeldahl apparatus for distillation and determination of total nitrogen, 40% NaOH solution were added.A strong current of steam was passed and the ammonia was received under 4% boric acid and then titrated against 0.02 N HCl,using mixtuer of bromocresol green and methyl red indicator (2:3). After correction with blanks, the results were expressed as percentage in dry weight. Total protein was obtained by multiplying the nitrogen percentage by 6.25.

Organic components

Samples obtained from vegetative, flowering and fruiting stages were used to determine total sugars, total soluble phenols, total Chl and total amino acids.

Preparation of ethanol extract

In ethanol extract of fresh leaves, total sugars and total soluble phenols were determined. One gram was cut into small pieces and crushed in a homogenizer using about 10 ml of 70% boiling ethanol for about 10 min, then filtrated through a centered glass funnel (G3). The residue was re-extracted with about 10ml of 70% boiling ethanol and filtered, then the volume was adjusted to 25 ml with 70% ethanol.

1. Total sugars

Total sugars were determined by using the method of phenol sulphuric acid reagent according to Dubois *et al*. (1956).

2. Total soluble phenols

Total soluble phenols were determined by colorimetric method using Folin-Denis reagent according to Swain and Hillis (1959).

3. Total Chlorophyll

Fresh leaves were extracted with dimethyl formamide solution [HCON $(CH3)_2$] and placed overnight at cool temperature (5°C). Chl a, b and carotenoids were measured by Shimadzu UV-120-02 spectrophotometer at wavelengths 663, 647 and 470 nm, respectively. Chlorophyll and carotenoids were calculated according to the equation described by, Nornai (1982).

Chlorophyll a $=12.70\ A_{663} - 2.79\ A_{647}$

Chlorophyll b $=20.76\ A_{647} - 4.62\ A_{663}$

Total Chlorophyll $=17.90\ A_{647} + 8.08\ A_{663}$

Total Carotenoids $= [1000\ A_{470} - (3.72\ Chl_{(a)} - 104\ Chl_{(b)})] / 229$

Total amino acids

Amino acids analysis were done in amino acids laboratory, NCRRT according to method of AOAC (1990) after preparing the sample by weighing 100 mg dry powdered sample in screw-capped glass tube containing 10 ml of 6.0 N HCl, the tubes were kept in an oven at 110°C, 24hours for complete digestion. The sample was filtered and the volume was completed to 100ml with distill water. Five ml of the solution was evaporated to dryness in a rotary evaporator.

A suitable volume of sodium citrate buffer (pH 2.2) was added to the dried film of each hydrolyzed sample. After all materials completely dissolved, the samples then filtered through a 0.4 um membrane filter. Samples were ready for injection (Baxter, 1996). The system used for analysis was high performance amino acid analyzer (HPLC), Biochroma 20 (auto sampler version) pharmacia Biotech at

NCRRT. Data analysis of chromatogram was done by Chromatography Data System Tutorial and user's Guide-version 6.7.

The active ingredients '' damsin and ambrosin''

Extaction were carried out according to Amine (1990). 2.5g of the powdered aerial parts of cultivated *Ambrosia maritima* L. plants were extracted with petroleum-ether (bp.40-60˚C) in a continuous extractor till exhaustion (tested by Dragendorff's reagent). The petroleum-ether was concentrated to a small volume (reduced pressure and at low temperature).

TLC investigation of the petroleum- ether extract.

Petroleum-ether extracts of cultivated plants were separately chromatographed on the plate of silica gel (5-plates, 0.5mm.thickness, silica gel G, Merck,system 7). The plate starting eluted for about 20 minutes with diethyl ether, the separated sesquiterpene-lactones were dried then sprayed with Dragendorff's reagent.

Isolation and identifications of ambrosin and damsin.

The resulted spots were corresponding to ambrosin and damsin. The estimation of ambrosin and damsin were carried out at National

Research Center, Dokky,Giza according to Slacanin *et al*. (1988).

Statistical analysis.

The experiment layout was designed in randomized complete block design with two factors. The first factor was four salinity levels (0, 2000, 4000, and 6000) ppm. The second factor was four gamma ray doses (0, 20, 40 and 80) Gy. Data of growth characters were statistically analyzed. Means were compared using the least significant difference test (LSD) at 5% level (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

The effects of different levels of salinity and doses of radiation on plant height, number of leaves / plant, fresh and dry weight of herb / plant are represented in Tables (2) and (3) for three stages of growth during two experimental seasons.

1. Effect of salinity and gamma rays on growth parameters

a. Plant height

Data concerning the effect of salinity on growth characters, are presented in Table (2) reveal that, the addition of different levels of salt mixture (NaCl: $CaCl_2$: $MgSO_4$) to the soil significantly decreased the heights of damsisa plants as compared to those of untreated control soil. At the first season, the decreases in shoot height were 4.4, 7.5 and 11.5 % for salinity sets 2000, 4000 and 6000 ppm respectively relative to normal control at the fruiting stage.

In the second season, the plant height of control plants registered 33.0 cm in normal soil. However, the plant height of salinity sets; 2000, 4000 and 6000 ppm have 27.39, 25.9, 23.2cm at vegetative stage. The decrease in plant height resulted from soil salinity treatments were in harmony with those obtained by Kotb and El-Gamal, (1994) on *Nigella sativa* L, El-Sherbeny (1995) on *Tagetes erecta*, Ramadan (1996) on guar, Marcelis and Vanhooigdonk, (1999) on *Raphanus sativus* (radish), El-Mogy,(1999) and El-Sanafawy (2000) on *Ambrosia maritma*, L. plants.

Table 2.Effect of γ-ray doses, soil salinity treatments and their interaction on plant height (cm) of *Ambrosia maritima* L plant during 2007/2008 and 2008/2009 seasons.

Season	2007/ 2008					2008/2009				
γ-ray(Gy)	0	20	40	80	MeanA	0	20	40	80	MeanA
Salinity (ppm)	Vegetative stage									
0	14.19	17.75	19.34	17.72	17.25	32.96	33.29	31.59	30.42	32.06
2000	13.10	17.17	14.22	14.62	14.77	27.33	29.42	28.21	23.83	27.20
4000	13.08	17.50	16.50	15.58	15.66	25.92	29.17	25.50	23.50	26.02
6000	12.33	14.34	15.17	14.88	14.18	23.17	26.59	26.16	24.46	25.09
Mean B	13.17	16.69	16.30	15.70		27.34	29.62	27.86	25.55	
LSD 5%	A=0.996	B=1.03	AB=N.S			A=2.04	B=1.73	AB=N.S		
	Flowering stage									
0	30.59	32.00	29.71	28.88	30.29	37.33	35.67	32.67	37.17	35.71
2000	25.25	26.67	27.67	30.25	27.46	34.59	37.32	35.00	34.17	35.27
4000	24.92	23.92	27.67	23.84	25.08	30.75	31.84	28.67	28.82	30.02
6000	24.83	24.63	27.59	29.00	26.51	27.92	37.00	32.28	32.58	32.45
Mean B	26.40	26.80	28.16	27.99		32.65	35.46	32.16	33.18	
LSD 5%	A=1.59	B=1.15	AB=2.29			A=N.S	B=N.S	AB=N.S		
	Fruiting stage									
0	32.13	36.21	35.75	40.09	36.04	45.42	47.55	46.96	47.67	46.90
2000	30.68	31.66	33.00	39.67	33.75	43.79	45.34	46.33	46.92	45.60
4000	29.68	30.75	32.83	34.00	31.82	42.17	39.87	40.67	44.09	41.70
6000	28.42	33.00	32.84	35.67	32.48	39.17	43.92	37.75	44.50	41.33
Mean B	30.22	32.91	33.60	37.35		42.63	44.2	42.93	45.79	
LSD 5%	A=2.24	B=1.31	AB=N.S			A=4.28	B=N.S	AB=N.S		

A=Salinity B= Irradiation AB= Interaction

It was noticed that, all plants produced from seedes recieved radiation were improved in growth under saline soil condition. Irradiated seeds that sown in control soil or under different levels of salinity mostly produced plants having taller shoots than their corresponding control. In the first season, the largest dose "80Gy" was the most effective one as it increase plant height by 24.77% in case of normal unstressed control set. While in 2000, 4000 and 6000 ppm sets, the "80Gy" dose increased shoot height by 29.3%, 14.56% and 25.51%, respectively as compared by its corresponding control at fruiting stage.

So gamma radiation can alleviate the harmful effect of soil salinity and this was obvious in shoot height, if compared by normal control. The decrease in shoot height was 4.4 %, 7.5 % and 11.5 % for the same above mentioned salinity treatments at fruit stage in the first season.

The interaction of soil salinity treatment, and radiation dose "80Gy" was the best in this concern, where it produces the tallest plants during the two seasons. Rejili (2008), study the effect of salinity and gamma radiation (350Gy) interaction on two populations of *Medicago sativa*. It was found that the two irradiated populations are fairly tolerant to salt at growth phase compared to the un-irradiated. Exposure to gamma radiation (350Gy), alone or in combination with salt stress, increased significantly shoot number, stem height and chlorophyll b pigment for the gannouch population, while no change occurred for the mareth population. Same finding were obtained by Irfaq and Nawab (2001) on wheat; Youssef and Moussa (1998) and Nassar *et al* .(2004) on chamomile seeds; Baek *et al*. (2005) on rice (*Oryza sativa* L) plants; and Wi *et al*. (2006) on morphological changes and biological response of plants as affected by gamma rays.

b. Number of leaves/plant

Table 3. Effect of γ-ray doses, soil salinity treatments and their interaction on number of leaves/ plant of *Ambrosia maritima* L during 2007/2008 and 2008/2009 seasons.

Season	2007/2008					2008/2009				
γ-ray(Gy) Salinity(ppm)	0	20	40	80	Mean A	0	20	40	80	Mean A
	Vegetative stage									
0	15.83	23.67	25.34	19.67	21.12	20.38	20.92	21.83	23.13	21.56
2000	10.20	19.50	21.17	26.50	19.34	17.00	22.25	21.75	15.25	19.06
4000	10.34	17.00	17.33	17.59	15.56	26.38	24.88	23.17	25.04	24.86
6000	10.67	12.67	21.34	28.33	18.25	24.67	23.96	19.58	24.33	23.14
Mean B	11.76	18.21	21.29	23.02		22.10	23.00	21.58	21.94	
LSD 5%	**A=2.73**	**B=2.18**	**AB=4.361**			**A=3.23**	**B=N.S**	**AB=N.S**		
	Flowering stage									
0	38.00	47.84	55.25	42.00	45.77	43.34	41.75	36.67	39.67	40.35
2000	36.67	38.33	28.17	48.67	37.96	42.50	50.59	45.81	33.75	43.16
4000	33.34	34.76	48.09	41.33	39.38	56.17	63.59	49.17	51.83	55.19
6000	31.50	36.67	70.67	47.50	46.58	44.17	45.83	42.33	57.75	47.52
Mean B	34.88	39.40	50.54	44.88		46.54	50.44	43.49	45.75	
LSD 5%	**A=N.S**	**B=N.S**	**AB=16.79**			**A=8.26**	**B= N.S**	**AB=N.S**		
	Fruiting stage									
0	48.00	48.83	59.00	69.88	56.43	46.17	61.59	44.33	59.67	52.94
2000	37.67	39.84	58.00	58.33	48.46	62.33	60.00	70.00	76.25	67.15
4000	35.34	39.50	54.00	61.00	47.46	51.33	74.56	64.22	73.33	65.86
6000	32.17	50.00	53.17	49.67	46.25	50.50	58.83	42.75	51.33	50.85
Mean B	38.29	44.54	56.04	59.72		52.58	63.74	55.33	65.15	
LSD 5%	**A=N.S**	**B=4.98**	**AB=N.S**			**A=3.17**	**B=3.44**	**AB=6.88**		

A=Salinity B= Irradiation AB= Interaction

It is evident form data in Table (3). That, number of leaves / plant decreased with increasing salinity levels. The harmfull effect was observed for all treatments at high levels of salinity. Untreated plants gave the highest number of leaves/ plant which recorded 15.83, 38.0, 48.0 leaves / plant in the 1^{st}, 2^{nd} and 3^{rd} stages of the first season, respectively.

While salinity treatments (2000 ppm) gave 10.19, 36.7 and 37.67 leaves/plant for the same above mentioned stage of growth. The same trends were found at 4000 or 6000 ppm, either in first and second season. These results are in accordance with those of Valia *et al*. (1993) on *Moringa oleifera*, Tiwari *et al*.(1994) on *Emblica officinalis* plants grown in pots, El-Makawy (1999) and El-Mogy (1999) on *Ambrosia maritime*,L plants.

There is dissimilarity between the used radiation doses in concern to number of leaves during the two seasons. In the first one, the dose 40 and 80 Gy mostly gave the highest number of leaves. While in the second season 20, 40 or 80 Gy had the highest number.

Generally gamma radiation enhanced plant growth and in teturn, number of leaves since all used doses gave number of leaves higher than it their corresponding control and than normal control. Many investigators mentioned that, gamma radiation had stimulatory effect on plant height and number of leaves, Hussien (1996) concluded that soybean plants of 90 days old carried the highest number of leaves when they grew from seeds irradiated with 200 Gy. Hussein *et al*. (1995) on *Datura metal* L., El-Sharnouby *et al*. (1997) on *Hibiscus sabdarifa* and Nassar *et al*. (2004) on chamomile seeds.

C. Number of branches /plant

. As shown in Table (4) the data obtained shows that there was no significant difference between several levels of salinity on number of branches/plant during the first season while in the second season the control treatment scored the highest number of branches per plant.

In the Floral stage there was no significant difference between salinity levels during the two successive seasons. Also in the same way there was no significant difference between salinity levels during the two successive in the fruiting stage.

Concerning gamma ray treatments there was no significant difference between salinity levels in the three studied stages during the two successive seasons.

In the same concern there were the same trends in the combination between salinity and gamma ray treatments. Concerning the non-significant results between salinity levels and gamma rays, the same results were obtained by El-Mogy (1999) and El-Sanafawy (2000) on *Ambrosia maritima* L plants. Colom and Vazzana (2002) also mentioned that number of stem per plant was negatively related to water stress in *Eragrotis curvvla*.

d. Fresh and dry weight

Concerning, fresh and dry weights of non-irradiated stressed damsisa plants grown under different salinity levels in soil Tables (5,6). It was found that fresh and dry weights decreased, during the three stages of growth as compared to non-irradiated (control) which grown in control soil through both seasons. Similar effects were obtained on Chamomila rectutita with Nassar *et al*.(2004) and Abdul Qados (2009).

Table 4. Effect of γ-ray doses, soil salinity treatment and their interaction on number of branches / plant of *Ambrosia maritima* L shoots during 2007/2008 and 2008/2009 seasons.

Season	2007/2008					2008/2009				
γ-ray (Gy) / Salinity (ppm)	0	20	40	80	Mean A	0	20	40	80	Mean A
						Vegetative stage				
0	1.17	1.50	1.33	1.25	1.31	1.92	1.92	1.92	1.25	1.75
2000	1.42	1.25	1.17	1.33	1.29	1.33	1.33	1.33	1.17	1.29
4000	1.00	1.25	1.17	1.33	1.19	1.17	1.17	1.42	1.25	1.25
6000	1.17	1.25	1.42	1.25	1.27	1.67	1.50	1.17	1.34	1.42
Mean B	1.19	1.31	1.27	1.29		1.52	1.48	1.46	1.25	
LSD 5%		**A=N.S**	**B=N.S**	**AB=N.S**			**A=0.296**	**B=N.S**	**AB=N.S**	
						Flowering stage				
0	1.42	1.58	1.50	1.42	1.48	1.25	1.17	1.08	1.08	1.14
2000	1.50	1.58	1.25	1.25	1.40	1.58	1.42	1.34	1.17	1.37
4000	1.50	1.67	1.17	1.34	1.42	1.50	1.42	1.50	1.08	1.37
6000	1.50	1.37	1.59	1.67	1.53	1.33	1.25	1.17	1.08	1.21
Mean B	1.48	1.55	1.38	1.42		1.42	1.31	1.27	1.10	
LSD 5%		**A=N.S**	**B=N.S**	**AB=0.307**			**A=N.S**	**B=0.159**	**AB=N.S**	
						Fruiting stage				
0	1.97	2.76	1.91	3.12	2.44	1.33	1.25		1.25	1.33
2000	2.12	1.95	2.74	2.98	2.45	1.33	1.33	1.50 1.33	1.17	1.29
4000	2.25	2.05	2.27	2.71	2.32	1.33	1.08	1.17	1.17	1.19
6000	2.37	2.22	1.69	2.70	2.24	1.25	1.17	1.42	1.17	1.25
Mean B	2.18	2.24	2.15	2.87		1.31	1.21	1.35	1.19	
LSD 5%		**A=N.S**	**B=0.498**	**AB=N.S**			**A=N.S**	**B=N.S**	**AB=N.S**	

A=Salinity B= Irradiation AB= Interaction

Table 5. Effec of γ-ray doses, soil salinity treatments and their interaction on shoots fresh weight (g) of *Ambrosia maritima* L. during 2007/2008 and 2008/2009 seasons.

Season	2007/2008					2008/2009				
γ-ray (Gy) / Salinity (ppm)	0	20	40	80	Mean A	0	20	40	80	Mean A
	Vegetative stage									
0	5.62	10.12	11.56	8.60	8.97	14.88	16.24	12.08	14.53	14.43
2000	4.84	9.32	7.72	6.07	6.99	12.84	11.69	10.27	11.04	11.46
4000	4.74	7.86	7.64	6.86	6.78	9.48	12.58	10.79	7.84	10.17
6000	4.70	8.86	10.10	10.98	8.66	10.20	12.41	11.28	12.73	11.65
Mean B	4.98	9.04	9.26	8.13		11.85	13.23	11.10	11.54	
LSD 5%	A=0.908	B=1.23	AB=N.S			A=2.01	B=N.S	AB=N.S		
	Flowering stage									
0	17.25	17.76	23.32	19.03	19.34	21.77	19.93	17.00	24.03	20.68
2000	13.47	13.87	14.25	16.43	14.51	28.57	38.85	23.95	20.63	28.00
4000	17.54	16.23	17.25	12.78	15.95	17.99	15.39	15.12	12.09	15.14
6000	12.64	14.39	20.89	20.59	17.13	19.50	23.10	31.59	12.77	21.74
Mean B	15.23	15.56	18.93	17.21		21.95	24.32	21.91	17.38	
LSD 5%	A=N.S	B=N.S	AB=N.S			A=N.S	B=N.S	AB=N.S		
	Fruiting stage									
0	23.70	34.26	35.24	38.28	32.87	28.82	28.57	27.65	39.04	31.02
2000	13.02	19.86	40.98	41.22	28.77	26.84	33.48	21.54	25.88	26.94
4000	16.43	24.72	28.72	35.46	26.33	25.62	38.43	21.02	18.60	25.92
6000	16.24	21.00	33.20	33.52	25.99	27.03	37.32	21.52	23.27	27.28
Mean B	17.35	24.96	34.54	37.12		27.08	34.45	22.93	26.70	
LSD 5%	A=N.S	B=6.87	AB=N.S			A=3.13	B=6.17	AB=N.S		

A=Salinity B= Irradiation AB= Interaction

Table 6. Effect of γ-ray doses, soil salinity treatments and their interaction on shoots dry weight (g) of *Ambrosia maritima* L during 2007/2008 and 2008/2009 seasons.

Season	2007/2008					2008/2009				
γ-ray (Gy) / Salinity (ppm)	0	20	40	80	Mean A	0	20	40	80	Mean A
					Vegetative stage					
0	2.07	3.60	4.30	2.96	3.23	7.08	7.57	5.54	5.28	6.37
2000	1.82	3.50	2.63	2.20	2.54	5.00	4.44	3.64	3.91	4.25
4000	1.93	2.72	2.68	2.61	2.49	3.33	3.98	3.92	3.40	3.66
6000	2.04	3.08	2.74	3.85	2.93	4.29	4.36	4.72	4.83	4.55
Mean B	1.97	3.22	3.09	2.91		4.92	5.09	4.45	4.36	
LSD 5%	**A=0.35**	**B=0.34**	**AB=0.677**			**A=1.84**	**B=N.S**	**AB=N.S**		
					Flowering stage					
0	4.26	4.35	8.75	9.88	6.81	7.63	6.91	5.88	8.65	7.27
2000	2.67	3.50	3.54	5.19	3.73	9.54	12.55	8.84	7.00	9.48
4000	4.67	5.45	5.36	3.37	4.71	6.83	6.45	5.85	5.35	6.12
6000	3.27	4.73	6.67	6.59	5.31	7.27	12.27	11.54	4.89	8.99
Mean B	3.72	4.51	6.08	6.26		7.82	9.54	8.03	6.47	
LSD 5%	**A=1.99**	**B=1.68**	**AB=3.37**			**A=N.S**	**B=N.SA**	**AB=N.S**		
					Fruiting stage					
0	10.35	17.28	17.38	17.66	15.67	13.02	13.55	13.69	21.58	15.46
2000	5.66	7.56	18.70	18.79	12.68	11.89	13.07	9.80	12.63	11.85
4000	7.96	10.76	12.48	17.74	12.24	9.54	17.73	10.36	11.97	12.40
6000	7.46	9.62	16.68	16.82	12.65	12.40	15.17	9.45	8.29	11.33
Mean B	7.86	11.31	16.31	17.75		11.71	14.88	10.83	13.62	
LSD 5%	**A=1.87**	**B=2.41**	**AB=4.82**			**A=2.32**	**B=2.94**	**AB=5.87**		

A=Salinity B= Irradiation A*B= Interaction

Increasing salt concentration caused a significant reduction in the fresh and dry masses of both shoots and roots as well as seed yield of *Ammolei mayus* was mentioned by Ashraf and Harris (2004) and Abdul Qados (2009).More over, Colom and Vazzana (2002) showed that plant dry weight was negatively related to water stress in *Eragrotis curvvla*. Also, the reduction in dry weight under salinity stress was observed by Munns (2002).

In this respect, the author attributed the reduction in weight to inhibition of the biosynthesis foods and their translocation to the growing shoots. Howerver, (Kinebery 1994 and Rawya 2001) mentioned that, the decrease in fresh weight might be due to the high level of salinity which increased osmotic pressure and caused a drop in plant water content and inhibition of both meristamatic activity and elongation of cells .

Also, decreasing fresh and dry weight of herb with increasing salinity levels may be due to the decrease in the growth resulting from the inhibition of photosynthesis that reduced carbohydrates storage.

Moreover, the results obtained showed that gamma radiation caused an increase in fresh and dry weights of plants. The most effective dose was 40 Gy dose at first stage of growth (vegetative stage) at the first season.

While plants produced from irradiated seeds (20, 40 or 80 Gy dose) under different levels of salinity, produced plants heaviest in weights (fresh and dry weight) than its corresponding control or control growing under non-salinized soil condition.

Also, 40 or 80 Gy produced plants heaviest in weight (fresh or dry weight) at flowering or fruiting stage during both seasons. Similar results were obtained Kawther *et al*. (1996), El-Mogy(1999) and Nassar *et* *al*.(2004). The low dose of gamma irradiation could alleviate the oxidative damages triggered by the salt stress, by increasing the antioxidant enzyme activities by Baek (2005).

As for gamma irradiation, the results indicated that the low doses (20, 30 and 40 Gy dose) stimulated the plant growth parameters, i.e. height, number of leaves, fresh and dry weight of plants.

The aforementioned changes in growth parameters of green bean plants raised from the seeds irradiated with various low dosages of gamma rays prior to sowing during different stages of plant development might be ascribed to the concomitant induced changes in the endogenous phytohormones of the developed plants like IAA, GA3 which could be induced by the low levels of gamma irradiation, Soliman and Abd El-Hamid.(2003).

Concerning the effect of salinity on plant growth, many workers suggested that the reduction in plant growth and yield due to salinity could be attributed to the effect of salinity on many metabolic processes including inhibition of protein and nucleic acid synthesis Mittlal and Dubey(1991), Singh and Dubey(1995); Reggiani(1994), decreasing transpiration, stomatal conductance and photosynthesis Ashraf and Oleary(1996), restricting the absorption of water by plant roots and water use efficiency; Mansour (1994), the toxic effect of certain ions present in soil, Salinity was also shown to reduce photosynthetic rate, transpiration rate and stomatal conductance in different plant species. Khathar and Kuhad, 2000.Arshi and Abdin, (2002) reported that photosynthetic and total Chl contents increased at low salinity levels and decreased at high salinity levels. Parida *et al*. (2004) suggested that NaCl has a limiting effect on photochemistry that ultimately affects photosynthesis by inhibiting chlorophyll synthesis.

2. Effect of salinity and gamma rays on chemical composition

a. Photosynthetic plant pigments concentration

It is clear from the dats in Tables (7,8, and9) that salinity treatments induced significant increases in Chl a, Chl b, and consequently of the total Chl as well as carotenoid concentrations in leaves of damsisa plants at different stages of growth during the two seasons of experiment.

In accordance with these results Reddy *et al*. (1992), Singh and Dubey (1995) found that chlorophyll content increase in salt tolerant *Salicornia brachiata* and in salt tolerant *Oryza sativa* plants respectively. The increase in photosynthetic pigments could be ascribed to the increase in their biosynthesis and or to the decrease in their degradation. In this respect, Reddy *et al*. (1997) reported that chlorophyll content of *chlorella* grown in saline medium increased with salinity, the increase was more in Chl (b) than Chl (a). Al-Sobhi *et al*. (2006) postulated that the increase in synthesis of Chl (b) under salinity is postulated to the cellular adaptation, to meet increasing demand of energy for NaCl toxicity on *Calotropis procera* seedling.

Also, the photosynthetic pigments were increased in damsisa plants arise from irradiated seeds at different stages during two seasons of growth, Table (7) the same results were obtained by Orabi (1998) on cowpea plants.

The author indicates that the doses of 10 and 20 Gy gamma irradiation significantly increased, Chl a, b and (a+b) as well as carotenoid contents of leaves, compared with the un-irradiated control.

Similar results were obtained by Farid *et al* (1999) on sweet marjoram exposed to (10, 20 and 40 Gy) of radiation; Said (2001) who exposing the peppermint to (10, 30 Gy) and Hamideldine and Hussein (2009) on Egyptian clover. It is also clear from Table (9,10 and11) that Chl (a) predominated over colorophyll (b) but the values become closer with increasing salinity which in agreement with other results for some treated plants (Hajar *et al*. ,1993). The ratio of Chl a/b showed mostly a reduction with increasing salinity concentration, especially at flowering and fruiting stage.

It was generally agreed that low doses of gamma rays could stimulate cell division, growth and development in plants. This effect of low dose of gamma-irradiation improves the stress-tolerance in plants subjected to the salt stress. The decrease of the total chlorophyll concentrations at 2000, 4000 and 6000ppm treated groups was significantly alleviated by the gamma-irradiation.

Interestingly, the salt stress-induced decrease in the seedling growth significantly alleviated by the low dose of gamma irradiation. Gamma rays have been reported to affect differentially the morphology, anatomy, biochemistry, and physiology or plant depending on the irradiation level.

These effects included changes in plant cellular structure and metabolism, e.g. dilution of thylakoid membranes, alteration in photosynthesis, modulation of antioxidant system, and accumulation of phenolic compounds (Kim et al., 2004; Kovacs and Keresztes, 2002, and Wi *et al* 2005). In this respect, the Non-Photochemical Quenching (NPQ), which is one of the protective mechanisms against damages in the

Table 7. Effect of γ-ray doses , soil salinity treatments and their interaction on photosynthetic pigments concentration (mg/g F.W) in leaves of *Ambrosia maritima* L at vegetative stage during 2007/2008 and 2008/2009 seasons.

Plant pigments	Season	2007/2008					2008/2009				
	γ-ray(Gy) / Salinity(ppm)	0	20	40	80	MeanA	0	20	40	80	Mean A
Chlorophyll a	0	4.78	4.66	3.48	3.66	4.14	4.41	4.97	4.85	4.80	4.76
	2000	4.94	4.55	4.39	4.11	4.50	5.22	4.55	5.10	5.38	5.06
	4000	5.34	4.23	4.11	4.33	4.50	4.82	5.34	5.25	5.04	5.11
	6000	4.85	5.02	4.02	5.07	4.74	4.86	5.26	4.90	4.91	4.98
	Mean B	4.98	4.62	4.00	4.29		4.83	5.03	5.02	5.03	
	LSD 5%	A=0.22	B=0.28	AB=0.56			A=N.S	B =N.S	AB=N.S		
Chlorophyll b	0	3.29	1.86	1.31	1.65	2.03	4.32	2.60	4.09	4.44	3.86
	2000	2.26	2.00	2.44	2.27	2.24	3.44	3.94	3.41	4.03	3.71
	4000	3.63	2.38	2.29	2.71	2.75	4.90	4.31	2.31	4.09	3.90
	6000	3.46	4.03	2.01	4.10	3.40	4.29	4.93	3.68	5.13	4.51
	Mean B	3.16	2.57	2.02	2.68		4.23	3.95	3.37	4.42	
	LSD 5%	A= 0.17	B=0.14	AB=0.28			A=0.50	B=0.38	AB=0.76		
Total Chlorophyll	0	8.07	6.52	4.79	5.31	6.17	8.73	7.57	8.94	9.24	8.62
	2000	7.20	6.56	6.83	6.37	6.74	8.65	8.48	8.51	9.41	8.76
	4000	8.96	6.61	6.41	7.04	7.25	9.71	9.65	7.55	9.14	9.01
	6000	8.30	9.05	6.03	9.16	8.14	9.15	10.19	8.58	10.03	9.49
	Mean B	8.13	7.18	6.02	6.97		9.06	8.97	8.39	9.46	
	LSD 5%	A=0.17	B=0.20	AB=0.40			A=0.47	B=0.53	AB=1.07		
Total Carotenoids	0	3.22	2.15	1.69	1.93	2.25	5.09	4.29	4.93	4.76	4.77
	2000	2.54	2.26	2.43	2.42	2.41	4.34	5.28	4.68	5.24	4.89
	4000	3.65	2.51	2.45	2.75	2.84	5.17	5.39	4.47	4.60	4.91
	6000	3.26	3.58	2.27	3.48	3.15	4.75	5.23	4.12	5.58	4.92
	Mean B	3.17	2.63	2.21	2.65		4.84	5.05	4.55	5.05	
	LSD 5%	A=0.09	B=0.07	AB=0.14			A=N.S	B=0.28	AB=0.55		

A=Salinity B= Irradiation AB= Interaction

photosynthetic apparatus by excess light under various stress conditions was increased in the NaCl-treated groups and significantly alleviated by the of gamma-irradiation (Demmig and Adams1996).

Table 8. Effect of γ-ray doses, soil salinity treatments and their interaction on photosynthetic pigments concentration (mg/g F.W) in leaves of *Ambrosia maritima* L at flowering stage during 2007/2008 and 2008/2009 seasons.

Plant pigments	season / γ-ray(Gy) / Salinity(ppm)	Season 2007/2008: 0	20	40	80	Mean A	Season 2008/2009: 0	20	40	80	Mean A
Chlorophyll a	**0**	6.75	6.91	6.89	6.62	6.79	5.10	4.77	5.04	4.40	4.83
	2000	6.88	6.72	6.64	6.90	6.79	5.05	5.06	5.04	5.03	5.04
	4000	6.63	6.75	6.63	6.72	6.68	5.05	4.96	5.08	5.09	5.05
	6000	6.90	6.93	6.71	6.68	6.81	5.09	5.07	5.08	5.05	5.07
	Mean B	6.79	6.83	6.72	6.73		5.07	4.97	5.06	4.89	
	LSD 5%		**A=0.08**	**B=0.08**	**AB=0.16**			**A=0.04**	**B=0.06**	**AB=0.11**	
Chlorophyll b	**0**	4.11	4.40	4.81	4.77	4.52	4.63	3.61	4.07	2.86	3.79
	2000	4.45	5.53	4.53	4.50	4.75	4.65	5.00	4.45	4.59	4.67
	4000	5.73	5.49	4.57	5.19	5.24	4.49	3.60	4.75	4.48	4.33
	6000	4.36	4.19	4.04	5.44	4.51	4.78	4.72	4.69	4.08	4.57
	Mean B	4.66	4.90	4.49	4.97		4.64	4.23	4.49	4.00	
	LSD 5%		**A=N.S**	**B=N.S**	**AB=1.03**			**A=0.19**	**B=0.22**	**AB=0.45**	
Total Chlorophyll	**0**	10.87	11.31	11.71	11.39	11.32	9.74	8.38	9.11	7.26	8.62
	2000	11.33	12.25	11.16	11.41	11.54	9.70	10.06	9.48	9.62	9.71
	4000	12.37	12.24	11.20	11.90	11.93	9.54	8.56	9.83	9.57	9.37
	6000	11.26	11.12	10.75	12.12	11.31	9.87	9.79	9.78	9.12	9.64
	Mean B	11.46	11.73	11.20	11.71		9.71	9.20	9.55	8.89	
	LSD 5%		**A=N.S**	**B=N.S**	**AB=0.91**			**A=0.19**	**B=0.20**	**AB= 0.40**	
Total Carotenoids	**0**	4.15	4.40	4.60	4.43	4.40	4.06	3.45	3.75	2.94	3.55
	2000	4.36	4.75	4.29	4.41	4.45	4.04	4.25	3.92	4.01	4.06
	4000	4.94	4.90	4.43	4.70	4.74	3.96	3.48	4.11	3.98	3.88
	6000	4.39	4.31	4.10	4.83	4.40	4.12	4.09	4.07	3.75	4.01
	Mean B	4.46	4.59	4.36	4.59		4.05	3.82	3.96	3.67	
	LSD 5%		**A=N.S**	**B=N.S**	**AB=0.49**			**A=0.09**	**A*B=0.21**	**AB=0.10**	

A=Salinity B= Irradiation AB= Interaction

It was concluded from the obtained results that gamma-irradiation could alleviate the harmful effects of salt stress and similar to those obtained Baek *et al*. (2005).

It was suggested that the low dose of γ-irradiation could alleviate the oxidative damages triggered by the salt stress as well as, increasing the antioxidant enzymes activities.

Table 9. Effect of γ- ray doses, soil salinity treatments and their interaction on photosynthetic pigments concentration (mg/g F.W) in leaves of *Ambrosia maritima* L at fruiting stage during 2007/2008 and 2008/2009 seasons

Plant pigments	season	2007/2008					2008/ 2009				
	γ-ray(Gy) / Salinity (ppm)	0	20	40	80	Mean A	0	20Gy	40y	80	Mean A
Chlorophyll a	0	5.28	4.09	4.41	5.34	4.78	3.94	3.68	3.07	4.36	3.76
	2000	4.92	4.50	5.27	5.14	4.96	2.38	3.64	2.75	4.48	3.31
	4000	5.33	5.33	4.73	5.33	5.18	3.70	3.49	4.40	3.81	3.85
	6000	5.30	5.35	4.85	5.28	5.19	3.86	3.90	3.46	2.79	3.50
	Mean B	5.21	4.82	4.82	5.27		3.47	3.68	3.42	3.86	
	LSD 5%	A=0.08		B=0.08		AB=0.15	A=0.13		B=0.09		AB=0.18
Chlorophyll b	0	2.38	2.67	3.60	3.59	3.06	2.38	2.11	1.58	2.86	2.24
	2000	3.61	3.61	4.71	4.12	4.01	0.95	2.09	1.18	3.01	1.81
	4000	2.81	3.94	3.44	3.23	3.35	2.23	1.94	2.84	2.21	2.30
	6000	3.27	3.54	4.27	4.79	3.97	2.29	2.51	1.85	1.35	2.00
	Mean B	3.02	3.44	4.00	3.93		1.96	2.16	1.86	2.36	
	LSD 5%	A=0.27		B=0.21		AB=0.42	A=0.09		B=0.10		AB=0.19
Total Chlorophyll	0	7.67	6.75	8.01	8.93	7.84	6.32	5.79	4.65	7.23	6.00
	2000	8.53	8.11	9.98	9.27	8.97	3.33	5.72	3.93	7.49	5.12
	4000	8.14	9.27	8.17	8.56	8.53	5.93	5.43	7.24	6.02	6.16
	6000	8.57	8.88	9.12	10.07	9.16	6.15	6.41	5.32	4.14	5.50
	Mean B	8.23	8.25	8.82	9.21		5.43	5.84	5.28	6.22	
	LSD 5%	A=0.30		B=0.19		AB=0.38	A=0.22		B=0.16		AB=0.32
Tota Caroten	0	2.97	2.69	3.32	3.65	3.16	2.61	2.33	1.89	2.91	2.44
	2000	3.07	3.33	4.19	3.66	3.56	1.32	2.28	1.54	3.03	2.04
	4000	3.25	3.82	3.35	3.46	3.47	2.37	2.11	2.84	2.36	2.42
	6000	3.49	3.63	3.80	4.23	3.79	2.50	2.65	2.14	1.70	2.25
	Mean B	3.20	3.37	3.66	3.75		2.20	2.34	2.10	2.50	
	LSD 5%	A=0.12		B=0.10		AB=0.20	A=0.10		B=0.06		AB=0.13

A=Salinity B= Irradiation AB= Interaction

Other authors reported that chloroplasts were extremely sensitive to gamma irradiation compared to other cell organelles; low doses induced changes in thylakoid, and chlorophyll content, whereas higher doses inhibited chloroplast development and caused changes in synthesis of nucleic acid in plastids (Wi *et al* . 2006).

Zabalza *et al*.(2006) attributed the stimulating effect of irradiation on chlorophyll to stabilizing the enzyme active site and photosynthetic reactions. There is a cycle of interconnversion between Chl a and b that is particularly significant under stress (Matile *et al*. 1999). In this context, Jaleel *et al*.(2007) found that stress enhances the activity of chlorophyllase and interferase with the de-nouo synthesis of protein, such as those that bind chlorophyll. The noticed increase incarotenoids due to stress conditions caused by either salinity and /or gamma rays was expected. Foyer and Harbinson (1994) reported that, carotenoids are involved protein of the photosynthetic apparatus against photo-inhibitory damage by singlet oxygen (O_2-) that is produced by the excited triplet state of chlorophyll.

b. Total sugars concentration

Regarding the effect of salinity, the results in Table (10) revealed that increasing salinity level by increase salt soil addition, generally increased the concentration of the total sugar significantly at the three stages of growth during the two seasons of experiment.

The highest concentrations of sugar were mostly achieved at 6000ppm in different stages of growth during the two successive seasons of experiment when compared with those of unstressed control.

Also, the total sugar concentrations increased significantly in case of plants produced from seeds exposed to gamma rays (40 or 80 Gy) as compared by those of un-irradiated control in 2008 seasons but insignificant changes were found in 2007season.

Generally, plant samples produced from seeds treated by gamma radiation and planted in different levels of salty soils, produced plants having higher concentrations of total sugar concentration than their corresponding control or higher than unstressed and nonirradiated control.

At 2008 season, there were significant changes in total sugar concentration for both salinity and radiation treatments. The highest content was at 6000ppm for 40 or 80 Gy in the three stages of growth. For salinity treatment, the means of sugar concentration at 6000ppm were increased by 22.93% , 30.48% , 33,38% at the first ,second and third stages of growth, as increased by 8.85% , 5.64% and 4.51% for radiation treatment "80Gy" for the same aforementioned stages of growth in 2008 season, respectively.

The results showed that total sugar concentration increased by increasing radiation dose or salinity treatments. It was observed that total sugar concentration was increase with increasing salinity levels(6000) at radiation dose (80Gy). In the first season (2007/2008), there are insignificant changes in sugar concentration, for salinity treatments and significant change for radiation treatment.

In this respet, Nieman, *et al.* (1988) reported that, salt stress increased the sugars concentration by over3- fold. These increases were accompanied by a reduction in UDPG, UTP and ATP pools in the growing leaves. The authors suggested that, sugar which was taken up by the cells would have limited conversion to cell material because of the reduced pools of ATP, UTP and UDPG. These reductions in ATP pools were caused by increasing ATP expenditure for solute pumping.

Table 10. Effect of γ-ray doses, soil salinity treatments and their interaction on total sugars concentration (mg/g F.W) in shoots of *Ambrosia maritima* L. during 2007/2008 and 2008/2009 seasons.

Season	2007/2008					2008/2009				
γ-rays (Gy)	0	20	40	80	Mean A	0	20	40	80	Mean A
Salinity (ppm)	**Vegetative stage**									
0	25.64	25.01	25.42	25.65	25.43	17.21	22.76	22.92	21.71	21.15
2000	25.64	25.50	25.89	25.72	25.69	22.85	23.76	24.62	25.32	24.14
4000	25.66	25.39	25.28	25.68	25.50	25.63	25.18	25.50	26.04	25.59
6000	25.48	25.54	25.48	25.54	25.51	25.63	25.61	26.42	26.33	26.00
Mean B	25.60	25.36	25.52	25.65		22.83	24.33	24.87	24.85	
LSD 5%	**A=N.S**	**B=0.212**		**AB= N.S**		**A=0.627**	**B=0.644**		**AB=1.288**	
	Flowering stage									
0	23.15	23.37	24.77	26.06	24.34	22.64	22.49	22.72	25.72	23.39
2000	26.87	27.01	27.96	29.31	27.79	25.23	27.19	27.80	26.90	26.78
4000	28.97	27.75	27.44	28.52	28.17	27.15	27.55	28.06	27.08	27.46
6000	27.96	27.56	28.06	28.31	27.97	30.00	30.25	30.57	31.27	30.52
Mean B	26.73	26.42	27.06	28.05		26.25	26.87	27.29	27.74	
LSD 5%	**A=0.944**	**B=N.S**		**AB= N.S**		**A=0.926**	**B= 0.605**		**AB=1.211**	
	Fruiting stage									
0	28.47	28.08	28.68	28.60	28.46	25.91	24.81	25.49	27.18	25.85
2000	28.89	29.19	29.15	29.74	29.24	26.39	28.63	28.50	28.14	27.91
4000	29.46	29.56	29.91	29.55	29.62	30.04	30.86	30.28	31.24	30.61
6000	29.92	29.94	29.95	29.57	29.84	33.86	34.40	34.78	34.87	34.47
Mean B	29.18	29.19	29.42	29.36		29.05	29.68	29.76	30.36	
LSD 5%	**A=0.694**	**B= N.S**		**A*B=N.S**		**A=0.954**	**B= N.S**		**AB= N.S**	

A=Salinity B= Irradiation AB= Interaction

In general, the increment in soluble components among which total sugars due to saline conditions might in turn play an important role in increasing the osmotic pressure of the cytoplasm.

Nesiem and Ghallab (1998) reported that the increase in soluble sugars may indicate that starch and polysaccharides (non– active osmolytes) are converted to simple sugars which enable the plants to keep better water relations under salinity. On the other hand, the greater accumulation of sugars in leaves of stressed plant may be related to its reduced growth as a result of NaCl which inhibit carbohydrate translocation or may be related to the greater energetical cost of osmotic adjustment with sugars apposed to Na^+ or Cl^- ions.

Aldesuquy *et al.* (1998) stated that, reducing sugar in tobacco tissues increased by increasing salinity levels. It is suggested that reducing sugar and other solutes contributed more to the solute potential and therefore maintained positive turgor leading to tolerance.

Plants could alleviate the salt stress by increasing sugar concentration that elevated the concentration of cell sap and accordingly alleviated the harmful effects of soil salinity by increasing plant ability to absorb water. Similar results were obtained on the *Majorana hortensis* L. (Farid *et al.* 1999) on peppermint and (Said, 2001).

Hartzendorf and Rollestschek (2001) studied the effects of NaCl-salinity on sugar content in leaves of *Phragmites australis*.The sugar contents were highest in leaves at 1.5% salinity. The sugar content did not vary significantly except for leaves.

Results obtained by Ali (1991) on datura plant were in harmony with our results, where total carbohydrates increased significantly with the rise of salinization level.

The same results were also obtained by Zidan and Al Zahrani (1994). Opposite findings were obtained by Kotb and EL-Gamal, (1994) on *Nigella sativa,* Rashad (1995), Ali (1996) on Egypt henbane, Fiad (1997) on *Nigella sativa* plant and El-Makawy (1999) on *Ambrosia maritima* and El-Mogy (1999) who concluded that total carbohydrate content increased under low soil salinity and decreased with increasing the concentration of soil salinity.

Nassar *et al*. (2004) found that in *Chamomilla recutita* the pre-sowing irradiation caused gradual increase in total carbohydrates and total soluble sugars, with increasing the dose of gamma radiation from 0.0 to 10 Kr. Same finding was obtained by Parida *et al*. (2003) on *Aegiceras corniculatum.*

Al-Sobhi *et al*. (2006) reported that the total soluble and insoluble carbohydrates content in the shoot and root tended to increase with increasing salinity stress in the culture solution and also with plant age which considered playing an important role in the osmotic adjustment of *Calotropis procera* seedlings.

Work by Chen *et al*. (2006) showed that, in the presence of NaCl, the production of total carbohydrates decreased whereas cellular reducing sugars, water soluble sugars and sucrose content and sps activity increased in *Microcoleus vaginatus* reaching a maximum in the presence of 200 mM/l NaCl. One of the biochemical mechanisms by which plants counteract the high osmolarity of salt was accumulation of compatible solutes, as proline and carbohydrates, which offered protection to photosynthetic machinery. Results obtained by (Takemura *et al*. 2000) are in coincidence with our results. Also, the mechanism of acclimation to salt in mangroves was suggested to be linked to the changes in the vacuolar size in *exanjula* (Hotta *et al*. 2000).

Many plants, which are stressed by NaCl salinity, accumulate starch and soluble carbohydrates (Greenway and Munns, 1980 and Rathert, 1984). This accumulation has been attributed to impaired carbohydrate utilization (Munns and Termaat, 1986).

c. Active ingredient percentage (damsin and ambrosin).

Some active ingredients of *Ambrosia maritima* shoots during flowering stage are shown in Table (11). It was observed that gamma radiation increase ambrosin content in damsisa shoots that produced from seeds treated by 20, 40 or 80 Gy of gamma rays.

Table 11. Effect of γ ray doses, soil salinity treatments and their interaction on active ingredients percentage in *Ambrosia maritima* L. shoots at flowering stage during 2008/2009 season.

Active Ingredients	Ambrosin					Damsin				
γ-ray (Gy)	0	20	40	80	Mean A	0	20	40	80	Mean A
Salinity(ppm)										
0	0.41	0.39	0.41	0.67	0.47	2.17	1.43	1.07	0.97	1.41
2000	0.45	0.56	0.41	0.43	0.46	1.43	0.81	1.5	0.97	1.18
4000	0.67	0.65	0.52	0.53	0.59	0.89	0.89	1.67	0.90	1.09
6000	0.52	0.49	0.43	0.59	0.51	0.81	0.9	0.97	0.90	0.90
Mean B	0.51	0.52	0.44	0.56		1.32	1.01	1.30	0.94	
LSD5%	A=NS		B=NS	AB=NS		A=0.33		B=0.26	AB=0.52	

A=Salinity B= Irradiation AB= Interaction

It was noticed that the highest dose "80Gy" increase ambrosin by 63.4% as compared by normal control. Meanwhile, all treatments used at different sets of salinity either irradiated or un-irradiated (control for salinity) mostly produced shoots having high ambrosin content than the control set. The opposite is true in concern to damsin content, except for 40 Gy dose.

The results declare that shoots produced from seeds treated by 40 Gy have high damsin than its corresponding control in salinity sets. It was found that ambrosin percentage increase by 9.8%, 63.4% and 26.8% above its corresponding control at 2000, 4000 and 6000 ppm soil concentration.

Hussien and Abd El-Nabi (1996) studied the effect of slaine solution irrigation of 2560 ppm along with control 300 ppm on damsisa volatile oil. They found that damsisa volatile oil percentage increased by salinity level increasing most components of volatile oil especially cineol that significantly increased.

El-Sanafawy (2000) studied the effect of different levels of sodium chloride, calcium chloride (1500, 3000 and 4500 ppm) and their mixture in the irrigation water on the amount of essential oil percentage of *Ambrosia maritima*, L. plants. It was observed that oil yield per plant were decreased with increasing the level of salinity in the irrigation water during the two seasons as compared with control.

Sangwan *et al*. (2001) stated that the production of essential oil not only depends upon the metabolic state of the source tissues, but also may be integrated with the stress factors. Razmjoo (2008) indicated that increased salinity significantly reduced essential oil content of chamomile.

Same findings were obtained by Khater *et al*. (2002) on damsisa plants irrigated with different saline water levels. The opposite is true in percentage to damsin content, except for 40 Gy dose. The results declare that shoots produced from seeds treated by 40 Gy contain more damsin percentage than its corresponding control in different salinity sets.

Ashraf and Harris (2004) also showed that oil content in the seed of medicinal plant, bishops weed (*Ammolei majus*), was decreased consistently with increase in external salt levels. Meanwhile, Agastain *et al*. (2000) noticed that all major processes such as photosynthesis, protein synthesis and energy and lipid metabolism are affected, during the onset and development of salt stress within the plant.Same results were obtained by Baher *et al*. (2002), on basil and Hendawy and Khalid (2005) on *Salivia officinalis* Khalid (2006) on *Ocimum americanum* .

d. Minerals content percentage

Plant growth and the accumulation of Na^+, K^+, Ca^{2+} and Mg^{2+} were considered to be the most important factors related to the specific effects of ions under salt stress, mineral investgated in *Ambrosia maritima* L shoots are shown in Table (12). Salinity stress disturbs the uptake and accumulation of essential nutrients. Generally Na^+ concentration increased with the increase in salinity levels on *Ambrosia maritima* L. Na^+ concentration increased to 3230 mg/kg in plant having 2000 ppm 2550 mg/kg for 4000 ppm and 3740 mg/kg at 6000ppm soil concentrations. In contrast, the control Na^+ concentration was 2380 mg/kg in vegetative stage, Table (12). Similar results have been found in many studies as on wheat (Begum *et al*. 1992), Ashraf and Rauf (2001) on maize and Hussain *et al*. (2009b) in Black seeds. Also,untreated plants gave 0.34% while the values of K^+% in plants arised in salty soil were 1.02%, 0.79% and 1.07%, for stressed control in 2000, 4000 and 6000ppm, respectively. K^+% was higher in plants produced from seeds treaded by 40 Gy and sown in soil having different salinity levels or normal soil as compared by its corresponding control. These results are in agreement with Izzo *et al* (1996). It was observed that Na^+ and K^+ decreased at high salt concentration (6000ppm) at fruiting stage, as compared by its corresponding control or normal control.

Also, Moghaieb *et al*. (2004) found that the accumulation of K^+ was prompted by moderate concentration of NaCl but decrease at higher salt concentration in *S.europaea* and *S.maritimes* plants. Similar findings were obtained by Hanafy (1989) on sweet majoram, Ramadan (1996) on guar, who showed that K^+% in plant leaves decreased with increasing soil salinity.

It was evident from data in the first and second stages of growth, that Ca^+% enclose more or less about 1% as effected by salinity stress in control set and in 2000 or 4000ppm sets. While at 6000ppm, the stressed control had 1.28% in vegetative stage. Concerning the Ca^{2+} % in the fruiting stage the stressed control was1.4% and decreased to 1.24%, 1.12% and 0.925 under the effect of 2000, 4000 and 6000ppm soil salinity.

The reduction in Ca^{2+} was observed and reported by El-Tarawy (1976) on *Matthiola incana*, El–Mahrouk (1980) on *Dimorptheca ecklanis* and *Callistephus chinensis*, Khan (1993). Al-Harbi (1995), Ashraf and Khanum (1997) on wheat and El-Sanafawy (2000) on

Table 12. Effect of γ-ray doses, soil salinity treatments and their interaction on mineral percentage in *Ambrosia maritima* L shoots during 2008/2009 season.

	Stage	Vegetative stage					Flowering stage					Fruiting stage				
	γ-ray(Gy)	0	20	40	80	Mean A	0	20	40	80	MeanA	0	20	40	80	MeanA
	Salinity(ppm)															
Calcium	0	1.04	1.03	1.01	0.83	0.98	0.86	0.87	0.93	0.84	0.88	1.59	1.43	1.01	1.04	1.27
	2000	1.00	1.42	1.19	1.22	1.21	1.07	1.07	0.88	0.95	0.99	1.22	1.34	1.23	1.47	1.32
	4000	0.92	0.95	1.22	1.14	1.06	1.33	0.91	1.24	1.35	1.21	1.28	1.26	1.46	0.87	1.22
	6000	1.64	1.15	0.85	0.87	1.13	1.16	1.13	0.87	0.81	0.99	1.07	1.09	0.97	1.42	1.14
	Mean B	**1.15**	**1.14**	**1.07**	**1.02**		**1.11**	**1.00**	**0.98**	**0.99**		**1.29**	**1.28**	**1.17**	**1.20**	
Potassium	0	0.34	0.95	1.02	0.8	0.78	1.63	0.46	1.62	0.14	0.96	1.19	1.21	0.58	1.04	1.01
	2000	1.02	0.56	1.19	1.07	0.96	1.31	1.34	1.38	0.36	1.10	0.95	1.41	1.24	1.62	1.31
	4000	0.8	1.09	1.45	1.14	1.12	1.35	0.95	1.65	1.16	1.28	1.43	1.28	1.46	1.6	1.44
	6000	1.07	1.19	1.12	1.14	1.13	1.5	1.33	1.19	1.5	1.38	1.11	1.04	0. 77	0.73	0.91
	Mean B	**0.81**	**0.95**	**1.20**	**1.04**		**1.45**	**1.02**	**1.46**	**0.79**		**1.17**	**1.24**	**1.11**	**1.14**	
Sodium	0	0.24	0.26	0.29	0.26	0.26	0.29	0.15	0.31	0.15	0.23	0.34	0.31	0.15	0.22	0.26
	2000	0.32	0.32	0.19	0.36	0.30	0.39	0.34	0.48	0.14	0.34	0.41	0.19	0.54	0.34	0.37
	4000	0.26	0.31	0.41	0.29	0.32	0.31	0.22	0.39	0.32	0.31	0.24	0.17	0.24	0.29	0.24
	6000	0.37	0.49	0.37	0.39	0.41	0.34	0.36	0.32	0.29	0.33	0.22	0.2	0.17	0.10	0.17
	Mean B	**0.30**	**0.35**	**0.32**	**0.33**		**0.33**	**0.27**	**0.38**	**0.23**		**0.30**	**0.22**	**0.28**	**0.23**	
Magnesium	0	0.66	0.62	0.41	0.36	0.52	0.45	0.42	0.46	0.56	0.47	0.65	0.39	0.32	0.31	0.42
	2000	0.36	0.43	0.58	0.48	0.46	0.45	0.45	0.55	0.46	0.48	0.54	0.36	0.35	0.37	0.41
	4000	0.56	0.40	0.43	0.39	0.45	0.46	0.51	0.50	0.51	0.50	0.46	0.35	0.43	0.38	0.41
	6000	0.51	0.45	0.34	0.31	0.40	0.36	0.31	0.30	0.26	0.31	0.45	0.32	0.32	0.39	0.37
	Mean B	**0.52**	**0.48**	**0.44**	**0.39**		**0.43**	**0.42**	**0.45**	**0.45**		**0.53**	**0.36**	**0.36**	**0.36**	

Ocimum basilium and *Ambrosia maritima* who reported that Ca% in plants increased with increasing soil salinity levels.

Concerning Mg^{2+} % in shoots of *Ambrosia maritima* plants decreased with increasing salinity concentration in soils in the three stages of during two seasons growth as compared by unstressed and un-irradiated control as shown in table (12).

Concerning to the effect of gamma radiation, It was observed, that at the first stage of growth all radiation dose decreased Mg^{2+} % content comparing with normal control (unstressed & non-irradiated). But, the opposite takes place at 2000ppm set; all plants produced from 20, 40 or 80 Gy doses had higher Mg^{2+} % than their corresponding control.

The Mg^{2+} percentage as compared by those in control set were higher in 40 Gy and 20Gy dose at control set. Meanwhile, at 4000 and 6000 ppm Mg^{2+} % decreased in plant treated by radiation dose (20, 40 and 80 Gy) as compared to their corresponding control in vegetative stage.

The reverse was observed at flowering stage, where Mg^{2+}% in 4000ppm set increased, while at fruiting stage Mg^{2+}% in shoots produced from 40 Gy dose at 4000ppm set, only and 80 Gy at 6000ppm salinity set had highest Mg^{2+}% as compared by its corresponding control.

The results are in accordance with those of El-Tarawy (1976) on *Matthiola incana*, and El–Mahrouk (1980) on *Dimorptheca ecklanis* and *Callistephus chinensis* and El-Sanafawy (2000) on *Ocimum basilium* and *Ambrosia maritima*, who stated that Mg^{2+}% in the leaves decreased with increasing soil salinity levels. Also, similar results were obtained by Youssif *et al*. (2010) on *Tetragonia tetragonioides*.ntage in shoots with different doses of radiation comparing with stressed control.

Gartten and Grive (1992) reported that salinity disrupted minerals, nutrient acquisition by plants in two ways, first, the ionic strength of the substrate, regardless of its composition which influenced nutrient uptake and translocation. Evidence for this was that salinity induced phosphate uptake in certain plants and cultivars. The second and more common was mechanism by which salinity disrupts the mineral relation of plants is by reduction of nutrients availability by competition with major ions i.e (Na^+ and Cl^-) in the substrate. These interactions often led to sodium induced Ca^{++} and/ or K^+ deficiencies and Ca^{++} induced Mg^{++} deficiencies.

The hormetic effects of low- dose ionizing radiation on plants and photosynthetic microorganisms are manifested as accelerated cell proliferation (Taguchi *et al*. 1994; Okamoto and Tatara. 1995; Chakravarty and Sen, 2001), stimulated germination and growth (Lee and Liu 1999; Kim *et al*. 2000 and 2002), improved stress-resistance (Zaka *et al*. 2004; Lee *et al*. 2002, 2003), and/or increased yield (Stan and Croitoru, 1970). In many cases, such effects could be characterized as the modulation of photosynthesis and antioxidant machineries.

The effect of gamma rays on increasing K^+, Ca^{2+} and Mg^{2+} ions as shown in the present investigation led to an increase of osmotolerance and/or regulate physiological various processes including absorption of nutrients. The antagonistic relations between Na^+ and K^+ (Helaly and El-Hosieny 2011) may be taken as an indication of the role of gamma rays on modifying K^+/ Na^+ selectivity under salt stress (Azooz.2004). This promotion effect may be due to its role in improving content which protects the membrane and membrane bound enzymes. The positive effects of gamma irradiation on the nutritional status of the salt stressed plants may be ascribedto overcoming the substitution occurred between Na^+ and K^+ as well as their roles as an osmoregulators and as an activators of several enzyme srequired for normal plant metabolism and endogenous hormones synthesis (ling *et al*. 2008).

e. Total nitrogen percentage

There are fluctuations in nitrogen percentage in damsisa plants in the three stages of growth during two seasons as shown in Table (13). It was clear that 4000 or 6000 ppm soil concentration mostly had the highest percentage of nitrogen as compared by control (normal soil). In the first season, The mean of nitrogen percentage was 3.2% for plants grown at 4000ppm soil concentration compared to unstressed control (2.4%).

While, at the second season 6000 ppm had the highest nitrogen percentage (4.1%) compared to unstressed control (2.85%) i.e. increased by 43.9% above control. Reversely, Badawy *et al*. (1990) showed that, total nitrogen % was reduced in *Majorana hortensis* plants grownunder saline conditions.

Also, significant changes were observed as a result of sowing irradiated seeds in 4000 or 6000 ppm and producing plants having highest protein percentage. Prasad et al. (1997) found that both with

Table 13. Effect of γ-ray doses , soil salinity treatments and their interaction on total nitrogen percentage in of *Ambrosia maritima* L shoots during 2007/2008 and 2008/2009 seasons.

Season	2007/2008					2008/2009				
γ- ray(Gy) / Salinity (ppm)	0	20	40	80	MeanA	0	20	40	80	Mean A
	Vegetative stage									
0	1.73	2.39	2.63	2.78	2.38	2.25	3.25	3.16	2.71	2.84
2000	1.68	3.02	2.91	2.56	2.54	3.31	2.01	1.94	3.51	2.69
4000	1.64	3.98	3.66	3.58	3.22	5.01	2.68	2.98	4.29	3.74
6000	1.41	2.92	2.80	5.78	3.23	3.20	2.73	6.24	4.23	4.10
MeanB	1.61	3.08	3.00	3.68		2.93	2.67	3.58	3.68	
LSD 5%	**A=0.69**	**B=0.74**	**AB=1.49**			**A=0.57**	**B=0.76**	**AB=1.52**		
	Flowering stage									
0	1.99	4.76	3.32	2.62	3.17	3.28	2.37	3.77	3.11	3.13
2000	1.39	4.89	2.97	2.90	3.04	2.53	3.73	4.22	3.01	3.37
4000	1.00	4.06	4.13	2.66	2.96	2.63	3.42	4.14	3.60	3.45
6000	2.58	4.20	5.63	5.06	4.37	3.73	1.83	2.62	3.91	3.02
Mean B	1.74	4.48	4.01	3.31		3.04	2.84	3.69	3.41	
LSD 5%	**A=1.2**	**B=0.81**	**AB=N.S**			**A=NS**	**B=0.48**	**AB=0.96**		
	Fruiting stage									
0	1.94	1.38	5.38	4.35	3.26	3.71	3.68	3.33	2.63	3.34
2000	1.52	4.95	4.28	3.39	3.54	2.80	3.56	4.25	3.22	3.46
4000	3.56	3.00	3.12	3.60	3.32	3.61	4.14	2.24	2.59	3.15
6000	5.08	3.15	2.56	2.31	3.28	3.94	2.73	3.25	2.99	3.23
Mean B	3.02	3.12	3.83	3.41		3.52	3.53	3.27	2.86	
LSD 5%	**A=1.03**	**B=0.91**	**AB=1.81**			**A=NS**	**B=NS**	**AB=1.11**		

A=Salinity B= Irradiation AB= Interaction

NH_4 and NO_3-N increased with increasing salinity up to 5ds/m. In contrast, El Mogy (1999) on *Ambrosia maritima* L plants showed that the moderate and higher treatments of soil salinity (0.2% and 0.4%) tended to decrease the nitrogen percentage and content of *Ambrosia maritima* leaves compared to control. The nitrogen content in shoots was significantly decreased by using levels of 0.2% or 0.4%. Whereas the maximum content of nitrogen was obtained when using soil salinity of 0.1% and N% in the plant leaves decreased with increasing salinity levels.

The same finding was obtained by El-Sanafawy (2000) on *Ambrosia maritima*. Munns (2002) said that salinity has been previously shown to be a major factor responsible of low nitrogen availability. The effect of NaCl salinity in presence or absence of irradiating the seeds of lupine (*Lupinus termis* L.) with gamma rays, on the nitrogen assimilation and ion uptake was investigated by Khodary (2004).

Protein, amino acids, nucleic acids, nitrate, potassium (K) and phosphorus (P) uptake have been determined to achieve this goal. Significant decrease in the contents of protein, amino acids were observed upon NaCl exposure (0, 500, 1000, 2000 and 3000 ppm).

On the other hand, in seeds irradiated with gamma rays (10, 25, 50 and 100 GY) these nitrogenous fractions were increased after NaCl treatments, the effect was more pronounced particularly with 25 Gy.

f. Amino acids concentration

The concentrations of amino acids in *Ambrosia maritima* L plants at flowering stage are shown in Table (14and15) during

2007/2008 and 2008/2009 season, respectively as affected by different levels of salinity and doses of gamma rays. It was observed that the amino acid pool increased by salinity in shoot produced from seeds planted in soil with salt concentration 2000, 4000 or 6000 ppm during the two season 2007, 2008 except 4000ppm level of salinity a 2007 season where it's value was less than control. The obtained results were similar with several reports of increase level of free amino acid pool during salt treatment in different plant species, Rhodes and Hanson (1993), Chandrasekha and Sandhyarani (1996)**,** Franco and Melo (2000), (Muthukumarasamy *et al*. 2000, Wang and Nil 2000 and Xiong and Zhu (2002)

Concerning amino acids content as affected by gamma radiation, it was observed that 20, 40 and 80 Gy dose significantly increased levels of amino acids pool, above normal control (non-irradiated & unstressed control) during the two seasons of experiment.

Also, treating seeds by gamma rays then sowing at different salinity levels mostly accumulate total amino acids pool as compared to their corresponding controls.

The results revealed that glutamic acid (3.22mg/g) was the prominent amino acid followed by arginine (2.68mg/g) and aspartic acid (2.26mg/g) in herb of *Ambrosia maritima* L plants. Similar results were reported by Al-Jassir (1992) on black cumin, Swailam (2009) on sesame, Hussein and Atia (2009) on mushroom observed that amino acids increased above the control values at 10 and 15 Gy dose, and Hussein (2010) on mungbean.

At the first season (2007), it was observed that, in control, 2000 and 4000 ppm, total amino acid increased in plants produced from irradiated seeds by 20, 40 or 80 Gy above its corresponding control and above the normal control (unstressed & non irradiated). Meanwhile, at the second season (2008), in the control and 2000 ppm only significant supremacy were observed above its corresponding control and above normal control. In other word, 6000 ppm at the first season and 4000, 6000 ppm salinity levels decrease total amino acid concentration.

It was mentioned that, these levels of salinity mainly at 6000 ppm inclusive significant decline in proline content, as compared by its corresponding control. It is well known that proline concentration in the leaves of many plants get enhanced by several stresses including salt stress (Lee and Liu, 1999; Hernandez *et al*., 2001) and gamma radiation. Ali (1991) in coincidence with our result obtained, He stated that free amino acids other than proline increased significantly with the rise of salinization level.

Table 14. Effect of γ-ray doses, soil salinity treatments and their interaction on amino acids concentration (mg/g D.W) at flowering stage in *Ambrosia maritima* L .shoots during 2007/2008 season

Salinity (ppm)	Control				2000				4000				6000			
γ ray(Gy) Amino acid	**0**	**20**	**40**	**80**	**0**	**20**	**40**	**80**	**0**	**20**	**40**	**80**	**0**	**20**	**40**	**80**
Aspartic	1.42	1.96	2.36	1.26	1.72	1.06	2.02	1.78	1.18	1.64	1.92	1.94	1.54	1.50	1.82	1.58
Threonine	0.70	1.18	1.30	0.60	0.74	0.48	0.94	0.82	0.50	0.88	0.96	1.04	0.90	0.82	0.94	0.74
Serine	0.86	1.14	1.38	0.70	0.88	0.62	1.14	1.02	0.64	0.98	1.10	1.18	1.06	0.94	1.10	0.90
Glutamic	1.90	2.92	3.36	1.56	1.98	1.24	2.60	2.32	1.44	2.36	2.58	2.68	2.36	2.24	2.50	2.06
Proline	6.60	16.22	20.7	3.12	4.98	1.98	16.0	11.68	1.38	6.92	9.5	11.8	14.9	8.24	9.80	6.5
Glvcine	0.98	1.32	1.30	0.80	1.04	0.64	1.06	0.98	0.84	1.04	1.14	1.16	1.14	0.94	1.06	0.86
Alanine	1.16	1.40	1.86	1.10	1.40	0.94	1.52	1.40	0.88	1.36	1.54	1.66	1.62	1.30	1.52	1.2
Cystine	0.06	0.12	0	0	0	0	0	0	0	0.04	0	0	0	0	0	0
Valine	0.62	0.90	1.16	0.60	0.80	0.48	0.84	0.74	0.52	0.76	0.84	0.96	0.90	0.76	0.84	0.62
Methionine	0.02	0.04	0.22	0	0.06	0	0.02	0.02	0	0.02	0.08	0.18	0.04	0.08	0.02	0.04
Isoleucine	0.38	0.66	0.84	0.34	0.48	0.28	0.54	0.44	0.28	0.46	0.48	0.62	0.58	0.50	0.54	0.38
Leucine	1.12	1.44	1.86	0.90	1.22	0.78	1.34	1.18	0.74	1.26	1.38	1.54	1.50	1.18	1.38	0.98
Tryrosine	0.46	0.68	0.96	0.32	0.52	0.26	0.66	0.50	0.24	0.56	0.68	0.74	0.72	0.48	0.66	0.38
Phenylalani	0.64	0.92	1.20	0.44	0.66	0.36	0.82	0.66	0.38	0.68	0.82	0.86	0.90	0.62	0.82	0.52
Histidine	0.28	0.72	0.86	0.20	0.30	0.16	0.52	0.32	0.12	0.28	0.42	0.40	0.54	0.30	0.40	0.34
Lysin	0.96	1.50	1.58	0.84	1.10	0.70	1.20	1.04	0.72	1.14	1.22	1.30	1.24	1.02	1.20	0.88
Arginine	0.76	3.14	2.90	0.72	1.34	0.60	1.46	1.18	0.52	1.08	1.40	1.28	1.66	1.08	1.30	1.56
Total mg/ g	18.9	36.3	43.8	13.5	19.2	10.6	32.7	26.1	10.4	21.5	26.1	29.3	31.6	22.0	25.9	19.5

Table 15. Effect of γ- ray doses, soil salinity treatments and their interaction on amino acids concentration (mg/g D.W)at flowering stage in *Ambrosia maritima* L .shoots during 2008/2009 season.

Salinity (ppm)	control				2000				4000				6000			
γ ray(Gy) Amino acids	0	20	40	80	0	20	40	80	0	20	40	80	0	20	40	80
Aspartic	2.3	2.0	2.0	1.86	1.92	2.06	2.1	1.9	2.1	2.38	2.18	1.92	2.02	1.9	1.78	1.66
Threonine	1.4	1.1	1.3	1.08	1.06	1.2	1.1	1.1	1.3	1.42	1.28	1.08	1.12	1.04	0.98	0.9
Serine	1.3	1.1	1.2	1.06	1.04	1.2	1.1	1.1	1.2	1.32	1.24	1.08	1.14	1.08	1.02	0.98
Glutamic	3.2	2.7	2.9	2.6	2.62	2.94	2.7	2.7	3	3.3	3.0	2.58	2.76	2.64	2.52	2.26
Proline	2.2	13	17	14.1	13.1	19.6	18	12	17	7.9	12.8	12.4	16.5	15.4	11.9	10.6
Glvcine	1.4	1.1	1.3	1.06	1.04	1.24	1.1	1.1	1.3	1.3	1.16	1.02	1.02	0.98	0.92	0.88
Alanine	1.6	1.2	1.2	1.44	1.32	1.74	1.5	1.5	1.3	1.98	1.74	1.42	1.48	1.4	1.28	1.28
Cystine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Valine	1.2	1.0	1.0	1.02	0.98	1.34	1.0	1.0	1.1	1.56	1.2	0.94	1.06	0.96	0.9	0.84
Methionine	0.1	0.2	0.1	0.14	0.04	0.46	0.1	0.2	0.2	0.38	0.22	0.04	0.24	0.12	0.02	0.14
Isoleucine	0.9	0.9	0.8	0.74	0.74	0.98	0.7	0.7	0.9	1.46	0.96	0.68	0.92	0.76	0.72	0.6
Leucine	1.8	1.6	1.6	1.5	1.44	2.02	1.5	1.6	1.7	2.3	1.74	1.54	1.78	1.44	1.3	1.28
Tryrosine	1.2	1.4	1.0	0.88	0.6	2.06	0.8	0.8	1.1	2.14	1.18	1.22	1.64	0.78	0.42	0.66
Phenylalani	1.4	1.2	1.1	1.02	1.02	1.48	1.0	1.0	1.2	1.84	1.32	1.12	1.3	0.98	0.92	0.8
Histidine	0.8	0.5	0.6	0.54	0.48	0.6	0.5	0.5	0.6	0.86	0.68	0.44	0.56	0.48	0.44	0.36
Lysin	1.6	1.2	1.4	1.22	1.12	1.36	1.2	1.2	1.4	1.48	1.32	1.16	1.22	1.12	1.04	1.0
Arginine	2.7	2.0	2.4	2.06	1.52	2.24	2.1	1.4	1.9	2.6	2.02	1.48	1.96	1.86	1.4	1.26
Total mg/ g	25.0	32.0	37.0	32.4	30.0	42.5	37.0	30.0	37.0	34.2	34.0	30.1	36.7	32.9	27.5	25.5

There are some exceptions during the two seasons, in 4000 & 6000 ppm salinity set during 2008 season.

Proline serves as a storage sinke for carbon and nitrogen and a free radical scavenger. Khodary, (2004) investigated the effect of NaCl in presence or absence of gamma irradiation on seeds of *lupinus termis*. The author determined protein, amino acids, nucleic acids and nitrate, potassium and phosphorus uptake. Significant decreases in the contents of protein, amino acids and nucleic acids were observed upon NaCl exposure (0, 500, 1000, 2000 and 3000 ppm). On the other hand, in seeds irradiated with gamma rays (10, 25, 50 and 100 Gy), these nitrogenous fractions were increased after NaCl treatments, particularly with 25Gy.

Proline may contribute to osmotic adjustment at the cellular level. Many investigators recorded an accumulation of amino acids especially proline in plant exposed to salt stress (Perez- Alfocea *et al*. 1993; Rhodes & Hanson, 1993; Zidan and Alzahran, 1994; Aziz and Larher, 1995; Hartzendorf and Rolletschek, 2001; Xiong and Zhu, 2002; Moghaieb *et al*. 2004 and El-Raslan, 2007). It also stabilizes sub cellular structures (membranes and proteins), and buffers cellular redox potential under stress (Bohnert and Jensen, 1996; Chen and Murata, 2000). The extreme sensitivity of the metabolic processes of proline synthesis and degradation themselves may benefit by regulating metabolic processes which are adversely affected by stress (Hare and Cress, 1997).

a-First group: control

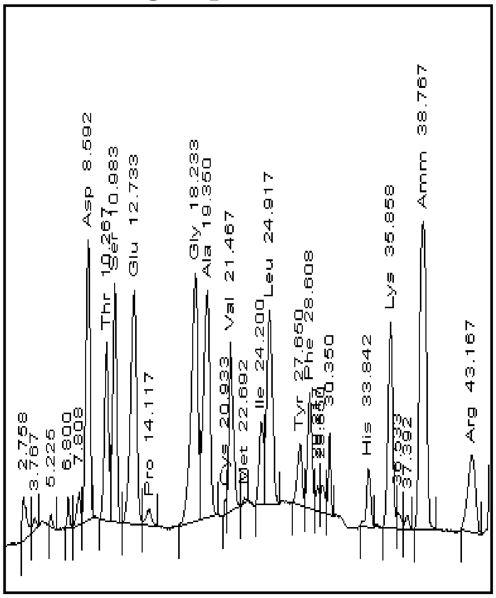

Fig 1. control

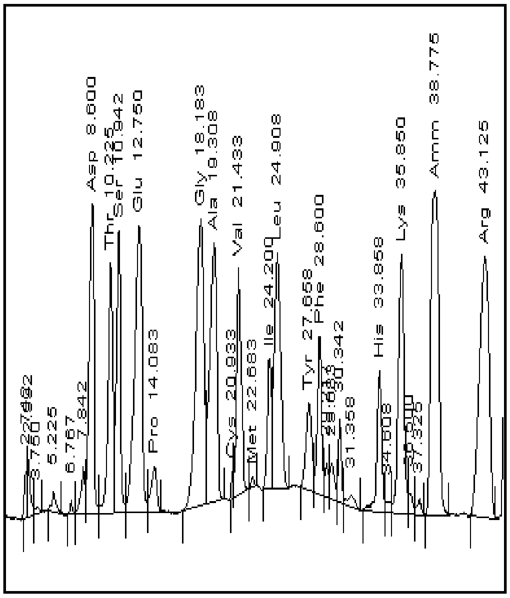

Fig 2. 20Gy

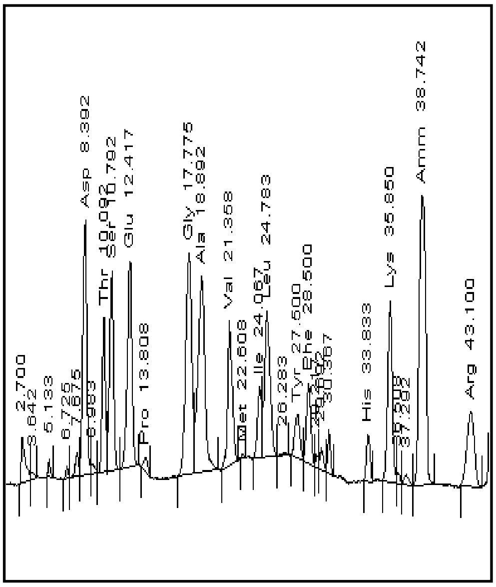

Fig 3. 40Gy

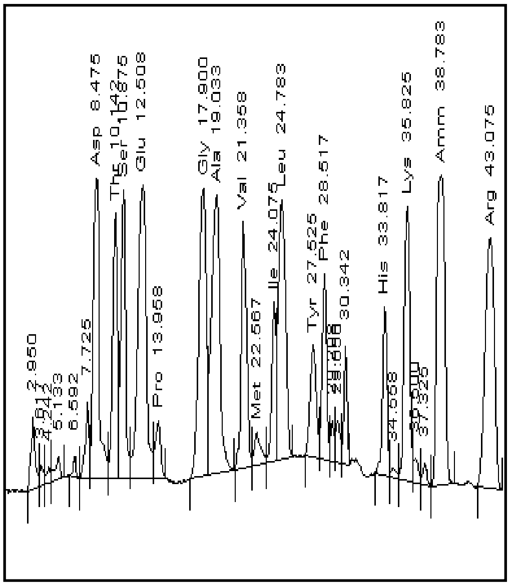

Fig 4. 80Gy

Effect of γ- ray doses, soil salinity treatments and their interaction on amino acids concentration (mg/g D.W) at flowering stage in *Ambrosia maritima* L shoots during 2007/2008 season

b- Second group: 2000 ppm

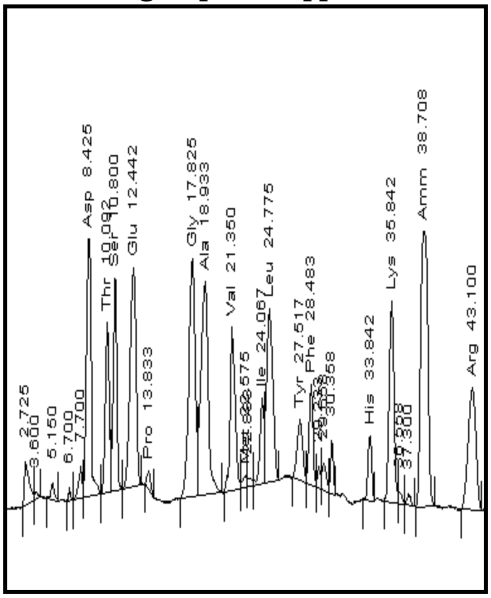

Fig 5. contro

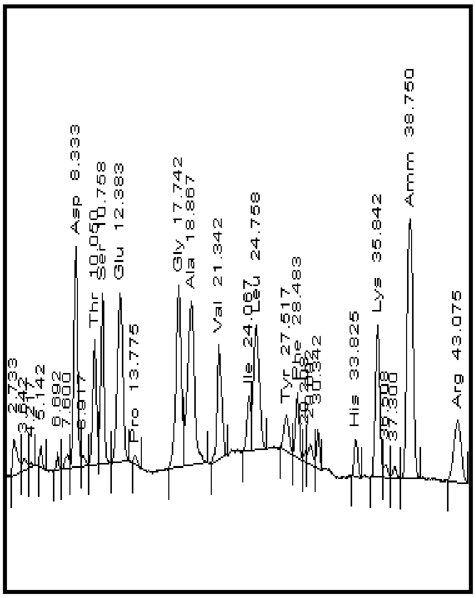

Fig 6. 20Gy

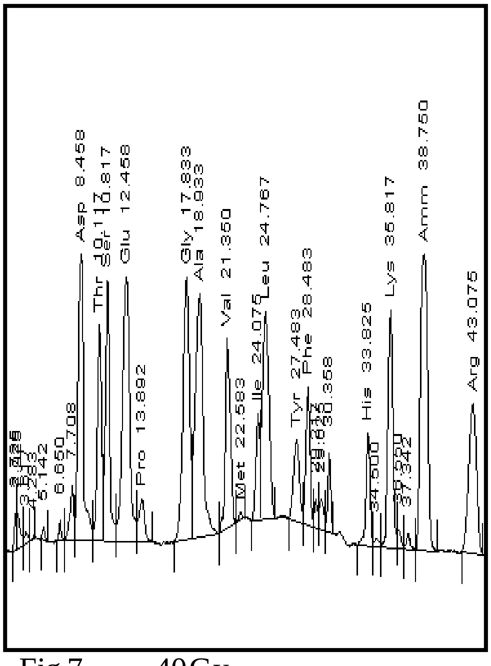

Fig 7. 40Gy

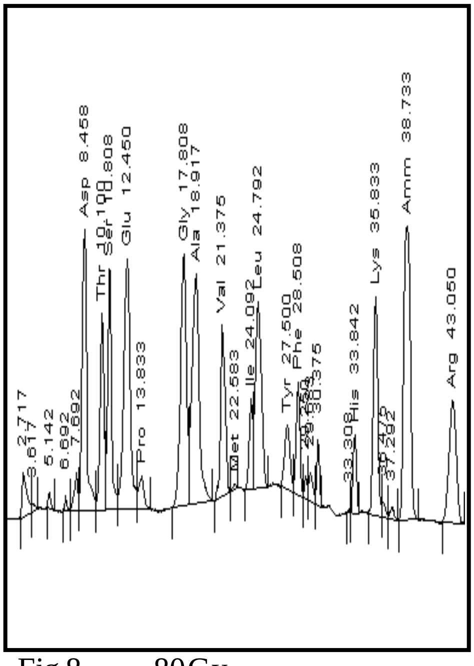

Fig 8. 80Gy

c -Third group: 4000ppm

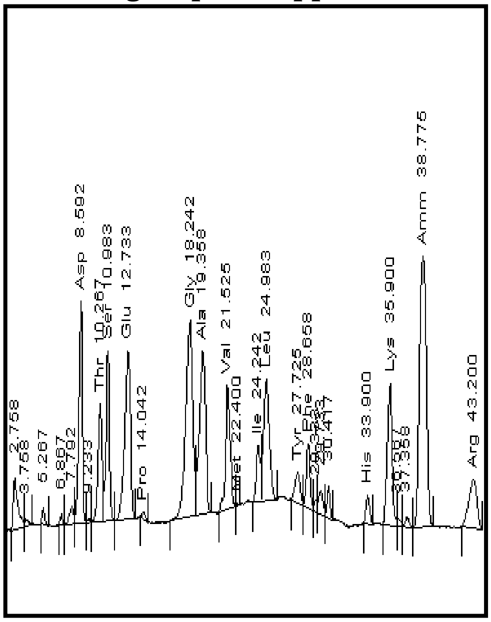

Fig 9. control

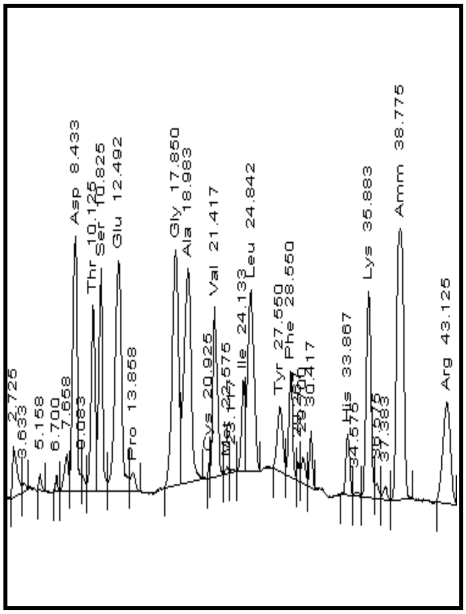

Fig 10. 20Gy

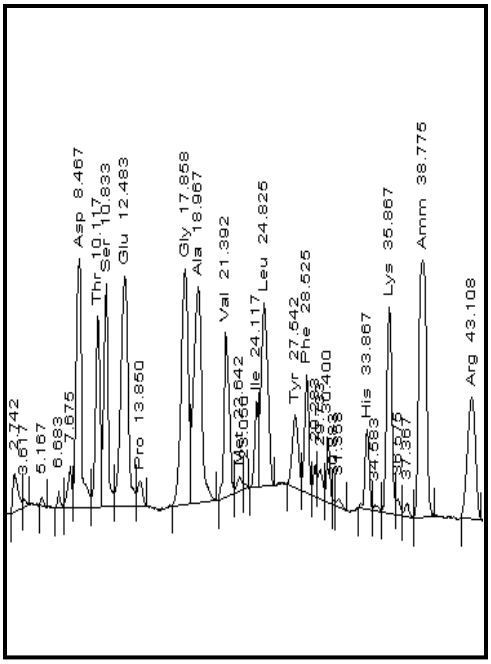

Fig 11. 40Gy

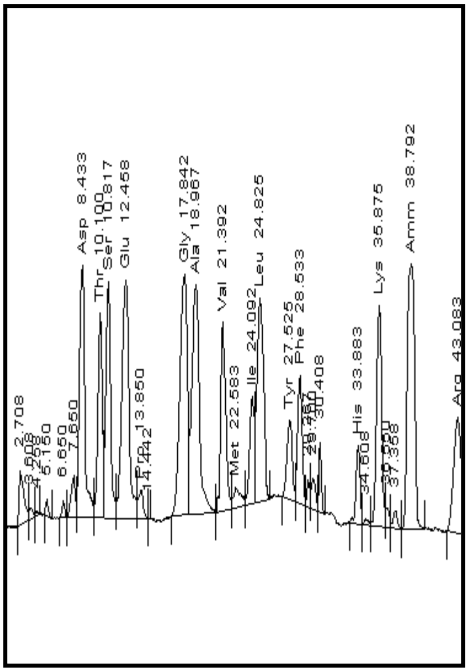

Fig 12. 80Gy

d- Fourth group: 6000ppm

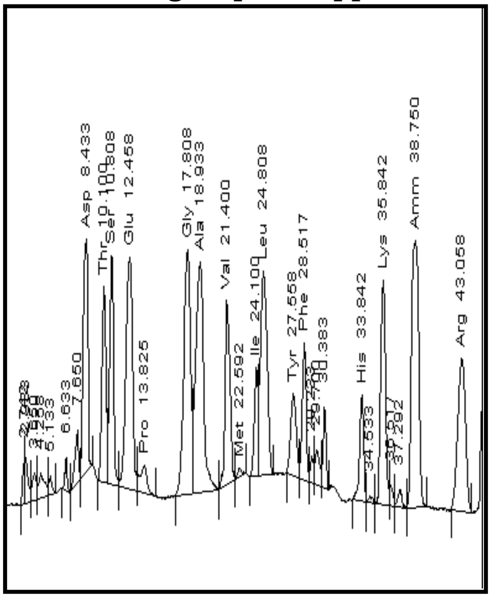

Fig 13. control

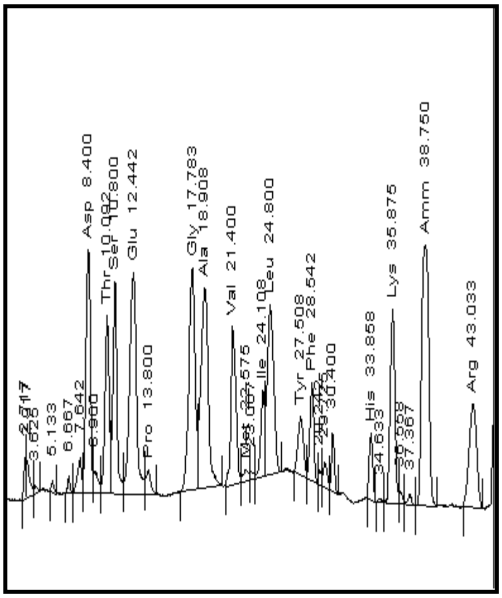

Fig 14. 20Gy

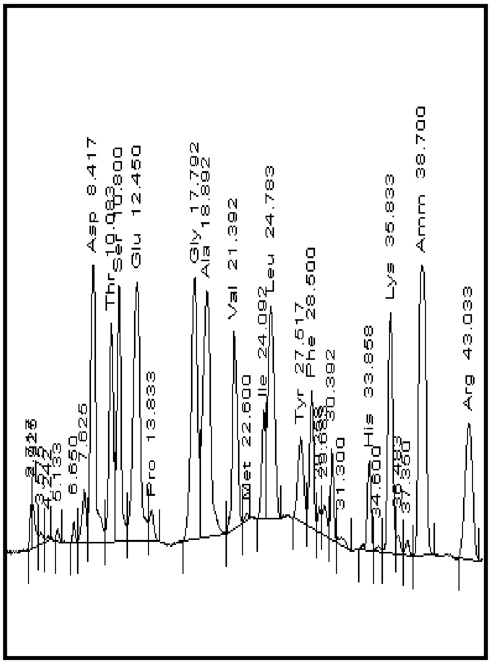

Fig 15. 40Gy

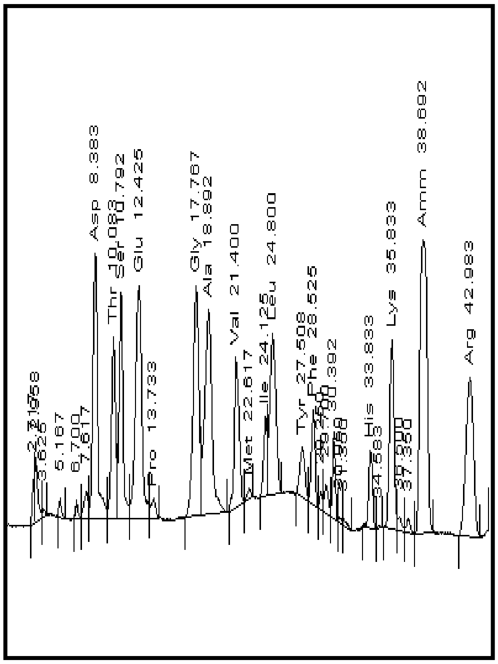

Fig 16. 80Gy

a-First group: control

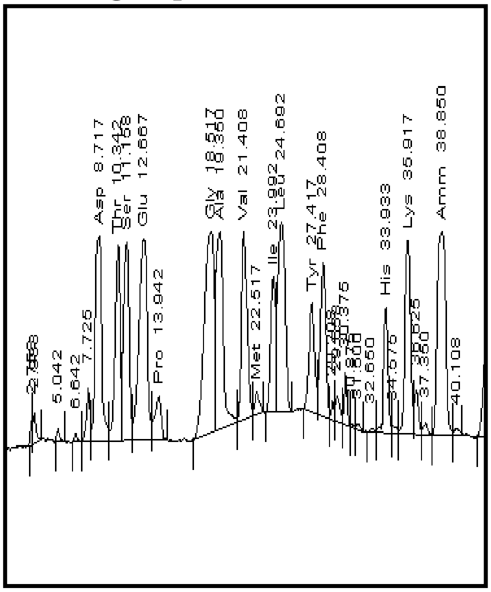

Fig 1. control

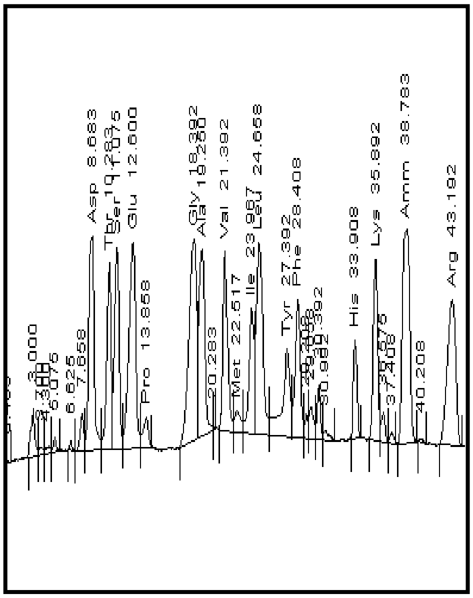

Fig 2. 20Gy

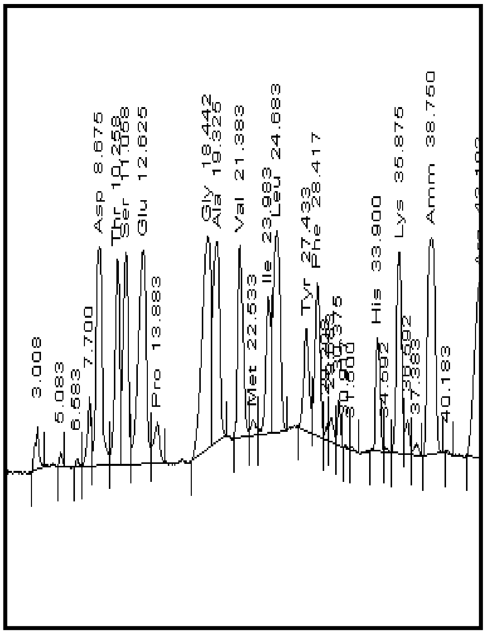

Fig 3. 40Gy

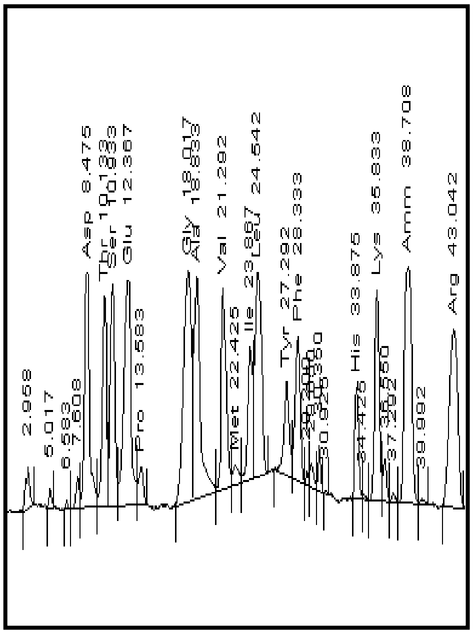

Fig 4. 80Gy

Effect of γ- ray doses, soil salinity treatments and their interaction on amino acids concentration (mg/g D.W) at flowering stage in *Ambrosia maritima* L shoots during 2008/2009 season.

b- Second group: 2000 ppm

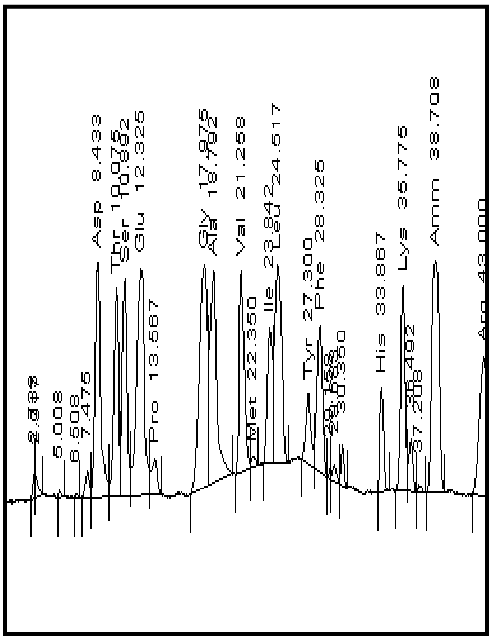

Fig 5. control

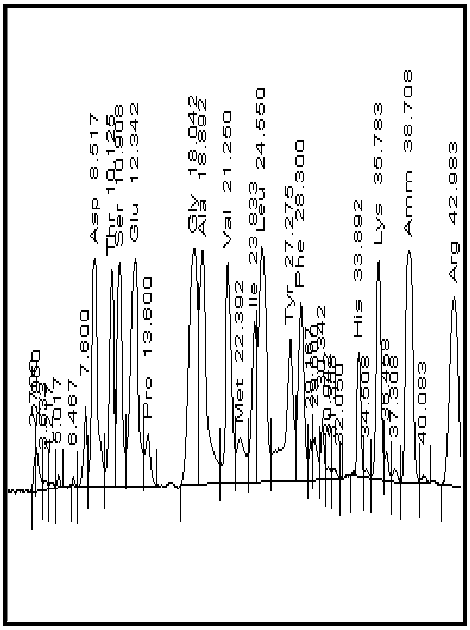

Fig 6. 20Gy

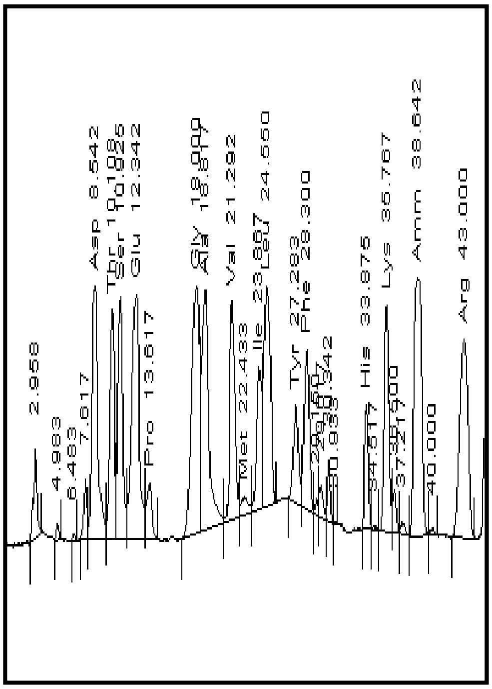

Fig 7. 40Gy

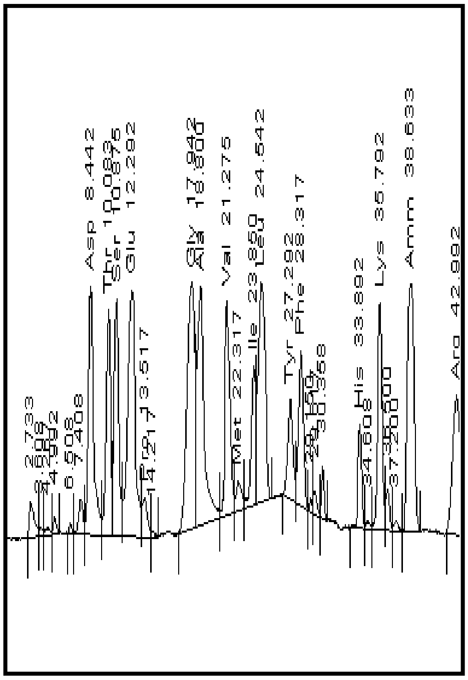

Fig 8. 80Gy

c- Third group: 4000ppm

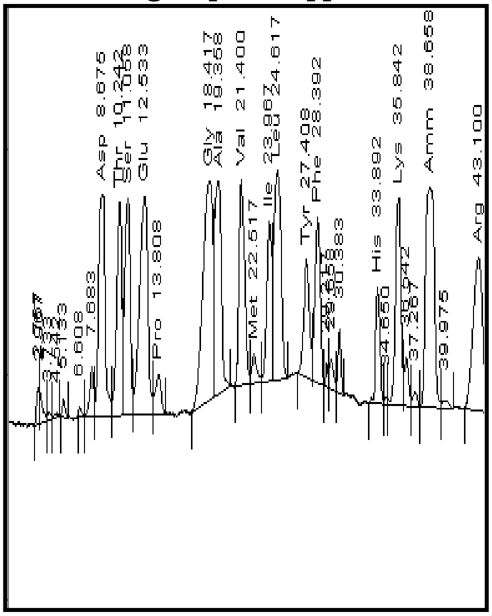

Fig 9. control

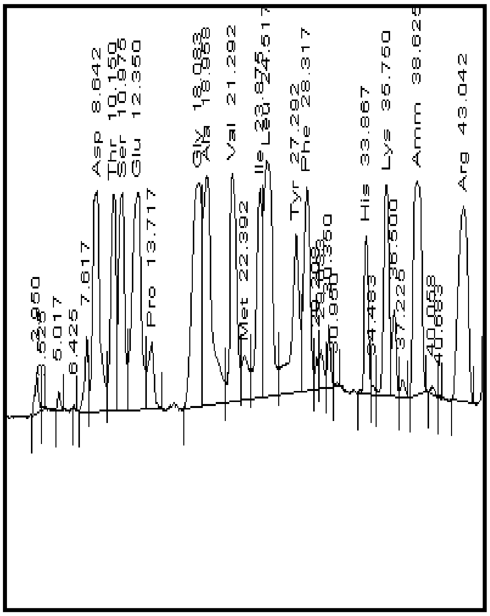

Fig 10. 20Gy

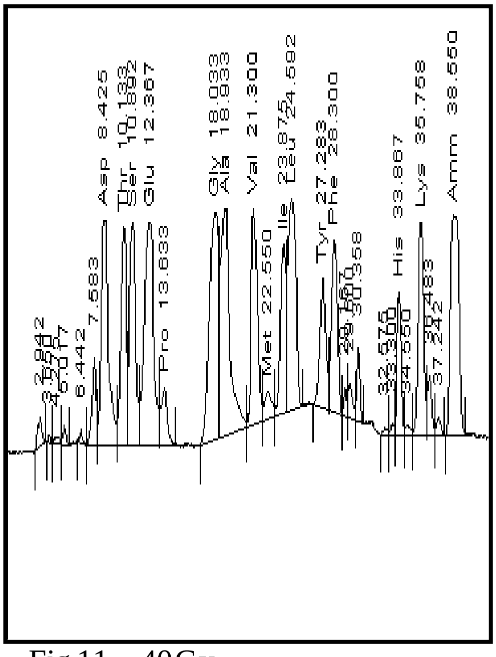

Fig 11. 40Gy

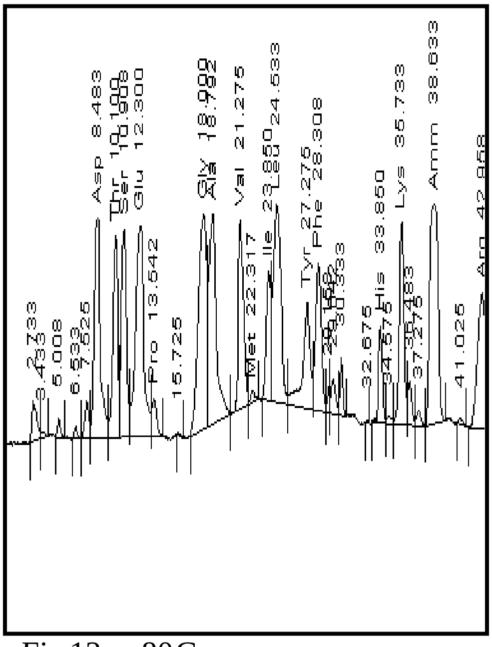

Fig 12. 80Gy

d- Fourth group: 6000ppm

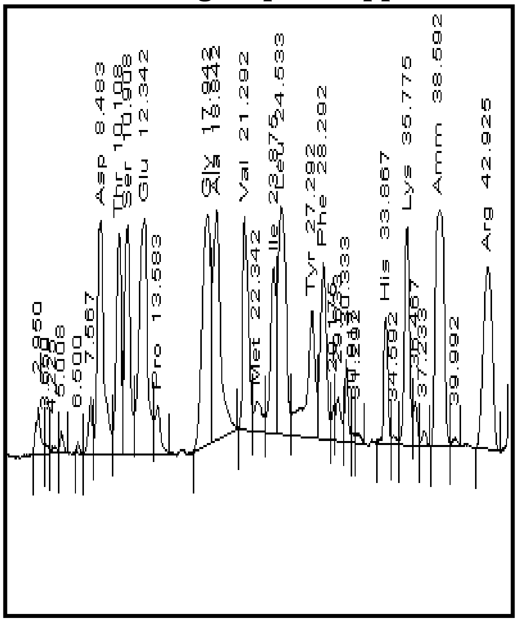

Fig 13. control

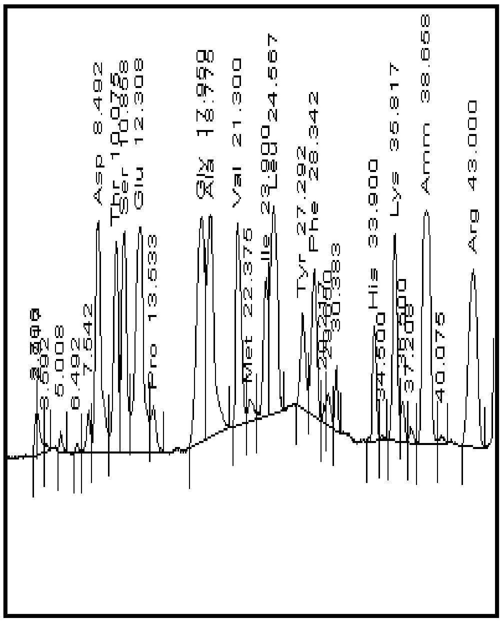

Fig 14. 20Gy

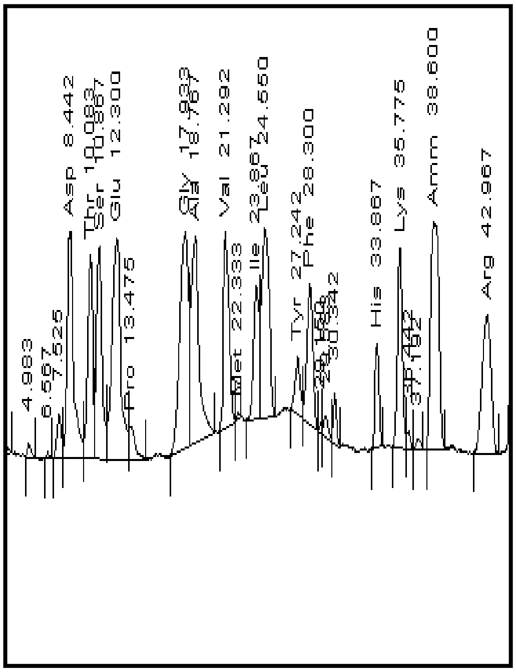

Fig 15. 40Gy

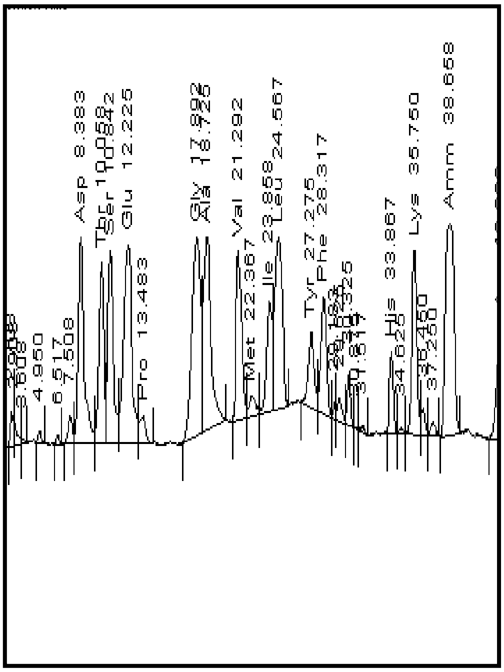

Fig 16. 80Gy

g. Total soluble phenols concentration

Table 16. Effect of γ-ray doses, soil salinity treatments and their interaction on total soluble phenols concentration (mg/g F.W) in *Ambrosia maritima* L shoots during (2007/2008) and (2008 /2009) seasons.

Season	2007/2008					2008/2009				
γ-ray (Gy) / Salinity (ppm)	0	20	40	80	MeanA	0	20	40	80	MeanA
					Vegetative stage					
0	5.11	6.63	6.97	7.13	6.46	7.92	10.48	10.88	11.09	10.09
2000	7.49	7.72	8.30	8.46	7.99	11.04	11.07	11.26	11.30	11.17
4000	8.91	9.77	10.02	10.47	9.79	11.24	11.48	11.45	11.51	11.42
6000	11.01	10.98	10.97	11.13	11.02	11.84	11.80	11.91	11.85	11.85
Mean B	8.13	8.77	9.07	9.19		10.51	11.21	11.38	11.64	
LSD 5%	**A=0.073**		**B=0.051**	**AB= 0.103**		**A=0.271**		**B=0.192**		**AB=0.384**
					Flowering stage					
0	6.44	7.00	7.61	8.00	7.26	11.14	11.26	11.25	10.70	11.09
2000	8.33	8.75	9.12	9.45	8.91	11.22	11.54	11.63	11.49	11.47
4000	9.96	10.40	10.52	10.83	10.43	11.48	12.05	12.28	11.74	11.89
6000	11.24	11.38	11.37	11.80	11.45	13.22	13.54	13.11	13.25	13.28
Mean B	8.99	9.38	9.65	10.02		11.77	12.10	12.07	11.79	
LSD 5%	**A=0.332**	**B=0.223**		**AB= N.S**		**A=0.343**		**B= 0.245**		**AB= N.S**
					Fruiting stage					
0	11.04	10.76	11.30	11.54	11.16	11.61	11.72	11.72	11.72	11.69
2000	12.01	11.79	12.16	12.40	12.09	11.72	11.73	11.73	11.73	11.73
4000	12.53	12.19	12.73	12.37	12.46	11.79	12.28	12.69	11.92	12.17
6000	13.04	12.69	13.05	13.50	13.07	12.78	13.35	13.17	13.14	13.11
Mean B	12.15	11.86	12.31	12.45		11.98	12.27	12.33	12.13	
LSD 5%	**A=0.713**		**B= 0.315**	**AB=N.S**		**A=0.399**		**B= N.S**		**AB= N.S**

A=Salinity B= Irradiation AB= Interaction

It was observed during the two seasons that total soluble phenols concentration increased significantly with the increase in soil salinity level as shown in Table (16). The highest increase noticed at 6000ppm that elevate phenols concentration by 17.44% ,19.75 and 12.15% at the three stages of growth (vegetative, flowering and fruiting stage, respectively) as compared by their corresponding control, during 2008-2009 season.

Also, total soluble phenol concentration increased by uses of gamma radiation treatments before sowing above the control value either control for salinity (soil without salt) or non-irradiated control, significantly in the three stages of growth.

Total soluble Phenols values increase significantly with salinity treatments or radiation treatments, but the interaction between them was insignificant at flowering and fruiting stages during two seasons studied.

Results obtained were in agree with Morgan, (2007) on wheat plants, who found that soluble phenols concentrations increased in the shoots of the plants that grown under saline soil, when compared with control. The same observation was obtained by Hanafy Ahmed (1996) on lettuce and Hanafy *et al*. (2002) on wheat. They suggested that simple organic molecules such as sugars, free amino acids and total soluble phenols may act as on osmoticum for the regulation of plants osmosis under saline soil conditions.

Phenol accumulation could be a cellular adaptive mechanism for scavenging oxygen free radicals that formed during stress and this free radical scavenger could be oxidized for preventing sub cellular damages Das *et al*. (1990).

Many published reports of UV-B stimulation of phenolic compounds. These compounds have been implicated both in plant defense (Chappell and Hahlbrock, 1984, and Guevara, *et al*. 1997) and as protection against UV- light (Ziska *et al*. 1992 and Lois, 1994).

Koseki *et al* .(2002) concluded that high doses of radiation (0, 10, 20, 30 KGy) on sweet basil and artichoke do not show great variation in tannins content with an increase of radiation dose. Rosemary presents a small sensitivity to radiation treatment. Phenolics content has a small change also in rosemary after 10 KGy.

The obtained results are in accordance with these results, Abu-Daya. (1990) found that radiation treatment significantly decreased the phenol compounds in the olive cake. Irradiation with 100 kGy destroyed about 75% of total phenol compounds. Yonies (1997) also found that gamma radiation of soybean seeds and sesame seeds by 2.5,5 and 8 kGy increased the phenol contents as compared with the control seeds.

Hussein *et al*. (2009) found that phenol concentration increased under salt stress in two cultivars of *Zea mays*, which irrigated by 4500 ppm NaCl solution. Also, polyphenol content was increased by salinity in *A. corniculatum* (Parida *et al*. 2004). Increase in poly phenol content in different tissue under increasing salinity has also been reported in number of plants (Agastian *et al*. 2000). Muthukumarasamy *et al*. (2000) recently, reported that increase in poly phenol in the tissue ameliorate the ionic effect of NaCl.

h. Total protein percentage

Table 17. Effect of γ-ray doses , soil salinity tretments and their interaction on total protein percentage in *Ambrosia maritima* L. shoots during 2007/2008 and 2008/2009 seasons.

Season	2007/2008					2008/2009				
γ-rays (Gy) / Salinity (ppm)	0	20	40	80	MeanA	0	20	40	80	MeanA
					Vegetative stage					
0	10.81	14.94	16.44	17.38	14.89	14.06	20.31	19.75	16.94	17.77
2000	10.50	18.88	18.19	16.00	15.89	20.69	12.56	12.13	21.94	16.83
4000	10.25	24.88	22.88	22.38	20.10	31.31	16.75	18.63	26.81	23.38
6000	8.81	18.25	17.50	36.13	20.17	20.00	17.06	39.00	26.44	25.63
Mean B	10.09	19.23	18.75	22.97		21.52	16.69	22.38	23.03	
LSD 5%	**A=0.39**	**B=0.48**	**AB=0.9 0**			**A=0. 71**	**B=0.95**	**AB=1.90**		
					Flowering stage					
0	12.44	29.75	20.75	16.38	**19.83**	20.50	14.81	23.56	19.44	19.58
2000	8.69	30.56	18.56	18.13	**18.98**	15.81	23.31	26.38	18.81	21.08
4000	6.25	25.38	25.81	16.63	**18.52**	16.44	21.38	25.88	22.50	21.55
6000	16.13	26.25	35.19	31.63	**27.30**	23.31	11.44	16.38	24.44	18.89
MeanB	10.88	27.99	25.08	20.69		19.02	17.74	23.05	21.30	
LSD 5%	**A=0.73**	**B=0.53**	**AB=1.1**			**A=0.80**	**B=0.61**	**AB=1.22**		
					Fruiting stage					
0	12.13	8.63	33.63	27.19	20.40	23.19	23.00	20.81	16.44	20.86
2000	9.50	30.94	26.75	21.19	22.10	17.50	22.25	26.56	20.13	21.61
4000	22.25	18.75	19.50	22.50	20.75	22.56	25.88	14.00	16.19	19.66
6000	31.75	19.69	16.00	14.44	20.47	24.63	17.06	20.31	18.69	20.17
Mean B	18.91	19.50	23.97	21.33		21.97	22.05	20.42	17.86	
LSD 5%	**A=0.65**	**B=0.57**	**AB=1.13**			**A=N.S**	**B=0.73**	**AB=1.46**		

A=Salinity B= Irradiation AB= Interaction

There are fluctuations on protein % in damsisa shoots at the three different stages of growth during the two seasons as shown in Table (17).But it was clear that shoots of plants that grown in soil under 4000 or 6000 ppm salt concentration mostly had the highest percentage of protein as compared by control normal soil. At vegetative stage, the mean of protein percentage was 20.10% and 23.38% for plants grown

at 4000ppm soil concentration compared to unstressed control (14.89% and17.77%) in control set for the first and second season, respectively. In contrast to the above results, a progressive and consistent decrease in the total protein percentage were found, El Mogy (1999) showed that the moderate and higher treatments of soil salinity (0.2% and 0.4%) tended to decrease the nitrogen percentage and protein content of *Ambrosia maritima* leaves compared to control. Whereas the maximum content of protein was obtained when using soil salinity of 0.1%, same finding on *Ambrosia maritima* was obtained by El-Sanafawy (2000). Salinity affecting both water absorption and biochemical processes such as N_2 and CO_2 assimilation and protein synthesis, Delfine *et al*. (1999).

Also, in gamma radiation treatments 20 or 40 Gy dose produced the highest protein concentration as compared by non-irradiated control. Also, significant changes were observed as a result of sowing irradiated seeds in 4000 or 6000 ppm and produced plants having highest protein percentage mainly at first and second stages of growth in 2007/2008 season and at second stage of growth in 2008/2009 season.

Prasad *et al*. (1997) found that both NH_4 and NO_3-N increased with increasing salinity up to 5ds/m. The effect of NaCl salinity in presence or absence of the irradiated lupin (*Lupines termis* L) seeds with gamma rays, on nitrogen assimilation and ion uptake was investigated by Khodary (2004). Significant decreased in the contents of protein and amino acids, were observed upon exposure to (0, 500, 1000, 2000 and 3000ppm). On the other hand, in seeds irradiated with gamma rays (10, 25, and 100 Gy) these nitrogenous fractions were increased after NaCl treatments, the effect was more pronounced particularly with 25 Gy.

Also, Hussein (2010) observed that treating seeds before sowing by gamma rays (50-250 Gy) increased total protein contents in the produced seedlings of mungbean seeds. Radiation caused oxidative injury by accelerating free radical generation in living systems. The primary damage induced by ionizing radiation is modified in enzymatic repair processes (Alikamanoglu *et al*. 2007).

It was previously shown that gamma irradiation significantly influences the cell metabolism and protein synthesis in plant meristem cells, (Casarett.1968).

According to the results obtained in the present study, it was observed that increased gamma dosage caused a reduction of total protein concentration. However, plants irradiated at relatively low dosage (10 and 20Gy) displayed a higher total protein concentration compared to their non-irradiated counterparts.

This result demonstrated that there was a direct correlation between gamma dosage and protein content. Gamma irradiation caused inhibition of tissue culture growth along with failure of RNA, and subsequently of protein synthesis (Bajaj. 1970). This accounts for the lower protein concentration in plants irradiated at high dosage (70Gy).

CONCLUSION

From the aforemenioed resuls, it could be concluded that Ambrosia maritima plants wih aid of gamma rays can tolerate soil salinity up to 6000 ppm . The recommended dose 40 Gy which produce plants having the best vegetative charcters, and active ingredients in two seasons of experiment.

Recorded dose 40 Gy with 4000 ppm the highest value for damsin and 80 Gy dose with 6000 ppm to infer the highest value of ambrosin

SUMMARY

This search was achieved in the National Center for Radiation Research and Technology during two seasons 2007/2008 and 2008/2009 in plastic pots 30cm in diameter. The type of soil used in planting was sand loamy soil. The aim of work was studying the response of damsisa seeds to gamma rays in doses (0, 20, 40 and 80 Gy) after sowing in soils plus mixture of salt. The used salts were sodium chloride, calcium chloride and magnesium sulfate in ratio 2:2:1. The concentration of used salts were 2000, 4000, 6000 ppm. A part of seeds left without treatment and considered as control. The obtained results during the two expiremental seasons can be summarized as the following:

Effect of salinity on growth and some chemical composition:

1. The addition of different levels of salt mixture ($NaCl$: $CaCl_2$: $MgSO_4$) to the soil significantly decreased the height of damsisa plants as compared to those of untreated control soil
2. Number of leaves / plant decreased with increasing salinity levels; untreated plants gave the highest number of leaves / plant
3. Insignificant changes were observed in number of branches/plant as affected by different levels of salinity.
4. Fresh or dry weight of un-irradiated damsissa plants that grown under different levels of soil salinity decreased during the three stages of growth as compared by non-irradiated control through two seasons of experiments.

5. Generally, the total sugar concentrations increased significantly with increasing salinity levels in the soil, at the three stages of growth during the two seasons of experiment.
6. It was observed during the two seasons of experiment that total soluble phenols concentration increased significantly with increasing of soil salinity. The highest increase was noticed at 6000ppm.
7. Salinity treatments induced significant increase in chlorophyll a, chlorophyll b, and consequently of the total chlorophyll as well as carotenoids concentration in the leaves of damsisa plants at different stages of growth during the two seasons of experiment.
8. A fluctuation in nitrogen % was recorded by damsisa plants in the three different stages during the two seasons of growth as affected by salinity. But it was clear that 4000 or 6000 ppm soil concentration mostly had the highest percentage of nitrogen as compared by control soil.
9. It was found that salinity treatments mostly produced shoots having high ambrosin content than the control set. The opposite is true with concern to damsin content. Ambrosin content increased by 9.8%, 63.4% and 26.8% above its corresponding control at 2000, 4000 and 6000 ppm solinity treatments. The opposite is true with concern to damsin content.
10. It was observed that amino acids pool was generally increased by salinity in shoots produced from seeds planted in soil with salt concentration 2000, 4000 or 6000 ppm during the two seasons

11. Generally Na^{+} and K^{+} concentration increased with increasing salinity levels .

12. Ca^{+2}% in plants increased with increasing soil salinity levels. The contrast was take place at flowering stage except with 80Gy irradiation treatment.

13. Mg^{2+} % in shoots of *Ambrosia maritima* plants decreased with increasing salinity concentration in soils during the two seasons in the three stages of growth as compared by unstressed and non-irradiated control

Effect of irradiation on growth and some chemical composition :

1. Irradiated seeds that sown in normal soils or under different levels of salinity were mostly produced plants having higher shoots than its corresponding control.

2. Gamma radiation generally, improved plant growth and in turn, number of leaves since all used doses gave number of leaves higher than its corresponding control and than normal control. Concerning doses of radiation and the interaction between salinity and radiation, insignificant changes were observed.

3. It was noticed that gamma radiation caused an increase in fresh and dry weights of plants. Also, plants produced from sowing irradiated seeds (20, 40 or 80 Gy) under different sets of salinity levels, produced plants having heaviest weight (fresh or dry weights) than its corresponding control or than control (grown under normal soil without salt mixture).

4.Significant increase in total sugar concentrations were produced from seeds irradiated by (40 or 80 Gy) before sowing as compared by those of un-irradiated control in 2008 season, while insignificant change were obtained at 2007season. It was observed that total sugar concentration increased with increasing salinity levels (6000) at radiation dose (80Gy).

5. Total soluble phenols concentration increased by uses of gamma radiation treatments before sowing above the control value either control for salinity (soil without salt) or un-irradiated control, significantly in the three stages of growth.
6. Photosynthetic pigments were increased in damsisa plants produced from irradiated seeds at different stages of growth during two seasons. Also, it was observed that chlorophyll (a) predominated over chlorophyll (b) but the values become closer with increasing salinity.
7. Significant changes were observed as a result of sowing irradiated seeds in 4000 or 6000 ppm and producing plants having highest nitrogen percentage.
8. It was observed that gamma radiation increase ambrosin content in damsisa shoots produced from seeds treated by gamma rays. The highest dose "80Gy" increase ambrosin content by 63.4%. But, shoots produced from seeds treatment by 40 Gy only contain more damsin content than its corresponding control in salinity sets.
9. Sowing treated seeds by gamma rays at different salinity levels mostly accumulate total amino acids pool as compared by its corresponding controls. Proline in particular was frequently recorded to be considerably accumulated more than any other amino acids in stress plants.

10. Treating seeds before sowing by gamma radiation generally increase Na^+ and K^+ concentration in damsissa plant during vegetative stage of growth as compared by its corresponding control or stressed control. Meanwhile, at flowering and fruiting stage, a decrease in Na^+ concentration was observed with some exceptions mainly at 40 Gy dose and rarely at 80 Gy dose.
11. It was observed that, at 2000 ppm salinity level increased Ca^{2+} concentration at first and second stage of growth. Also, the dose 40 and 80Gy in 4000ppm increased Ca %. While at fruiting stage, it was noticed a reduction in Ca^{2+} concentration in shoots with different doses of radiation comparing to stress control.
12. Mg^{2+} % in shoots of *Ambrosia maritima* plants decreased with increasing salinity concentration in soils during two seasons in the three stages of growth as compared by unstressed and un-irradiated control.

REFERENCES

Abd El-Wahab, A.T. (2009). Physiological response of lovage (*Levisticum officinale*, Koch) plant to gamma radiation and organic fertilizers. Ph.D. Thesis, Fac. Agric., Cairo Univ., Egypt, 168 p.

Abd El-Wahab, M.A. (2006). The efficiency of using saline and fresh water irrigation as alternating methods of irrigation on the productivity of *Foeniculum vulgare* Mill Subsp. Vulgare Var. Vulgare under North Sinai conditions. Research Journal of Agricultural and Biological Sciences, 2(6): 571-577.

Abdul Majeed and Zahir,M. (2010).Gamma irradiation effects on some growth parameters of *Lepidium sativum* L**.** World Journal of Fungal and Plant Biology,1 (1): 8-11

Abdul Qados,A.M.S.(2009). Effect of arginine on growth, yield and chemical constituents of wheat grown under salinity condition. Academic J. of Plant Sci., 2(4):267-268.

Abdul Qados,A.M.S.(2011). Effect of salt stress on plant growth and metabolism of bean plant *Vicia faba* L. Journal of the Saudi Society of Agricultural Sci ., 10:7-15.

Abu-Daya, Y. M. I.(1990). Biochemical Studies on Olive Cake Ph.D. Agric. Sci. Biochemistry, Fac. of Agric., Cairo University, Egypt,176p.

Agastian,P.; Kingsley, S.J. and Vivekanandan, M. (2000). Effect of salinity on photosynthesis and biochemical characteristics in mulberry genotypes. Photosynthetica ,38:287–290.

Ahloowalia, B.S; Meluzynski ,M. and Nichterlein ,K. (2004). Global impact of mutation-derived varieties. Euphytica,135:187-204.

Ahmed, R. B. (1988). Physiological studies on geranium. Ph.D. Thesis, Fac. Agric., Zagazig Univ., Egypt,122p.

Ahmed, H.F.S.; Mohmoud, M.M.; Hamid-Eldin, N. and Bhieldin, N. (2005). Gamma irradiation and sodium azid induced changes in growth, leaf protein patterns and genomic DNA of two strains of maize under drought stress. Isotope & Rad. Res., 73(1):1-17.

Aldesuquy, H. S.; Badawi, A. N.; El-Dohlob, S. M. and Ali, A. H. (1998): Physiological studies on adaptation of wheat plants to irrigation with sea water. III Regulation of mineral, carbohydrate and proline content by the combined effects of phytohormones and sea water. J. Union Arab Biol. Egypt, 6:276-288.

Al-Harbi, A. R. (1995). Growth and nutrient composition of tomato and cucumber as affected by sodum chloride salinity and supplemental calcium. J. Plant Nutr., 18: 1403-1416.

Al-Jassir, M. S.(1992). Chemical composition and micro flora black cumin (*Nigella sativa* L.) seeds growing in Saudi Arabia. Food Chem., 45: 239-242.

Ali, M. A. M. (1996). Physiological studies on Egyptian henbae In El-Arish Region. Ph.D. Thesis,.Fac. Agric., Suez Canal Univ.,Egypt,168p.

Ali, R.M. (1991). Changes in chemical composition of fruits of salinized *Datura stramonium*. Journal of Islamic Academy of Sci., 4(4): 289-292.

Alikamanoglu, S.; Yaycili, O.; Atak, C.; Rzakoulieva, A. (2007). Effect of magnetic field and gamma radiation on *Paulownia tomentosa* tissue culture. Biotechnol. Eq. 21(1):49-53.

Al-Sobhi, O.A.; Al-Zahrani, H.S. and Al-Ahmadi, S.B. (2006). Effect of salinity on chlorophyll & carbohydrate contents of *Calotropis Procera* seedlings scientific. Journal of King Faisal University, 7: 105-115.

Amin, W.M.A.(1990). A pharmacognostical study of certain Egyptian Molluscicidal plants. Ph.D. Thesis, Faculty of Pharmacy, Cairo Universty, Egypt, 257p.

Antonelli, A.; Fabbri, C. and Boselli, E. (1998). Modifications of dried basil (*Ocimum basilicum* L.) leaf oil by gamma and microwave irradiation. Food Chemistry, 63 (4):485-489.

AOAC. (1990). Official Methods of Analysis of the Association of Official Agricultural Chemists. 15th Ed., Washington, D.C., USA.

Arevalo, L.; Bustos, M.E. and Saucedo,C. (2002). Changes in the vascular tissue of fresh Hass avocados treated with cobalt 60. Radiation Physics and Chemistry, 63: 375-377.

Ashraf, M. and Harris, P.J.C. (2004). Potential biochemical indicators of salinity tolerance in plants, Plant Sci. 166:3–16.

Ashraf, M. and Khanum, A. (1997). Relationship between ion accumulation and growth in two spring wheat lines differing in salt tolerance at different growth stages. J. Agron. Crop Sci., 178(1): 39-51.

Ashraf, M. and Oleary J.W. (1996): Responses of newly developed salt-tolerance genotype of spring wheat to salt stress: yield components and ion distribution. Agron. Crop Sci.,176: 91-101.

Ashraf, M. and Rauf, H. (2001). Inducing salt tolerance in maize (*Zea mays* L.) through seed priming with chloride salts: Growth and ion transport at early growth stages, Acta Physiol. Plant., 23:407-414.

Arshi, M. Z. and Abdin, I. M. (2002): Growth and metabolism of senna as affected by salt stress. Biol. Plant.,45 (2): 295 -298.

Ayed, N.; Yu, H.L. and Lacroix, M. (1999). Improvement of anthocyanin yield and shelf-life extension of grape "Pomace" by gamma irradiation. Food Research International, 32:539-543.

Aziz, A. and Larher, F. (1995). Change in polyamine titers associated with the proline response and osmotic adjustment of rape leaf disc submitted to osmotic stresses. Plant Science, 112:175-196.

Aziz, L. and Khan, M. A. (2001). Effect of seawater on the growth, ion content and water potential of *Rhizophora mucronata* Lam. J. Plant Res. 114: 369-373**.**

Azooz, M.M. (2004). Proteins sugars and ion leakage as a selection criterion for the salt tolerance of three sorghum cultivars at seedling stage grown under NaCl and nicotinamide. Int.J.Agric.Biol.,6:27-35.

Badawy, E.S.; Bagoury, H. M.; Ahmed, G.F.; Hanafy, M. S. and Abd-Alla, A.T. (1990). Effect of irrigation with saline water containing sodium chloride on growth, yield and composition of majoram plants *Majorana hortensis*, Moench. The Second Arab Conf. of Medicinal Plants, Cairo, Egypt.

Badawy, E.; Sakr, S.S. and El-Sharnouby, M. E. (2003). Production and composion of Lavender plants through tissue culture as affected with gamma irradiation treatments. Acta. Horti, 597:325-328.

Badr, H.M.; Alsadon, A.A and Al-Harbi, A.R.(1997). Stimulation effects of gamma radiation on growth and yield of two tomato (*Lycopersicon esculentum,* Mill) J.King Soud Univ.,9(2):277-286.

Baher, Z.F.; Mirza, M.; Ghorbanil, M. and Rezaii, M.Z. (2002). The influence of water stress on plant height, herbal and essential oil yield and composition in *Satueja hortensis* L. Flavour and Fragrance J., 17: 275-277.

Bajaj,Y.P.S.(1970).Effect of gamma-irradiation on growth, RNA, protein, and nitrogen contents of bean callus cultures. Oxford J. Annals of Botany, V. 34 (5) : 1089-1096.

Baxter, J.H. (1996). Amino Acids. In "Handbook of Food Analysis" vol.1 Leo M.L.Nollet Eds. Marcel dekker,Inc., New York, pp. 197-228.

Beak, M . H.; Chung, B. Y.; Kim, J. H.; Wi, S. G.; Kim, J. S. and Lee, I. J.(2006). Gamma radiation and hormone treatment as tools to reduce salt in rice (*Oryza sativa* L.). J.Plant Biol., 49(3):257-260.

Beak, M. H.; Kim, J. H. ;Chung, B.Y.; Kim, J. S. and Lee, I.S. (2005). Alleviation of salt stress by low dose γ-irradiation in rice. Biologia plantarum, 49 (2): 273-276.

Bedevian, A.(1936). Illustrated Poly Glottic Dictionary of Plant Names" Argus and Papazian presses" Cairo.

Begum, F.;Karmoker, J.L.; Fattah, Q. A. and Maniruzaman, A. F. M. (1992). The effect of salinity on germination and its correlation with K^+, Na^+, Cl^- accumulation in germinating seeds of *Triticum aestivum* L. Plant Cell Physiol., 33(7): 1009-1014.

Beltagi, M. S.; Ismail, M. A. and Mohamed, F. H. (2006). Induced salt tolerance in common bean (*Phaseolus vulgaris* L.) by gamma irradiation. Pak. J .of Biol.Sci., 9 (6): 1143-1148.

Black, E.D. (1982). Methods of Soil Analysis, Agron. No.9, Part 1: Physical and mineralogical properties, Amer.Soc. Agron., Madison, WI, USA.

Bohnert, H. J. and Jensen, R.J. (1996). Strategies for engineering water-stress tolerance in plants. Trends Biotechnol., 14: 89- 97.

Breitfellner, F.; Solar, S. and Sontag, G. (2003). Radiation induced chemical changes of phenolic compounds in strawberries. Radiation Physics and Chemistry, 67: 497-499.

Casarett, A. P. (1968). *Radiation biology*. Prentice-Hall, ISBN 0137503563, Englewood Cliffs,NJ,pp38-86.

Chakravarly, B.and Sen, S.(2001). Enhancement of regeneration potential and variability by "irradiation in cultured cells of *Scilla indica*.Biol Plant., 44:189-193**.**

Chandrasekhar, K. R. and Sandhyarani, S. (1996). Salinity induced chemical changes in *Crotalaria striata* D.C. Indian J. Plant Physiol.,1: 44 – 48.

Chappell, J. and Hahlbrock, K. (1984). Transcription of plant defense gene in response to UV light of fungal elicitor. *Nature*, 311: 76-78.

Charest, C. and Phan, C.T. (1990). Cold acclimation of wheat (*Triticum aestivum*): properties of enzymes involved in proline metabolism. Physiol. Plant., 80:159–168.

Chartzoulakis, K. S. (2005). Salinity and olive growth, salt tolerance, photosynthesis and yield. Agricultural Water Management, 78(1-2):108-121.

Chartzoulakis, K. S. and Klapaki, G. (2000). Response of two green house pepper hybrids to NaCl salinity during different growth stages. Sci. Hort., 86: 247–260.

Chaudhri, S.K. (2002). A simple and reliable method to detect gamma irradiated lentil (*Lens culinaris* Medik) seeds by germination efficiency and seedling growth test. Radiation Physics and Chemistry, 64:131-136.

Chen, T . H. H . and Murata, N. (2000). Enhancement of tolerance of abiotic stress by metabolic engineering of betaines and other compatible solutes. Plant Biol., 5:250-257.

Chen, L.D.Li; Song, L.; Wang, G. and Liu, Y. (2006) . Effects of salt on carbohydrate metabolism in desert soil alga *Microcoleus vaginatus* Gom. Journal of Intergrative Plant Biology, 48(8): 914-919.

Chinusamy,V.;Jagendorf,A. and Kang Zhu, J.(2005). Understanding and improving salt tolerance in plant. Crop Sci., 45: 437- 448 .

Colom, M. R.and Vazzana, C. (2002). Water stress effects on three cultivars of *Eragrostis curvula*. Italy J. Agron., 6:127-132.

Corthals, G.; Gygi. S.; Aebersold, R. and Patterson, S.D.(2000). Identification of proteins by mass spectrometry.Proteome Res., 2:286-290.

Das, S. K.; Molar, N.K. and Mehrotra, C.L. (1990). Salt tolerance of some agricultural crops during early growth stage. Indian J. Agric. Sci., 41(10): 882-888.

Delfine, S.; Alvino, A.; Vilana, M.C. and Loreto, F. (1999). Restriction to carbon dioxide and photosynthesis in spinach leaves recovering from salt stress. Plant Physiology, 199:1101-1106.

Demmig, A.B. and Adams,W.W.(1996). The role of xanthophyll cycle carotenoids in the protection of photosynthesis. Trends Plant Sci., 1: 21-26.

Dorgham ,E.A. (1999). Effect of low gamma-ray and seedling rates on growth , yield and its components as well as seed quality of lentils (*Lens culinaries,* Med).Arab J. of Nucl. Sci. and Appl. ,32(1) : 249-256.

Dubois, M.; Smith, F.; Gilles, K. A.; Hamilton, J. K. and Rebers, P.A. (1956).Colorimetric mothod for determination of sugars and related substances. Annal. Chem., 28(3): 350-356.

El-Demerdash, H. M. (2007). Genetic studies on two soybean cultivars irradiated with gamma rays. Isotope & Rad. Res., 39(3):719-730.

El-Ghareeb, I.M. (2006). Gamma rays mutagenic influence in development pea agronomic and biochemical characters. Annals of Agric. Sci., Moshtohor, 44(2): 637-652.

El-Khateeb, M.A. (1994). Response of *Murraya exotica* L. seedling to saline water irrigation. Bulletin of Fac. of Agric., Cairo Univ., 45(1):149-163.

El-Khateeb, M.A.; Sharabas, M.T.; El-Sharnouby, M.E.; Hamid-Eldin, N.; Nasr, A.A. and Sayed, R.I. (2007). Effect of sterilization and gamma irradiation on growth, chemical and anatomical composition of Melissa plant through tissue culture. Isotope &Rad. Res., 39(3):575-582.

Ellyfa, K.; Ahmed, O.H.; Shaharudin, S. and Abdul Rahman,D. (2007). Gamma radio sensitivity study on snap bean(*Phaseolus vulgaris*). International Journal of Agricultural Research, 2(9):844-848.

El-Mahrouk, E.M.(1980). Effect of Soil Salinity on *Dimorphotheca ecklonis, Callistephus chinensis, lantana Camara* and *Myoporum pictum*. M.Sc. Thesis, Fac. Agric., Kafr El-Seikh.,Tanta Univ., Egypt.114p.

El-Makawy, M.A.M. (1999). Effect of certain cultural treatments on growth and chemical composition of some medicinal plants grown under north sinai conditions. Ph.D Thesis,Fac. Agric.,El-Arish Sues Canal Univ.,Egypt,182p.

El-Mogy, A .M. E. (1999). Physiological studies on growth and active ingredients of *Ambrosia maritime* L. plants. Ph.D. Thesis, Fac. Agric.,Zagazig Univ., Egypt.168p.

El-Nimer, H.M.; Khalid, K.M. and Nasr, S. N. M. (1992). Growth, physiological and chemical composition of Datura plants in saline soils. Egypt. J. Agric. Res., 70(4): 997-1009.

El-Raslan, F.; Inal ,A.; Savasturk, O. and Gunes, A. (2007). Changes in antioxidative system and membrane damage of lettuce in response to salinity and boron toxicity. Scientia Horticultutae, 114:5-10.

El-Sanafawy,S.S. (2000). Physiological Studies on *Ocimum basilicum*, L.and *Ambrosia maritima*, L. Plants. Ph.D. Thesis, Fac. Agric.,Kafer El Shakh,.Tanta Univ., Egypt.91p

El-Shafey, S.A.; Awad, A.E.; Meawad, A.A. and El-Shaer M. (1991). Physiological influences of gamma irradiation on the growth, oil yield, leaf pigments and chemical composition of sweet basil plants. Zagazig J. Agric. Res. ,18(6): 2221-2228**.**

El-Sharnoubi, A.E.M. (2002). Effect of gamma irradiation and salinity on production and chemical composition of *Hypericum perforatum* plant through tissue culture. Ph.D. Thesis, Fac. Agric., Cairo Univ,Egypt,188p.

El-Sharnouby, M.E.; Mostafa, A.A. and Ragab, E. (2007). Effect of gamma irradiation and additives on the production and chemical composition of sweet basil through tissue culture. Bulletin Fac. Agric., Cairo University, 58 (4):239-243.

El-Sharnouby, S.E.; Naguib, N.Y. and Hussein, M.S. (1997). Effect of gamma irradiation and sulphur fertitizer on growth and chemical composition of *Hibiscus sabdarifa* L., J. Physiol. Sci., 21(1):115-127.

EL-Sherbeny, E .M. (1995). Physiological studies on the effect of salinirrigation water and some growth regulators on *Tagetes erecta* plant.Ph.D.Thesis, Fac.Agric, Zagazig Univ., Egypt,146p.

El-Tarawy, M.A. (1976). Effect of soil salinity on *Kokia tricophylla*, *Zinnia elegans*, *Matthiola incana* and *Calendula officinalis*. M.Sc.Thesis, Fac.Agric., Kafr El-Seikh,Tanta Univ, Egypt.146p.

Erkan, M.; Wang, S.Y. and Wang, C.Y. (2008). The effect of UV treatment on antioxidant capacity, antioxidant enzyme activity and decay in strawberry fruit. Post Harvest Biology and Technology, 48: 163-171.

Everardo, A. N; Stolzy, L. H. and Mehuys, G.R. (1974). Effect of soil osmotic potential produced with two salt species on plant water potential, growth and grain yield of wheat. Plant and soil, 42: 619-629.

Farid, M.R.; Haba, E.A.; Mahmoud, H.F. and El-Sawy, M.M.A. (1999). Physiological and biochemical response of sweet marjoram (*Majorana hortensis* L.) to foliar kinetin application and gamma radiation. Memofiya J. Agric. Res., 24(1): 251-260.

Fiad, A. M .E. (1997). Physiological studies on the effect of soil saline and fertilization on *Nigella sativa* plants. Ph.D.Thesis, Fac. Agric,.Zagazig Univ.,Egypt,115p.

Foyer, C.H. and Harbinson .J. (1994). Oxygen metabolism and the regulation of photosynthetic electron transport. In:causes of photooxidative stress and amelioration of defense systems in plants, foyer C.H and P.M. mullineaux (Eds.).CRC Press,Boca raton. FL., 13:1-42.

Franco, O.L. and Melo, F.R. (2000). Osmoprotectans - a plant strategy in response to osmotic stress. Russ J. Plant Physiol., 47:137–144.

Frost, A; Rrez, C.J. and Purrington, C.B. (2003). Fitness of cuscuta salina(convolvulaceae) parasitizing *Beta vulgaris* chenopodiaceae grown under different salinity regimesi.American Journal of Botany, 90(7): 1032–1037.

Gaber, A. M.; Mostafa, H. A. and Ramadan, A. A. (2002). Effect of gamma irradiation of faba bean (*Vicia faba*) plant on its chemical composition, favism causative agents and hormonal levels. Egyptian Journal of Physiol .Sci.,24(1): 1-16.

Gartten, S.R. and Grive, C.M.(1992). Mineral element acquisition and growth response and plants growth in saline environments. Agric. Ecosystems and Envronments,38(4): 275-300.

Girija, C.; Smith, B.N. and Swamy, PM. (2002). Interactive effects of sodium chloride and calcium chloride on the accumulation of proline and glycinebetaine in peanut (*Arachis hypogaea* L.). Environ. and Exper. Bot., 47:1-10.

Girija, M. and Dhanavel, D. (2009). Mutagenesis and efficiency of gamma rays ethyl methan sulphonate and their combined treatments in cowpea (*Vinga unguiculata* L.). Glob. J. of Mol. Sci., 4: 68-75.

Gouia, H.; Ghorbel , M.H. and Touraine, B. (1994). Effects of NaCl on flow of N and mineral ions and NO_3- reduction rate within whole plants of salt-sensitive bean and salt-tolerant cotton. Plant Physiol., 105:1409-1418.

Greenway, H. and Munns, R. (1980). Mechanisms of salt tolerance in nonhalophytes. Annu.Rev. Plant Physiol.,31:149-190.

Guevara, P.; Perez-Amdor, M.C. and Herrera, J. (1997).Influence of UV light on flavonoid profiles of two maize lines with different response to armyworm (*Spodoptera frugiperda*) attack. Phyton., 60, 137-140.

Guirgis, A. A.; Abdl El-Kawi M.A.; Abbas, H.N.; Arfaa A.M.S. and Maksoud, A.I. (2007). High rosmiric acid content in induced mutants and in vitro elicited sweet basil (*Ocimun basilicum* L.) callus. Asian J. Plant Sci., 6(7):1058-1064.

Gulzar, S.; Khan, M.A. and Ungar, I.A. (2003). Effects of salinity on growth, ionic content and plant water relations of *Aeluropus lagopoides*. Comm. Soil Sci. Plant Anal., 34: 1657–1668.

Hajar, A.S.; Heikal, M.M.; Maghrabi, Y.M. and Abuzinadah, R.A.(1993). Response of *Arachis hypogaea* (Peanut) to salinity stress .J.K.A.U. Sci., 5: 5-13.

Hameed, A; Shah, T.M; Atta. B.M; Haq.M.A.and Sayed ,H. (2008). Gamma irradiation effects on seed germination and growth,protein content, peroxides and protease activity,lipid per oxidation in Desi and kabuli chickpea. Pak. J. Bot.,40(3):1033-1041.

Hamideldine, N.(2010). Molecular comparative studies on the effects of gamma irradiation and osmopsriming on tomato seeds. J. Rad. Res .Appl. Sci.,3(1):129-148.

Hamideldine, N. and Hussein,O. S. (2009). Response of irradiated Egyptain clover (*Trifolium alexandrinum*, L.) to water stress. Arab.J. of Nucl. Sci .and Application, 42(4):295-304.

Hanafy Ahmed, A.H. (1996). Physiological studies on tipburn and nitrate accumulation in lettuce plants. J.Agric. Sci. Mansoura Univ., 21(11) : 3971-3994.

Hanafy Ahmed, A. H.; Higazy, M.A.; El-Shafey, Y.H. and Moussa, S.F. (2002). Effect of salinity, silicon and proline on the growth, yield and chemical composition of wheat plant. Proc.2nd Congr. Recent Tec.Agric., 28-30 October (2002), Fac. Agric., Cairo Univ., pp. 965-978.

Hanafy, M. S.(1989) Effect of cChemical Fertilization and Salinity on Production of Herb and Essential oil of Marjoram Plants.Ph. D. Thesis, Fac.Agric. Cairo, Univ. Egypt.144p.

Hanna-alla, M. H. (1997). Effect of gamma-radiation on some characters of onion (*Allium cepa* L). Menofiya .J. Agric .Res.,22 (2):509-524.

Hare, P.D. and Cress, W.A. (1997). Metabolic implictions of stress-induced proline accumulation in plants. Plant Growth Regulation, 21: 79-102.

Harrison, K. and Were, L.M. (2007). Effect of gamma irradiation on total phenolic content yield and antioxidant capacity of Almond skin extracts. Food Chemistry, 102:932-937.

Hartzendorf, T. and Rolletschek ,H. (2001). Effects of NaCl-salinity on amino acid and carbohydrate contents of *Phragmites australis*. Aquatic Botany, 69:195-208.

Hassan, H.M.; Ali, M.A. and Darwish, I.M. (2000). Effect of gamma irradiation on the susceptibility of cowpea to root knot nematode (*Meloidogyneincognita*). Minia. J. Agric.Res. & Develop, 20 (1): 47-56 .

Hassanein, R. A. (2003). Effect of some Amino Acids, Trace Elements and Irradiation on Fennel (*Foeniculum vulgare* L.) M.Sc. Thesis, Fac. Agric., Cairo Univ., Egypt, 119 p.

Hassanein, R.A.; Sharabash, M.T.M.; Abd Alla, M.A.; Orabi, I.O. and Farag, I.A.A. (1998). Effect of gamma irradiation and phosphorous fertilizer on growth and yield of faba bean seeds during their development and at harvest. Al-Azhar J. Agric. Res. 27: 47-62.

Hebbara, M.; Rajakumar, G.R.; Ravshanker, G. and Raghavaiah, C.V. (2003). Effect of salinity stress on seed yield through physiological parameters in sunflower genotypes. Helia., 26(39):155-160.

Hegazi, A.Z. and Hamideldin, N. (2010). The effect of gamma irradiation on enhancement of growth and seed yield of okra (*Abelmoschus esculentus*L. Monech) and associated molecular changes. Journal of Horticulture and Forestery,2(3):38-51.

Helaly, M.N.M. and El-Hosieny, A.M.R. (2011). Effectiveness of gamma irradiated protoplasts on improving salt tolerance of Lemon (*Citrus limon* L.Burm.f.).American Journal of Plant Physiology, 6(4):190-208.

Hendawy, S.F. and Khalid, Kh.A. (2005). Response of sage (*Salvia officinalis* L.) plants to zinc application under different salinity levels. J. Appl. Sci. Res., 1(2):147-155.

Hernandez, J.A.; Ferrer, M.A.; Jimenez, A.; Barcelo, A.R. and Sevilla, F.(2001). Antioxidant systems and O^{-}_2/H_2O_2 production in the apoplast of pea leaves. Its relation with salt-induced necrotic lesions in minor veins. Plant Physiol.,127:817-828.

Heuer, B.; Yaniv, Z. and Ravina ,S. (2002). Effect of late salinization of chia (*Salvia hispanica*), stock (*Matthiola tricuspidata*) and evening primrose (*Oenothera biennis*) on their oil content and quality. Industrial Crops and Products, 15: 163–167.

Hotta, M.; Nemoto, S.and Mimura, T. (2000). Re-evaluation of role of vacuole during salt adaptation in higher plant cells. Plant Cell Physiol.41(Suppl.):79-91.

Hussain, K.; Abdul Majeed, M.; Nisar, F.; Nawaz, K.; Bhatti, K. H. and Afghan, S.(2009a). Growth and ionic adjustments of chaksu (*Cassia absus* L.) under NaCl stress American-Eurasian J. Agric. & Environ. Sci., 6 (5): 557-560.

Hussain, K.; Abdul Majeed, K.; Nawaz, K. ;Bhatti, K.H. and Nisar, F.(2009b). Effect of different levels of salinity on growth and ion contents of black seeds (*Nigella sativa* L.). Current Research Journal of Biological Sciences 1(3): 135-138.

Hussein, M.M.; Balbaa, L.K. and Gaballah, M.S. (2009). Salysilic acid and salinity effects on growth of maize plants. Res. J. Agric. Biol. Sci., 3(4):321-328.

Hussein, M.S.; El-Sherbeny, S.E. and Naguib, N.Y. (1995). The effect of γ radiation and manganese application on growth and chemical constituents of *Datura metel* L. Egypt. J. Physiol. Sci., 19(1-2): 241-254.

Hussein, O. S. (1996). Effect of some treatments on vitality of stored saybean seeds. M.Sc. Thesis, Fac.of Sci., AI-Azhar University for Cairo, Egypt,184p.

Hussein, O.S. (2010). Effect of ascorbic acid and /or sodium chloride on radiated *mugbean* seeds. Arab J.Nucl.Sci.& Appli.,43(2)281-282.

Hussein, O.S. and Atia, I.A. (2009). Using of Gamma rays in Stimulation and Improvement of Mushroom Spawns " *Plerotus ostreatus*" Egypt. J.Rad.Sci.Applic., 22 (1):275-385.

Hussien, E.H.; and Abd El-Nabi, L. (1996). Effect of irrigation with saline water on damsisea oil and it's efficacy on *Spodoptera lihoralis* (BOISD). 1st Egypt.Hung.Hort.Conf.,Vol.1.

Hussien, M. S. (1986). Studies on the Physiological Drought Tolerance in Lemongrass.Ph.D. Thesis ,Fac. Agric., Zagazig Univ. Egypt.136p.

Irfaq, M. and Nawab, K. (2001). Effect of gamma irradiation on some morphological characteristics of three wheat (*Triticum aestivum* L.) cultivars. J. Biol. Sci., 1(10): 935-945.

Iyengar, E.R.R. and Reddy, M.P. (1996). Photosynthesis in high salt-tolerant plants. In: Pesserkali, M. (Ed.), Hand Book of Photosynthesis. Marshal Dekar, Baten Rose, USA, pp. 56–65.

Izzo, R.; Belligno. A; Muratore, G. and Izzo, F.N. (1996). Seedling growth and Ca^{2+},K^{+} and Na^{+} accumulation in maize roots as affected by NaCl. Agrochimica, 40 (1) : 25-32.

Jackson, M. l. (1973). Soil chemical analysis. Prentice-Hall, Inc. Limited New York.pp125-179.

Jaleel, C.A.; Manivannan, P.; Lakshmanan, G.M.A.; Sridharan, R. and Panneerselvam,R.(2007). NaCl as a physiological modulator of proline metabolism and antioxidant *Phyllanthus amarus*.Comptes rendus Biol., 330:806-813**.**

Javanmardi, J.; Khalighi, A.; Kashi, A.; Bais, H.P. and Vivanco, J.M. (2002). Chemical characterization of basil (*Ocimum basilicum* L.) found in local accessions and used in traditional medicines in Iran. J. of Agricultural and Food Chemistry, 50 : 5878-5883.

Johnson, C.B.; Kirby, J.; Naxakis, G. and Peorson, S. (1999). Substantial UV-B-irradiated induction of essential oil in sweet basil (*Ocimum basilicum* L.). Phytochemisrty, 51:507-510.

Kandeel, A.M.; Hassan, S.M. and Sadek, A.A. (1991). The growth and chemical composition of *Ocimum basilicum* L. plants as affected by gamma radiation. Zagazig J. Agric. Res., 18(6): 2111-2121**.**

Kawther, R. ; Shehata, S. A. M. and Bondok, M. A. (1996). Hormone balance, germination, growth and pod shedding of faba bean as affected by gamma irradiation. Annals Agric. Sci., Ain shames Univ., Cairo, 41(2): 551-566.

Kerrit, A. A. (2005). Effect of some growth regulators on maize plants growth and productivity under salt stress in Gaza Strip. Ph.D Thesis Woman´s College for Arts, Science and Education. Ain Shams University, Egypt.178p.

Khalafallah, A. A.; Tawfik, K. M. and AbdEl-awad, A. Z. (2008). Tolerance of seven faba bean varities to drought and salt stresses. J. Agric. Biol. Sci., 4(2):175-186.

Khalid, A. Kh . (2006). Influence of water stress on growth, essential oil, and chemical composition of herbs (*Ocimum* sp.) Int. Agrophysics, 20: 289-296.

Khan, A. A. (1993). Preplant physiological seed conditioning, Horti. Rev., 13:131-181.

Khan, D. and Ahmed, R. (1998). Effect of saline water irrigation on germination, growth and mineral distribution in *Indigofolia oblongifolia* forsk.Hamdard Medicus. , 41(4):81-93.

Khan, M.A.; Ungar, I.A.and Showalter, A.M.(1999). Effects. of salinity on growth, ion content, and osmotic relations in *Halopyrum mocoronatum*(L.) Stapf. J. Plant Nutr. ,22: 191–204.

Khater, M.R.; Hussein, S.H. Mohamed, E.M. and El-Latife, T.A. (2002). Effect of saline irrigation water and plant spacing on damsisa plant (*Ambrosia maritime* L.). J. Agric. Sci. Mansoura Univ., 27: 3451-3461.

Khatkar, D. and Kuhad , M. S. (2000). Short-term salinity induced changes in two wheat cultivars at different growth stages. Biol. Plant.,43 (4) 629-632.

Khattak, K. F.; Simpson, T. J. and Ihasnullah. (2008). Effect of gamma irradiation on the extraction yield, total phenolic content and free radical-scavenging activity of *Nigella sativa* seed. Food Chemistry, 110:967-972.

Khidr, Z. A.; Essam, E.D.M.; Tahoon, S.K.E. and Sabal, A.E.S. (2010). Stress evokes changes in response to sakha-69 wheat according to sodium and calcium anions. Australin Journal of Basic and Applied Sciences,4(12):6140-6153.

Khodary,S.E. A. (2004). Effect of NaCl salinity on improvement of nitrogen metabolism and some ions uptake in lupine plants subjected to gamma irradiation.Int. J. Agri. Biol. 6 (1):1-4.

Kim, j. H.; Beak, M.H.; Chnug, B.Y.; Wi ,S.G. and Kim ,J. S. (2004). Alternation in the photosynthic pigments and antioxidant machineries of red pepper (*Capsicum annuum* L.) seedlings from gamma –irradiated seeds. J. Plant Biol .,47:314-321.

Kim, K.N.; Cheong, Y.H.; Gupta, R. and Luan, S. (2000). Interaction specificity of *Arabidopsis calcineurin* B-like calcium sensors and their target kinases. Plant Physiol., 124:1844–1853

Kim, M.C.; Panstruga, R. ; Elliot, C. ; Muller, J.; Devoto, A. ; Yoon, H.W.; Park, H.C.; Cho, M.J. and Schulze-Lefert, P. (2002). Calmodulin interacts with MLO protein to regulate defense against mildew in barley . Nature, 4226: 447-450.

Kinebery, M.E.A. (1994). Evaluation of some new promising flax strains under soil salinity condition.Ph.D. Thesis, Fac. of Agric., Moshtohor, Zagazig Univ., Egypt,156p.

Kiong, P.A.; lai A.G.; Hussein, S. and Harun, A. (2008). Physiological responses of *Orthosiphon stamineus* plantlets to gamma irradiation. American Eurasian J. Sustainable Agricultural, 2 (2): 135-199.

Koseki, P.M.; Villavicencio, A.L.C.H.; Brito, M.S.; Nahme L.C.;Sebastiao, K.I. and Rela, P.R. (2002). Effect of irradiation in medicinal and eatable herbs . Radiation Physics and Chemistry, 63:681-684.

Kotb, S.H.; Ali, A.F. and Khater, M.R.(2001). Effect of salinity treatmens and active dry yeast on growth and active ingredients of *Ambrosia maritima*L. The Fifth Arabian Horticulture Conference,Ismailia, Egypt, 24-28 March,pp.217-224.

Kotb, S.H and El-Gamal. E. A. (1994). Effect of salinity treatments on growth,oil yield and chemical composition of *Nigella sativa* L. Egypt. J.Agric.Res., 72 (1):195-205.

Kovacs, E. and Keresztes, A. (2002). Effect of gamma and UV-B/C radiation on plant cell. Micron, 33: 199-210.

Kumari, R. and Singh, Y. (1996). Effect of gamma rays and EMS on seed germination and plant survival of *Pisum sativum* L., and *Lens culinaris* . Medic. Neo Botanica, 4(1): 25-29.

Lee, S. J.; Umane, K.; Shibamoto, T. and Lee, K.G. (2005). Identification of volatile components in basil (*Ocimun basilicum* L.) and thyme leaves (*Thymus vulgaris* L.) and their antioxidant properties. Food Chemistry, 91:131-137.

Lee, T. and Liu, C. (1999). Correlation of decreased calcium contents with proline accumulation in the marine green macroalga *Ulva* fasciata exposed to elevated NaCI contents in seawater .J. Exp. Bot., 50 :1855-1862.

Lee, Y; Kim, J.S; Baek, M.H. ;Lee,Y.K. and Im, D.S. (2002). Effects of low dose gamma radiation on the growth activities of enzymes and photosynthetic activities of gourd (*Lagenaria siceraria*). Kor J Environ Biol., 20:197-204.

Lee, Y.; Kim, J.S.; Baek, M.H.; Yoo, J. C. and Kwon, S.T. (2003). Effects of low dose γ-irradition on physiological activities of radish (*Raphanus sativus*) during early growth and reduction of ultraviolet-B stress.J of the Kor Soci Horti Sci,44 (3): 314-320.

Ling, A.P.K.; Chia, J.Y.; Hussein, S. and Harun, A.R. (2008). Physiological responses of *Citrus sinensis* to Gamma irradiation. World Applied Sci.J.,5:12-19.

Lois, R. (1994). Accumulation of UV-absorbing flavonoids induced by UV-B radiation in *Ambidopsis thaliana* L. Planta, 194: 498-503.

Madan, S.; Nainawatte, H.S.; Jain, R.K. and Choudhury, J.B. (1995). Proline and proline metabolising enzymes *in vitro* selected NaCl tolerant *Brassica juncea* under salt stress., Ann. Bot., 76: 51–57.

Mansour, M.M.F. (1994). Changes in growth, osmotic potential and cell permeability of wheat cultivars under salt stress. Biol.Plant.,36(3): 429-434.

Marcelis, L.F.M.and Van,H. J. (1999). Effect of salinity on growth, water use and nutrient use in radish (Raphanus sativus L.). Plant Soil, 215: 57-64.

Marschner,H.(1995). Mineral Nutrition of Higher Plants. 2nd.Academic press,Harcourt Brace Company, Publishers London, San Diego, New York, Boston, Sydney, Tokyo, Toronto.

Masada, Y. (1976). Analysis of essential oil by gas chromatography and matter spectrometry.A Halsted Press Book, John WileySons, New York, London.pp.118-120.

Matile, P.; Hortensteiner, S. and Thomas, H. (1999). Chlorophyll degradation. Ann. Rev.Plant Physiol.Plant Mol Biol., 50:67-95.

Meloni, D.A.; Oliva, M.A.; Ruiz, H.A. and Martinez, C.A.; (2001). Contribution of proline and inorganic solutes to osmotic adjustment in cotton under salt stress. J. Plant Nutr., 24:599–612

Miflin, B. (2000). Crop improvement in the 21st century; J. Exp. Bot.;51:1-8

Misra, A. V.; Sahu, S. M.; Misra, M.; Singh, P.; Meera, I.; Das, N.; Kar, M. and Shau, P. (1997). Sodium chloride induced changes in leaf growth, pigments and protein contents in two rice cultivars. Biol. Plant., 39: 257-262.

Mittle, R. and Dubey, R.S. (1991). Influence of salinity on ribonuclease activity and nucleic acids status in rice seedlings differing in salt tolerance. Plant Physiol. Biochem., 18(1):57-64.

Moghaieb, R .E.A.; Saneoka, H. and Fujita, K. (2004). Effect of salinity on osmotic adjustment, glycin ebetaine accumulation and the betaine aldehyde dehydrogenase gene expression in two halophytic plants, *Salicornia europaea* and *Suaeda maritime*. Plant Sci., 166: 1345-1349.

Mohamed, F.A.; Hashim, M.F; El-Bagoury O.H. and Maghraby G.M.(1998). Physiological response of soybean to gamma radiation and GA_3.1-Plant growth and nitrogen content of plant. Fourth Arab Conference on the Peaceful Uses of Atomic Energy ,Tunis :14-18/11/1998 AAEA,

Morales, M.A.; Sanches-Blanco, M.J.; Olmos, E.; Torrecillas, A. and Alarcon, J.J. (1998). Changes in the growth, leaf water relations and cell ultrastructure in *Argyranthemum coronopi-folium* plant under saline conditions J. Plant Physiol., 153(1/2):174-180.

Morgan, H. S. (2007). Some physiological studies on wheat plant growing under salinity stress conditions M.Sc. Thesis, Fac. A gric.,Cairo Univ.,Egypt.364p.

Mostafa, M.A. (2002). Genetic Improvement for Sweet Potato Using the New Techniques and Gamma Rays. M.Sc. Thesis , Fac . Agric. Al- Azhar University, Egypt.182p.

Moussa, H. R. (2006). Gamma irradiation regulation of nitrate level in rocket (*Eruca vesicaria* subsp. sativa) plants. Journal of New Seeds, 8(1):91-100.

Moussa, M and abdul Jaleel, A. (2011). Physiological Effects of Glycinebetaine on Gamma-Irradiated Fenugreek Plants (*Trigonella foenum-graecum* L.). International Journal of Vegetable Science.,17:60-74.

Munns, R. (2002). Comparative physiology of salt and water stress. Plant Cell Environ., 25:239–250.

Munns, R. and Termaat, A. (1986). Whole plant response to salinity Australian J.Plant Physiol., 13: 143-160.

Muthukumarasamy, M.S.; Gupta, D. and Panneerselvam, R. (2000). Influence of triadimefon on the metabolism of NaCl stressed radish. Biol. Plant., 43:67-72.

Nassar, A.; Hashim; M.F.; Hassan, S.N. and Abo-Zald, H. (2004). Effect of gamma rays and phosphorus on Chamomile. Int. J. Agri. Biol., 6 (5)**:**776-780.

Nesiem, M.R. and Ghallab, A.M. (1998). Interactive effect of abscisic acid and salinity on growth and yield of two wheat cultivars (*Triticum aestivum).*Proceeding Sixth Egyptian Botanical Confer., Cairo Univ. , I: 133-154.

Nieman, R.H.; Clark, R.A.; Pap, D.; Ogata, G. and Maas, E.V.(1988).

Effects of salt stress on adenine and uridine nucleotide pools, sugar and acid-soluble phosphate in shoots of pepper and safflower. J.Exp.Bot.,39(200):301-309.

Nornai, R. (1982). Formula for determination of chlorophylls pigments extracted with N. N. dimethyl formamide. Plant Physiol., 69: 1371-1381.

Norfadzrin. F.; Ahmed, O.H.; Shaharudin, S. and AbduRahman. A.(2007). Apreliminary study on radiosensitivity of tomato(Lycopersicon esculentum) and okra (Abelomoschus esculentus).International Journal of Agricultural Research, 2(7):620-625.

Okamoto, H. and Tatara, A. (1995). Effects of low-dose γ-irradiation on cell cycle duration of barley roots. Environ Exp Bot., 35:379-385.

Omar, S.R.; Osmanu, H.A.; Shaharudin, S. and Nick, M.A.M. (2008). Gamma radiosensivity study on chili (*Capsicum annuum*).American J of App Sci.,5(2):67-70.

Orabi, O. A.I. (1998). Effect of seed irradiation and salinity on growth, chemical composition, and seed production and its quality of cowpea.Egypt. J.Appl.Sci., 13 (1):201-215.

Parida, A.K; Das, A.B and Mittra,B. (2004). Effects of salt on growth, ion accumulation, photosynthesis and leaf anatomy of the mangrove, *Bruguiera parviflora*. Trees-Structure and Functions, 18:167-174.

Parida, A. K.; Das, A .B.; Sanadac, Y. and Mohantyb, P. (2003). Effects of salinity on biochemical components of the mangrove, *Aegiceras corniculatum*. Aquatic Botany, 80:77-87.

Perez-Alfocea, F.; Estan, F.; Caro, M. and Balarin, M.C. (1993). Response of tomato cultivars to salinity. Plant Soil, 150:203–211.

Petersen, M. and Simmonds, M.S.J. (2003).Rosmarinic acid. Phyto chemistry , 62:121-125.

Piceman, A. K.; Arnason, J. T. and Lamert, J.D.H. (1986). Hymenin another sesquiterpene lactone in *Ambrosia maritima*. J.Nat.Prod. 49: 556.

Piper, G.S. (1947). Soil and Plant Analysis. Interscience Publishers, Inc.NY, 368p.

Prasad, A.; Patra, D.D.; Anwer, M. and Singh, D.V. (1997). Interactive effects of salinity and nitrogen on mineral N status in soil and growth and yield of German chamomile (*Matricaria chamomilla*) (*Chamomilla recutital*).Journal of Indian Society of Soil Science, 45(3): 537-541.

Ramadan, **E. M. (1996)**. Effect of salinity and some elements on guar .M. Sc. Thesis ,Fac. Agric., Zagazig Univ., Egypt,145p.

Rashad, E. M. (1995). Physiological studies on the effect of saline irrigation water and some growth regulators on *Tagest erecta* plant. Ph.D. Thesis, Fac.Agric.,Zagazig Univ., Egypt,136p.

Rathert, G. (1984). Sucrose and starch content of plant parts as a possible indicator for salt tolerance. Australian J. of Plant Physio., 11 (6):491-495.

Rawya, A.E (2001). The influence of some environmental conditions on the productivity and quality of flax fiber and seed. Ph.D.Thesis , Fac. of Agric., Cairo Univ., Egypt,187p.

Razmjoo, K.; Heydarizadeh, P. and Sabzalian, M.R. (2008). Effect of salinity and drought stresses on growth parameters and essential oil content of *Matricaria chamomila*. Int. J. Agri. Biol., 10: 451–454.

Reddy, M. P; Sanish, S. and Lyengar, E.R.R. (1992). Photosynthetic studies and compartmentation of ions in different tissues of *Salicornia brachiata* Rob under saline conditions Photosynthetica, 26: 173- 179.

Reddy, M.P.; Rao,U.S. and Lyengar, E.R.R. (1997). Carbon metabolism in plants under stress, p.159–190. In: P.K. Jaiwal, R.P. Singh, and Agulati (eds.). Strategies for improving salt tolerance in higher plants. Science Publ., Enfield,N.H.

Reggiani, R.; Bozo, S. and Bertrani, A.(1994). Changes in polyamine metabolism in seedlings of three wheat (*Triticum aestivum* L.) cultivars differing in salt sensitivity. Plant Sci., 102(2): 121-126.

Rejili, M.; Telahigue, D.; Lachiheb, B.; Mrabet, A.and Ferchichi, A. (2008). Impact of gamma radiation and salinity on growth and K^+/Na^+ balance in two populations of *Medicago sativa* (L.) cultivar Gabes. Progress in Natural Science, htm, 18 (9):1095-1105.

Rejskova, A.; Patkova, L.; Stodulkova, E. and Lipavska, H. (2007). The effect of abiotic stresses on carbohydrate status of olive shoots (*Olea europaea* L.) under *in vitro* conditions. J. Plant Physiol., 164 :174-184.

Rhodes, D. and Hanson, A. D. (1993). Quarternary ammonium and tertiary sulfonium compounds in higher plants, Annu. Rev. Plant Physiol. Plant Mol. Biol., 44: 357-384.

Said, H. A. I. (2001). Biochemical studies on the major constituents of mint oil under the influence of some environmental conditions. M.Sc. Thesis , Fac. Agric., Ain Shams Univ.,Cairo. Egypt.,142p.

Sangwan, N. S.; Farooqi, A. H. A.; Shabih, F.and Sangwan, R.S. (2001). Regulation of essential oil production in plants. Plant Growth Regul., 24: 3–21.

Shah, T.M.; Mirza, J.I.; Haq, M.A. and Atta, B.M. (2008). Radio sensitivity of various chickpea genotypes in M1 generation I-laboratory studies.Pak.J.Bot., 40(2):649-665.

Shimose, N.; Sekiya, J.; Kimura, O. and Suzuki, I. (1991). Salt tolerance of *Amaranth mugwort*, eggplant and perilla. Japanes J . of Tropical Agriculture, 35(1):16-19.

Singh , A.K and Dubey, R.S. (1995). Changes in chlorophyll a and b contents and activities of photosystems 1 and 2 in rice seedlings induced by NaCI. Photosynthetica, 31(4): 489- 499.

Slacanin, I.; Vargas, D.; Marston, A and Hostettmann, K. (1988).

Determination of molluscicidal sesquiterpene lactones from *Ambrosia maritima* (Compositae).J. Chromato, 457: 325-331.

Snedecore,G.W.and Cochran,W.G.(1980). Statistical methods.

Seventh Edition, Iowa State Univ.,Ames., Iowa, U.S.A.

Soliman,M.S.A. and Abd El-Hamid, M. (2003). Certain physiological, biological and molecular aspects of kidney bean plants originating from gamma-irradiated seeds during seed germination and plant development. Egypt.J.Rad.Sci. Applic.,16 (1):189-211.

Song, H. P.; Kim, D. H.; Lee, C. H.; Kim , K. S. and Byun, M.W. (2006). Effect of gamma irradiation on the microbiological quality and antioxidant activity of fresh vegetable juice. Food Microbiology, 23: 372-378.

Stan, S. and Croitoru, A. (1970). Effects of low, moderate and high levels of gamma radiations(Co-60) on soybean plants,l. Analysis of growth and yield, Stim.Newsl. 1,23.

Stoeva, N. (2000). Physiological responses of young bean plants (*Phaseolus vulgaris* L.) as a result of pre-sowing treatment of the seeds with gamma-rays. Journal of Environmental Protection and Ecology, 1(4): 425-428.

Sudhakar, C.; Reddy, P. S. and Veeranjaneyulu, K. (1993). Effect of salt stress on the enzymes of proline synthesis and oxidation of green gram seedlings. J. Plant Physiol., 141: 621–623.

Swailam, M. H. (2009). Quality characteristics of irradiated sasame seeds during storage**.**Egypt**.** J.Rad.Sci.Applic., 22 (1):323-342 .

Swain, T. and Hillis, W. E. (1959). The quantitative analysis of phenolic constituents. J.Sci.Food Agric.,10:63-68**.**

Taguchi, Y.; Tsutsumi, N.;Tatara, A.; Eguchi, H. and Tano, S. (1994). Effects of low-dose γ-irradiation on the root apical meristem of barley. Environ. Mut .Res. Commun.,16:205-211.

Takemura, T.; Hanagata, N.; Sugihara, K.; Baba, S.; Karube, I. and Dubinsky,Z. (2000). Physiological and biochemical responses to salt stress in the mangrove, *Bruguiera gymnorrhiza*. Aquatic Botany ,68 :15–28.

Tejera, N. A; Campos, R.; Sanjuan, J. and Liuch,C. (2005). Effect of sodium chloride on growth, nutrient accumulation, and nitrogen fixation of Common Bean plants in symbiosis with isogenic strains. Journal of Plant Nutrition, 28: 1907–1921.

Tiwari, R. K.; Pathak, R. K. and Pandey, D. (1994). Response of canola seedling (*Emblica officinalis*) to soil sodicity.Ind. J.Plant.Physiol., 37 (3) :180-182.

Toker, C. B.; Uzun, H.; Canci, F. and Oncu Ceylan (2005). Effects of gamma irradiation on the shoot length of *Cicer tsibkov* seeds. Radiat. Phys. Chem., 73: 365-367.

Tuckholm, V. (1974)." Students Flora of Egypt", 2^{nd} Ed. P.568, Cairo University, Cooperative Printing Company, Beirut.

Tuncturk, M.; Tuncturk, R.; Yildirim, B. and Ciftci, V. (2011). Effect of salinitystress on plant fresh weight and nutrient composition of some canola (*Brassica napus*.L)cultivars. African Journal of Biotechnology, 10 (10):1827-1832.

Valia, R.Z.; Patil, V. K. and Patil, Z. N. (1993). Effect of soil on the growth and chemical composition of drumstick (*Moringo leifera*,lamk). South.Ind.Hort.,41(2):84-90.

Vaijapurkar, S.G; Agarwal, D.; Chaudhuri, S.K.; Senwar K.R. and Bharnagar, P.K. (2001). Gamma-irradiated onions as a biological indicator of radiation dose. Radiat Meas., 33:833 – 836

Wang, Y. and Nil, N. (2000). Changes in chlorophyll, ribulose biphosphate carboxylase–oxygenase, glycine betaine content, photosynthesis and transpiration in *Amaranthus tricolor* leaves during salt stress. J. Hor. Sci. Biotech., 75: 623–627.

Wi, S.G.; Chung, B.Y.; Kim, J. H.; Baek, M. H.; Yang, D.H., Lee, J. W. and Kim, J.S. (2005). Ultrastructural changes of cell orangelles in *Arabidopsis* stem after gamma irradiation. J. Plant Biol., 48 (2):195-200.

Wi, S.G.; Chung, B.Y.; Kim, J.S.; Baek, M.H.; Lee, J.W. and Kim, Y. S. (2006). Effect of gamma irradiation on morphological changes and biological responses in plants. Micron,38(6): 553-564.

Xiong, L. and Zhu, J.K. (2002). Molecular and genetic aspects of plant response to osmotic stress. Plant Cell Environ., 25:131–139.

Yeo, A. (1999). Predicting the interaction between the effects of salinity and climate change on crop plants. Sci. Hort. ,78: 159-174.

Youssef, A.A. and Moussa, Z.A. (1998). Effect of gamma rays on growth and essential oil composition of chamomile (*Chamomilla recutita* L.). Arab Univ. J. Agric. Sci. Ain Shams Univ., Cairo ,6(2): 301-311.

Youssif, B.S.; Nguyen, N.T.; Fukuda, Y.H.; Hakata, Y. Okamoto, Y. ; Masaoka, A. and Saneoka, **H. (2010).** Effect of salinity on growth, mineral composition, photosynthesis and water relations of two vegetable crops; New Zealand spinach (*Tetragonia tetragonioides*) and water spinach (*Ipomoea aquatica).* Int. J. Agric. Biol., 12: 211–216.

Yonies, B.M .M. (1997). Biochemical studies on the effect of radiation on plants. M.Sc. Thesis,Fac. of Agric.,Cairo University,Egypt,134p.

Zabalza, A.S.; Gaston. L. M.; Sandalio, L. A. and Royuela, M. (2006). Oxidative stress is not related to the mode of action of herbicides that inhibit acetolactate synthase. Environ. Exp.Bot., 59:150-159.

Zaka, R.; Chenal, C. and Misset, M.T. (2004). Effects of low doses of short-term gamma irradiation on growth and development through two generations of *Pisum sativum*.Science of Total Environment, 320:121-129.

Zidan,M.N.and Alzahrani,H.S.(1994). Effect of NaCl on germination, seedling and some metabolic changes in sweet basil (*Ocimum basilicum*). Pakistan Journal of Scientific and Industrial Research, 37(12):541-543.

Ziska,L.H.;Teramura, A. H. and Sullivan, J.H. (1992). Physiological sensitivity of plants along an elevational gradient to UV-B radiation .American Journal of Botany, 79: 863-871.

الملخص العربى

تأثير أشعة جاما والملوحة على النمو والتركيب الكيميائى لنبات الدمسيسه

تم اجراء هذا البحث فى المركز القومى للبحوث وتكنولوجيا الإشعاع خلال موسمين 2008/2007 و 2009/2008 في أصص بلاستيكية قطرها 30 سنتيمترا وكان نوع التربة المستخدمة رملية طينية. والهدف من البحث دراسة استجابة بذور الدمسيسه لأشعة جاما بالجرعات (0، 20، 40 ،80 جراي)حيث ثم زراعه البذور في التربة المضاف إليها مزيج من املاح كلوريد الصوديوم، كلوريد الكالسيوم وكبريتات المغنيسيوم بنسبة 2: 2: 1. وتركيز الأملاح المضاف الى التربه كان صفر, 2000، 4000، 6000جزء فى المليون. بالإضافة إلى معامله الكنترول التى تمت زراعه البذور فيها بدون اضافه املاح للتربه. ويمكن تلخيص النتائج التي تم الحصول عليها كالتالي:

تأثير الملوحة على النمو وبعض المكونات الكيميائية لنبات الدمسيسه :-

1- أدت معا مله التربة بمستويات مختلفة من الملوحة (كلوريد الصوديوم:كلوريد الكالسيوم:كبريتات المغنيسيوم) إلى انخفاض كبيرفى طول نباتات الدمسيسه ،وذلك عند المقارنة مع تلك النباتات النامية فى التربة غير المعا مله.

2- انخفاض عدد الأوراق/نبات مع زيادة مستويات ملوحة التربة، وقد لوحظ النقص الشديد لعدد الاوراق عند تركيز 6000 جزء فى المليون،وذلك عند مقارنتها بعدد الأوراق فى النباتات الغير معاملة والمزروعة فى التربة الطبيعية.

3- وقد لوحظت تغيرات طفيفة بالنسبة لعدد الأفرع / نبات تحت تأثير المستويات المختلفة من الملوحة.

4- انخفض الوزن الطازج وأيضا الوزن الجاف لنباتات الدمسيسة المزروعة تحت مستويات مختلفة من ملوحة التربة انخفاضا ملحوظا،وكان هذا الإنخفاض فى الأوزان مرتبطا بزيادة مستوى الملوحة فى مراحل النموالمختلفة وذلك بالمقارنة بالوزن الطازج أو الجاف للنباتات المزروعة فى التربة الغيرمعامله بالملوحه خلال موسمي التجربة.

5- لوحظ عموما زيادة فى تركيز السكريات الكليه مع زيادة مستوى الملوحة في التربة ، في ثلاث مراحل مختلفه من النمو وذلك فى موسمي الزراعه .

6- لوحظ خلال موسمى التجربة أن تركيز الفينولات الكليه الذائبه زاد زيادة كبيرة بزيادة ملوحة التربة. وكانت أعلى زيادة فى النباتات النامية تحت تركيز 6000 جزء فى المليون.

7- أظهرت نتائج معاملات الملوحة زيادة كبيرة في تركيز الكلوروفيل أ ، الكلوروفيل ب ، وبالتالي تركيز الكلوروفيلات الكلي وتركيز الكاروتينويدات في أوراق النباتات في مراحل النمو المختلفة خلال موسمي التجربة.

8- لوحظ وجود تغيرات في تركيز النتروجين الكلى المسجله فى نباتات الدمسيسة حينما تتأثر بمستوى الملوحة في المراحل الثلاث من النمو خلال الموسمين. ولكن كان من الواضح أن النباتات التي زرعت في التربة المحتوية على تركيز 4000 أو 6000 جزء في المليون يحتوى معظمهما على أعلى نسبة من النيتروجين مقارنة بالكنترول.

9- سجلت زياده فى تركيز الأمبروسين بنسبة9.8% و 63.4% و 26.8% فى النباتات المعامله بالملوحه بتركيزات 2000و4000و6000جزء في المليون على التوالى بالمقارنة (بالكنترول) النباتات الغيرمعامله بالملوحه. والعكس صحيح بالنسبة لمحتوى الدامسين فى النباتات.

10- سجلت زيادة فى تركيز الأحماض الأمينية في المجموع الخضرى للنباتات المزروعة في التربة المعامله بالملوحه بتركيزات 2000 ، 4000 أو 6000 جزء في المليون خلال موسمى التجربه.

11- اوضحت النتائج الى ارتفاع تركيز الصوديوم والبوتاسيوم المتزايد فى نباتات الدمسيسة عموما مع زيادة مستويات الملوحة.

12- اوضحت النتائج زياده نسبة الكالسيوم في النباتات مع زيادة مستويات ملوحة التربة خلال مرحلتى النمو الخضرى والثمرى. بينما اوضحت النتائج اتجاه معاكس فى مرحلة الأزهار.

13- ادى زيادة تركيز الملوحة في التربة الى انخفاض تركيز المغنيسيوم فى المراحل الثلاث من النمو خلال الموسمين عند المقارنة بمعامله الكنترول الغير معامل بالملوحه.

تأثير أشعة جاما على النمو وبعض المكونات الكيميائية لنبات الدمسيسه:-

1- اوضحت النتائج ان البذور المشععة والمزروعة في التربة العادية أو تحت مستويات مختلفة من الملوحة غالبا ما تنتج نباتات أعلى من حيث ارتفاع النبات وذلك عند مقارنتها بالنباتات الناتجه من البذور الغير مشععة والمزروعة تحت نفس الظروف.وكانت الجرعة 80 جراى هى الأفضل من حيث طول النبات فى المرحلة الثمرية.

2- اوضحت النتائج ان اشعة جاما قد شجعت نمو النبات عموما ، وهذا بدوره ، يزيد من عدد الأوراق حيث أن جميع الجرعات المستخدمة تعطى عدد أوراق أعلى من الكنترول المزروع تحت نفس الظروف من الملوحة أو الكنترول العادي.أما بشأن التفاعل بين الملوحة والاشعاع ، فقد لوحظت تغيرات غير معنوية.

3- لوحظ أن أشعة جاما تسبب زيادة فى الأوزان الطازجه والجافة لنباتات الدمسيسة. أيضا وجد أن النباتات الناتجة من زراعة البذور المشععة (20 ، 40 أو 80 جراى) في مستويات مختلفة من الملوحة ، أعطت نباتات اعلى فى الأوزان الطازجة أو الجافة- بالمقارنه بالنباتات المزروعة فى التربة العادية دون ملوحة .

4- لوحظ زيادة كبيرة في تركيز السكريات الكليه للنباتات والناتجة من البذور التى تم تعريضها بالجرعات (40 أو 80 جراى) مقارنة بالكنترول الغير معامل بالاشعاع خاصة في موسم 2008 ، ولكن ولوحظ أن التغير ضئيل في تركيز السكريات الكليه خلال موسم 2007 .كما لوحظ زيادة فى تركيز السكريات مع الجرعة 80 جراى المزروعة مع إرتفاع مستوى الملوحة إلى 6000جزء فى المليون.

5- زاد تركيز النباتات من الفينولات الكليه الذائبه باستخدام معاملات أشعة جاما مقارنه بقيمة الكنترول (التربة بدون ملح) وبشكل كبير في المراحل الثلاثة للنمو(الخضرى –الزهرى – الثمرى).

6- تؤدى زراعة البذور المعاملة بواسطة أشعة جاما تحت مستويات الملوحة المختلفة الى زياده تركيز الأحماض الأمينية الكليه في النبات بالمقارنة بالكنترول المقابل لها. وكان الحمض الأمينى "البرولين" قد سجل أعلى قيمة أكثر من أي أحماض أمينية أخرى.

7- اوضحت النتائج زياده فى تركيز صبغات الكلوروفيلات في نباتات الدمسيسه الناتجه من البذور المشععة في مختلف مراحل النمو خلال موسمي النمو.

8-لوحظ وجود تغير كبير فى تركيز النيتروجين نتيجة زراعة البذور المشععة في تركيزات ملوحه 4000 أو 6000 جزء في المليون، وتنتج نباتات بها أعلى نسبة من النيتروجين .

9- لوحظ أن إشعة جاما زادت في إنتاج تركيز الأمبروسين فى نباتات الدمسيسة الناتجة من البذور المعالجة بواسطة أشعة جاما. وكانت أعلى محتوى للأمبروسين فى الجرعة " 80 جراى"وقد زادت تركيز الأمبروسين بنسبة 63.4%. ولكن معاملة الجرعة 40 جراى فقط هى التى انتجت نباتات تحتوي على تركيز مرتفع من الدامسين.

10- اوضحت النتائج ان زراعة بذور الدمسيسه بعد معاملتها باشعة جاما قد ادى الى زيادة الصوديوم والبوتاسيوم خلال مرحلة النمو الخضري، مقارنة بمعامله الكنترول الغير مشعع والمزروع فى تربة غير ملحيه.وفي الوقت نفسه ،لوحظ انخفاضا في تركيز الصوديوم خلال مرحلتى الإزهار والاثمار ، مع بعض الاستثناءات خاصة في الجرعة 40جراي ونادرا في الجرعة 80جراي.

11- سجلت زيادة في تركيز الكالسيوم عند تركيزملوحه 2000 جزء فى المليون فى المرحلة الأولى والثانية من النمو. وتزيد أيضا تركيز الكالسيوم مع الجرعة 40 و 80 جراى عند تركيز 4000 جزء فى المليون فى النبات، بينما فى مرحلة الإثمار لوحظ انخفاض فى تركيز الكالسيوم فى النبات مع جرعات الإشعاع المختلفة مقارنة بالكنترول.

12- انخفاض تركيز المغنيسيوم في نباتات الدمسيسة مع زيادة تركيزالملوحة في التربة في المراحل الثلاث من النمو خلال موسمى الزراعه مقارنة بالتركيز فى النباتات الكنترول الغير معامل بجرعات الاشعاع.

الخلاصه

ادت معاملات الملوحه نقص فى صفات النمو وتركيز الدامسين وزياده فى السكريات الكليه والكلوروفيل والاحماض الامينيه و تركيز الامبروسين . كما ادت المعامله باشعه جاما الى تحسين صفات النمو ومعظم المركبات الكميائيه المدروسه وكانت الجرعه 40 و80 جراى هى الاكثر فاعليه. وقد ادى التداخل بين الملوحه والاشعاع الى تحسين صفات النمو والمكونات الكيميائيه وقد اكد هذا دور الاشعاع فى زياده تحمل النباتات لملوحه التربه والتقليل من تاثيرها الضار على النبات

اسم الطالب: أحمد محمد الحفنى مؤمن الدرجه: ماجستير

عنوان الرسالة: تأثير أ شعة جاما والملوحة على النمو والتركيب الكيميائى لنبات الدمسيسة

المشرفون: دكتور:أحمد حسين حنفى احمد

دكتور: عبد الرحمن مرسى غلاب

دكتور: اميمه سيد حسين محمود

قسم: النبات الزراعى فرع : فسيولوجيا النبات تاريخ منح الدرجه 28 / 3 / 2012

المستخلص العربى

يهدف هذا البحث الى دراسه تاثير مخلوط من املاح كلوريد الصوديوم ، كلوريد الكالسيوم ، كبريتات الماغنسيوم)بنسبه 1:2:2 بتركيزات (صفر ، 2000، 4000، 6000 جزء فى المليون) على صفات النمو وبعض المكونات الكيميائيه فى المجموع الخضرى لنبات الدمسيسه فى مراحل النمو المختلفه خلال موسمين النمو. وقد تم تعريض البذور لاشعه جاما للجرعات(صفر 20، 40، 80 جراى) قبل زراعتها مع بذور الدمسيسه الغيرمعا مله بجرعات الاشعاع فى تربه (رمليه طينيه) فى اصص قطر 30 سم وتم رى جميع اصص التجربه بماء الصنبور. نتج عن معاملات الملوحه نقص فى طول النبات وعدد الاوراق وتركيز الدامسين وزياده فى الوزن الطازج والجاف والسكريات الكليه والكلوروفيل والاحماض الامينيه و تركيز الامبروسين . كما ادت ايضا المعامله باشعه جاما الى زياده صفات النمو ومعظم المركبات الكميائيه وكانت الجرعه 40 جراى و80 جراى هى الاكثر فاعليه وقد تم التحقق من التاثير المشترك لمستويات الملوحه المختلفه والجرعات الاشعاعيه المستخدمه. هذا التداخل بين الملوحه والاشعاع ادى الى تحسين صفات النمو والمكونات الكيميائيه وقد اكد هذا دور الاشعاع فى تحمل النباتات لملوحه التربه والتقليل من تاثيرها الضار على النبات.

الكلمات الداله: الدمسيسه،الملوحه,الاشعاع , الامبروسين،الدامسين،القياسات الخضريه،تركيز الصبغات،السكريات الكليه،الفينولات الكليه الذائبه،البروتين،الاحماض الامينيه، العناصرالمعدنيه

تأثير أشعة جاما والملوحة على النمو والتركيب الكيميائى لنبات الدمسيسة

رسالة ماجستير
فى العلوم الزراعية
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دكتور/ محب طه صقر..
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دكتور/ محمد رمضان أبوالعلا..
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التاريخ 2012/3/28

تأثير أشعة جاما والملوحة على النمو والتركيب الكيميائى لنبات الدمسيسة

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