PROPAGATION AND CULTIVATION OF SOME COMMON HALOPHYTES AS FODDER CROPS IN EGYPT

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ABSTRACT

This study focuses on the propagation and cultivation of halophytic plants as fodder crops under different saline conditions and the possible ways to utilize these plants in animal nutrition. The methods of propagation and cultivation of six halophytic species grown in Egypt are investigated in order to highlight their potential for uses as fodder in Egypt. These species are *Aeluropuslagopoides,Atriplexhalimus, Atriplexleucoclada, Atriplexnummularia, Kochia indica*and*Panicumturgidum.*The criteria and requirements for cultivation of halophytes by using severe saline water are discussed. The results indicated that, the best four halophytic species that naturally grow in Egypt and are of high potentialities as fodder producing plants are *Atriplex nummularia, Atriplex halimus, Atriplex leucoclada* and *Panicum turgidum*. They are rich with their nutritive values and their water requirements are low. Using semi woody cuts in propagation of *Atriplex nummularia* recorded highest number of formed roots and using basic cuts or intermediate cuts provided highest of number of formed roots/plant. *It is concluced that, Kochia indica* as an halophytes may be used not only as a tool for combating desertification in arid and semi-arid regions through depleting soil salts, but also offer new salt-tolerant forage crops that can grow better under organic agriculture

Key words: Aeluropus**,** Atriplex, Kochia, Panicum, Halophytes, Cultivation

1 INTRODUCTION

Salinity is one of the principal problems in the arid regions as it leads to decrease in crop yield. To improve soil proprieties and maximize crop production, salinity should be reduced or removed by using best practices of cultivation salt - tolerant plants e.g halophytic crops (Stuart, et Al. 2012).

Halophytes are characterized as plants that can survive and reproduce in environments where the salt concentration exceeds 200 mM of NaCl (~20 dS m^{-1}). These species are capable of completing their life cycle under highly saline (NaCl) conditions (Stuart,et al., 2012). Halophyte plants can be grown in land and water containing high salt concentration. They can be substitute for conventional crops, and can be a good source of food, fuel, fodder, fiber, essential oils, and medicine (Lokhandeand Suprasanna, 2012). A halophyte which lives in desert is typically a succulent, so that it can store water to ensure that it has an ample supply (Breckle, 2002).

Halophytes can be categorizedinto two types, facultative halophytes and obligate halophytes. Facultative halophyte is a plant which can live in salty conditions, but would prefer to avoid salt, when salt concentrations are diluted by the rain. On the other hand, obligate halophyte needs salt to survive. Also, halophytes can be divided into two types according their habitats, hydro- halophytes and xero-halophytes. Hydro-halophytes are the plants that can grow in wet lands such as in mangrove or salt marshes along the coastlines. Xero-halophytes may grow in dry habitats where the soil is always saline but may dry out so much that water becomes less available for the plant. Most species in sabkhat of desert areas are xero-halophytes. Most of xero-halophytes are succulent plants with salt bladders on the leaf surface, or excrete the salt with evaporation water, where the salt crystals remain visible on the leaf surface (Hamed, et al. 2014).

When saline desert lands are developed based on using saltwater for irrigation, halophytes produce 8-15 t/ha of dry substance and 1, 03 and 5 t/ha of seeds. Thus, halophyte plant cultivation using saltwater (sea, collector-drainage, ground) can become a source for manufacturing high-protein energy fodders, hard forage medicinal raw oil, as well as efficient tools for biotic reclamation (Mirza Hasanuzzaman, et Al. 2014).

This study focuses on the propagation and cultivation of halophytic plants as fodder crops under different saline conditions and the possible ways to utilize these plants in animal nutrition in Egypt, especially in the salt-affected soil. In this study, the methods of propagation and cultivation of six halophytic species grown in Egypt will investigated in order to highlight their potential for uses as fodder in Egypt.

2 PROPAGATION AND CULTIVATION OF HALOPHYTESIN EGYPT

Salts can affect seed germination either by restricting the supply of water (osmotic effect) or causing specific injury through ions to the metabolic machinery (ionic effect). Most seeds are located near the soil surface, where salt concentration changes due to continuous evaporation of groundwater (Ungar, 1991). When rainfall leaches salt from the surface and supply water to the seed, the seeds can establish in saline environment. Seeds should remain viable in high salinity conditions and germinate when salinity decreases (Khan and Ungar, 1997).

Most secreting halophytes show germination at NaCl concentrations ranging from 0.34 to 0.52 M. 44%of stem succulent species could germinate above seawater followed by 27% in leaf succulent and about 20% both in secreting and grass species. Stem succulent halophytes could germinate in salinities higher than 0.2 M NaCl. Most halophytes belonging to other groups (e.g. xero-halophytes) have germination tolerance ranges between 0.2 to 0.6 M NaCl except for leaf succulents which could not germinate at or above 0.2 M NaCl. Halophyte seeds differ in their ability to recover from salinity stress and germinate after being exposed to hypersaline conditions (Khan, 20030.

2.1 Aeluropuslagopoides(L.)Trin.exThwaites

Aeluropus species could be used in increasing forage production in salt affected wastelands because of its high protein content and high salinity tolerance. This grass is used locally as a fodder for livestock and could be useful in coastal sand dune stabilization. It is currently being grown experimentally in the field as a fodder using brackish water irrigation (Shahriari, 2012). This species is distributed naturally in Egypt in the Mediterranean cost, Oases, Nile region including Nile Delta and Gebel Elba.

Aeluropuslagopoides produce their seeds all the year, and their seeds propagate in clonally. The best treatment for seed germination (80%) is at 20/30 ºC, while at 25/35 ºC it is 75% in light conditions (El-Keblawy,2017). Temperature has significant effect on final germination of *A.lagopoides*germination increases with the increase in incubation temperature. Seed germination of*A.lagopoides*is better in light conditions than in dark conditions.*Aeluropuslagopoides* hold on the maternal space through greater germination and their ability to propagate vegetatively (El-Keblawy, 2017). Seed germination percentages of *A. lagopoides*at 75, 150, 225, 300, 375 and 450 m MNaCl in 14 h light: 10 h dark photoperiod and 70% relative humidity are 75%, 60%, 62%, 37%, 5% and 4%, respectively after 14 days (Shahriari, 2012). Inhibition of germination is greater at cooler temperatures (10/20 ºC) when no seed above a concentration of 300 m MNaCl. The germination response at moderate temperatures (20/30 ºC) is optimal, with 30% of seeds germinating in 500 m MNaCl (Gulzar, et. al, 2001).

2.2Atriplex halimusL.

Atriplex halimus isarobust shrub, to 3 m, much branched from woody base. *Atriplexhalimus* grows naturally in the coastal sands by the sea, salt marshes and wadies. This species is one of the dominant species in the transitional zones between areas of shallow and deep water tables, in the salt marshes of the western Mediterranean desert of Egypt. it was in the man-made terraces of the Egyptian Nile delta. Also, the plant distributes in Siwa Oasis, wadi Hashim and wadi El-Zitona west Matrouh (Ayyad and El-Ghareeb, 1982; Shaltout, et al., 1995, El- Khouly, 2001).

Atriplexhalimus is mainly used for forage and land reclamation, the leaves are edible as raw like salad or cooked like spinach. It makes valuable windbreak in coastal areas. It is able to accumulate ions of salinity in its tissues (PFAF, 2014), (Ben Hassine, et. al, 2009).

The seeds are usually collected by manual or mechanical stripping of flower remnants in December when seeds are ripe and not susceptible to shattering. To produce high quality seeds they must be cleaned, dried, treated with fungicides, and stored under dry and well-aerated conditions. Successful seed germination is relatively moderate at 60 %, which can be enhanced substantially by washing the seeds under running tap water for 10-12 hours. The weight of 1,000 seeds is 0.76g.

Seed - sow of *A.halimus* occurs in April/May in a cold frame in a compost of peat and sand. The seeds usually germinates in 1 - 3 weeks at 13°c. The seedlings are potted up when still small into individual pots, grown on in a greenhouse for the first winter and then planted out in late spring or early summer after the last expected frosts. The seed is seldom formed. Regarding to propagation by cutting, cuttings of half-ripe wood in July/August in a frame is very easy. They are pottedup as soon as they start to root (about 3 weeks) and then planted out in their permanent positions late in the following spring. Cuttings of mature wood are in the current season's growth, November/December where are very easy, and then potted up in early spring and plant out in their permanent position in early summer (Salim, 2011).

The most-efficient method of establishment of *A.halimus* is via transplanted seedlings, rather than direct sowing, but this is slow and expensive [Le Houérou, 1992]. Around 2000 seedlings are planted per hectare; with a spacing of 1×5 m. The usual density of *A.halimus* for cultivation is 1000- 3000 sh-1 ha-1 in rows spaced 4-6 m, the shrubs being spaced 1-2 m on the rows. Direct sowing requires the soaking of seeds in running water in order to eliminate the salt and saponins. The utilization of pre germinated seeds, just after swelling but prior to the emergence of the radicle, is particularly successful in Autumn. The plant is also cultivated by cuttings. Cuttings are collected from very well-grazed individual *A.halimus* shrubs for the production of adult shrubs from which seeds will be collected later for further multiplication and introduction in various production systems in the arid zone. Nitrogen fertilization may be required to improve seedling growth. To ensure their long-term productivity, weeds should be controlled, shrubs should be cut back every 2 - 3 years and very-infrequent browsing (leading to woody plants) should be avoided.

Shaygan, et Al. (2017) exposed the seeds of *A. halimus* to various solutions of NaCl ranging from soil saturation (0 MPa) to permanent wilting point (−1.5 MPa). At an osmotic potential of −1.5 MPa, 3% of the seeds germinated when exposed to NaCl solution. This indicates that *Atriplexhalimus* seeds are less tolerant to salinity stress. The results suggest that direct seeding of *Atriplexhalimus* may be an effective path for revegetation of post-mining landscapes where salinity stress are predominant features of the environment. When *A. halimus,* was treated with different concentrations of NaCl (0, 1, 2, 3 and 3.5%), the production of the most significant biomass was recorded at 1 and 2% NaCl concentrations. High NaCl concentrations (3 and 3.5%) induce a reduction of the biomass (Abbad, et. al, 2004).

2.3. Atriplexleucoclada Boiss Diagn. Pl. Orient.

Atriplexleucoclada is a palatable species, having a considerable portion in rangelands production. *Atriplexleucoclada*is dominated in the desert plains and the inland oases and depressions of Western Desert of Egypt (Kharga, Dakhla and Siwa), and is common in the northern Mediterranean coastal belt of the Western Desert. ,it is alsoin the coastal sands and Sabkhas of Suez Gulf in Sinai Peninsula and Mountainous Southern Sinai (Ugma, Al Halal and Maghara mountains) (Ayyad& Ammar, 1974); (El-Khouly&Zahran, 2002); (NAP, 2015).

The most widely used propagation technique for *Atriplexleucoclada* is transplanting seedlings, as its dormancy reduces the effectiveness of revegetation from seeds. Fluctuating daily temperature could break seed dormancy induced by the hard testa and facilitate germination. *Atriplexleucoclada*can grow and reproduce under rainfall conditions ranging between 100 and 300 mm/year, with yields varying from 1,000 to 3,000 kg of dry matter/ha per year [CGIAR,2017]. Atriplexleucoclada has a high ability to absorb nitrogen from the soil and can benefit from the action of nitrogen-fixing microorganisms. It forms an efficient root system, with fine roots close to the surface (0–50 cm) and one taproot down to 5m deep. *Atriplexleucoclada* shrubs are able to access resources both in the shallow soil and also deep in the soil horizon (CGIAR,2017).

When *Atriplex leucoclada* multiplies by seeds, thescratch seeds of *A. leucoclada*achieveup to 80% germination when cultivated under 95% humidity and 22 C°. The length of storage seeds of *A. leucoclada* reduces the percentage of germination. Seeds sowing rateis (1.5-2 kg / donum) and the depth of sowing (1.5 cm), and removing the fruiting covers speed up the germination of seeds. Seeds are dispersed after land preparation as needed at the beginning of the rainy season. The plant can be propagated by seedlings after planting the seeds in the soil mixture with fine sand and peat moss (3:1) in plastic bags inside the nursery during the period from October to November, where five seeds are planted in depth three times the diameter of the seed in each bag, then removed some of them to select the best seedling and irrigated daily in the first week after planting, using vertical sprinklers to avoid water pressure and torrential in the first stage of germination (Mirreh, et al,1992).

A particularly efficient way of establishing and managing Atriplex plantations is to use depressions usually cultivated to cereals with wide spaced (10-20 m) rows of shrubs set in contour [Le Houerou and Pontanier,1987].Thereafter the seedlings are irrigated three times per week when it reaches the seedling height to 10 mm, and this experience has achieved germination percentage of 86-95%. In early spring (temperature between 15-20 mº), the seedlings are transferred to the field after they reach a height of about 30 cm following land preparation, settlement and combing field by the plow. They are cultivated in lines 1 × 3 spaces between seedlings, and the pits are moistened with water before planting. The seedlings are irrigated after planting (Mirreh, et. al, 2000).

Most of the Atriplex shrub species are linked to saline and/or Sadie soils in their native habitat. This is not necessarily when man-made plantations are concerned, as Atriplex spp. do not need the presence of free NaCl in the soil or water for their growth, as shown by many productive plantations in non saline environments all over the world arid zone. In terms of soil texture, most forage species need medium to fine textured (i.e. silty, loamy and clay) soils (Amouei, 2013).

2.4. AtriplexnummulariaLindl

Atriplexnummularia, is a Saltbush plant. *It* is used as a fodder plant for cattle and sheep and for prevention of soil erosion. It provides a useful windbreak which, along with readily visible leaves at night, makes it suitable for roadside plantings. The ornamental foliage can be pruned to make hedges and provides an attractive silvery contrast against darker plants in the garden. On the other hand, *A. nummularia* is very adaptable and can tolerate severe droughts as well as periodic flooding. It is salt tolerant. *A. nummularia* also recovers well after intense defoliation, making the plant very suitable for pruning. It tolerates most soils but is best grown in a well drained position which is sunny for most of the day (Catherine, 2007). This species is common in Northwestern coast of Egypt.

Atriplexnummularia can be propagated by cuttings or seed. Propagation by seed is usually done by sowing the fruiting bracteoles. Germination rates are increased by rubbing the fruits with the hands under running water for several minutes or soaking them in water for at least an hour. The fruits can then be sown directly into the soil or first placed into a Viro-cell for sowing. The best times to sow seeds are in autumn, early winter and spring (Catherine, 2007).

Kndil and Shariaef , (2015) used nine treatments in the combination of three types of stem cut as follows: woody cut, semi woody cut and fresh cut. Also, they used three stem cuts according to their position in the stem length as:, and basic. Cutting should include nutritional materials required to form roots and new branches and the new plant is able to depend on itself for producing the length of stem. The length of cuts was is 10-17 cm and they are cut off the horizontal bar from the edge grassroots at straight bottom horizontal bar directly. The tip upper are cut diagonally top node where the distance is of 12.5 cm to keep the leaves on the edge of the upper and must reduce the size of securities if it was great to reduce the amount of water lost receives. Stem cut should be collected in the early morning and kept in moist condition i.e. kept in black plastic bags away from the sun. In addiction irrigation should be constant at high temperature to compensate the loss of water through the leaves during rooting process. They showed that, semi woody cuts had the highest values of growth parameters measured, number of formed roots (51.5), number of new leaves/plant (18.8), root volume /plant (23.3 cm^3) and the number of new leaves/plant (18.8 leaves/ plant).Kndil and Shariaef (2015) showed that using basic cuts or intermediate cuts produced significantly higher number of formed roots/plant(68.7 and 50.5 roots/plant, respectively). Using basic cuts or intermediate cuts created highest of affected number of new leaves/plant, which were 23.7 and 16.0 leaves/plant, respectively. The results indicated a significant effect due to the interaction between types of stem cuts and cuts position on stem length on the number of formed roots/planting basic cuts with rooting cut of semi woody cuts, woody cuts and fresh cuts significantly exceeded the average number of formed roots/plant with 71.1, 70.0 and 64.8 roots/plant for basic cuts, woody cuts and fresh cuts respectively. Also, the results showed that using basic cuts with rooting cut of semi woody cuts, followed by semi woody cut and fresh cut significantly exceeded the average number of formed roots/plant, which were 26.5, 23.2 and 21.5 new leaves/plant, respectively. Using basic cuts with of semi woody cuts, followed by semi woody cuts and fresh cuts significantly exceeded the average number of root volume, which were 31.4, 37.6 and 24.8 cm^3 /plant, respectively. Using sand rotting media produced highest number of new leaves/plant and number of branches/plant, which was 63.5 leaves/plant and 16.0 branches/plant. The treating cuts with Abscisic acid (ABA) at rate of 10 ppm or1-Naphthaleneacetic acid (NAA) at rate of 10 ppm for 24 hour produced highest number of new leaves/plant and number of branches/plant. The cuts treated with ABA at rate of 10 ppm or treated with NAA at rate of 10 ppm for 24 hours and using sand rotting media, clay rotting media, Beat moss rotting media and water rotting media significantly amplified the regular number of new leaves/plant.

2.5*Kochia indica*Wight

Kochia indica is annual plant that belongs to the family Chenopodiaceae. This plant can grow in saline habitats. The vegetative yields have greater potentiality as source of livestock fodder (Anon, 2009).

Kochia indica reproduces by seed. In the fall, the plants often break away from the roots and tumble over the ground, scattering the seeds, it typically produces from 13 - 15,000 seeds per plant.In Saudi Arabia, *K.indica*germinateswell on salt affected land using saline water (0.53 percent total dissolved solids) for irrigation. In Egypt, *K. indica* successfully grows by using groundwater for irrigation with total dissolved salt rangingfrom 5000 ppm to 8000 ppm (El Shereef, 2016). In Egypt *K. indica* was grown under drip irrigation system with saline water (EC: 6.6 dSm-1). Five organic fertilization treatments were applied (control, chicken manures, cattle manures, charcoal and green manure). The results indicated that, growing Kochia plants under organic fertilization haspositive impact on soil bioremediation process by decreasing EC as well as the content of Na+ and Cl- in the soil. *Kochia indica*, is a promising halophytic plant for feeding goats and sheep in desert area. It can be concluded that *K.indica*as a halophyte may be used not only as a tool for combating desertification in arid and semi-arid regions through depleting soil salts, but also offers a new salt-tolerant forage cropthatcan grow better under organic agriculture (Tawfik, et Al. 2018).

2.6. *Panicumturgidum*Forssk

*Panicumturgidum*is one of the most drought resistant plants in the Egyptian desert**.** This species is described as a perennial good fodder grass found in the plains and wadies.

*Panicumturgidum*produces large seeds and germinates to very high levels in both light and dark conditions and at a wide range of temperatures. Itproduces seeds all the year, and itsseeds propagate clonally.The effect of the interaction between light and temperature conditions on seed germination is significant in *P.turgidum*, where these seedsshow no response to temperature increase. The best germination percentage s 100% at 20/30 Cº in dark condition and at 25/35 Cº in light condition. *Panicumturgidum*holds on the maternal space through greater germination and itsability to propagate vegetatively (Al-Shamisi, 2009).

Seeds of *P. turgidum*have showngreat innate dormancy. No germination occurs for freshly harvested seeds of *P. turgidum*. The ability of a considerable fraction of *P. turgidum* seeds to maintain dormancy ensures the buildup and persistence of a soil seed bank which is considered vital for a species in the unpredictable environments of deserts. Germination of seeds stored for fiveyears is significantly greater in dark than in light at 15-25°C, but the reverse is true at higher temperatures (35 and 40°C). Salinity can significantly reduce germination at 100 m MNaCI and completely inhibit it at 200 mM. Optimum germination is achieved at 30°C. Seed germination of *P. turgidum*ismost salinity tolerant at 35°C. Similarly, germination rate decreases with increase in salinity, but increases with the increase in temperature (Al-Shamisi, 2009).

Heneidy, and Waseem, (2007) found that the germinating capacity of seeds is intimately related to the vigour of the plants producing these seeds. They concluded that, the larger seeds possess more stored energy than smaller seeds which may affect the emergence, survival and establishment of seedlings. Also, they found that, the propagation of *P. turgidum* by sowing gave the highest yield, better than that by rhizomes or by transplantation (seedlings).

3 CRITERIA OF HALOPHYTES CULTIVATION BY USING SALINE WATER

Some halophytes have a period of seed aging. The more the plant is tolerant to salination the longer is this period. It is necessary to preliminarily group plants according to the time of seed aging and also according to the place of their growing before seed harvesting territories assigned for each species are examined and plots with ample bearing plants are defined, as well as time of their harvesting is specified. It is necessary to follow set optimal criteria of seed sowing of halophyte plants of each species. Farmers need to sow 3-5 times more seeds than it is stipulated by criteria on the basis of pure seeds (Mamedov, et. al, 2009) This is caused by the fact that when harvesting them, leaves, small branchlets, and dry buds get into containers. It is very important that plant seeds of halophytes are sown in soil in time. The selected plot is to be ploughed up and harrowed before sowing. Seeds are better to be sown in rows in 50-60 cm and when embedding in sandy soils is should done at 3-5 cm (Mamedov, et. al, 2009).The best period of seed sowing is from October to January.

As far as farming, cropping or feed production is concerned, the choice of the best irrigation method is as important as choosing the optimal fertilizing technique. There is a wide span of halophyte utilization. In most cases the amount and quality of the irrigation water as well as economic parameters control any possible utilization. The key point for irrigation is the demand on salinity of each species chosen (Menzel and Lieth, 1999). Halophyte production systems can be established in an ecologically sustainable way if surface salinity increase is prevented. This requires intermittent irrigation and good drainage. Most waste waters and even seawater usually contain a sizable amount of fertilizer. Since ion concentrations and composition are different at each site, a routine chemical analysis of water and plant material is essential (Hamed, et al. 2014).

The soils commanded with sever saline water range widely in their texture and most of them have loam to clayey textures, with 60-90 cm as the common depth. Lands irrigated with water below 5.0 mmhos are generally double cropped whereas those with higher salinity are used in rotation with a fallow period of varying duration but extended mostly to 18 months in between for natural amelioration (Dhir and Bhatia, 1975).

In the use of saline water cultivators generally divide the commanded land into two or three parcels which are irrigated in turn with fallow period in between (Dhir and Bhatia, 1975).

In the cultivated area they generally do not use saline water on a particular piece of land every year but rather rotate irrigation so as to allow a fallow period for natural amelioration of soil from excessive salt build up in soil through rainfall (Dhir and Bhatia, 1975).

Only fish waste is used in halophytes cultivation by NASA research laboratory, where fish waste is distinguished as completely “green” fertilizer (Glenn, et. al, 1999). Most waste waters and seawater usually contain a large amount of fertilizer (11 of the 13 mineral nutrients needed by plants are present in seawater in adequate concentrations for growing crops) (Hamed, et al. 2014).

Nitrogen and phosphorus amendment in sea water have improved growth significantly and increased their concentration in plant tissues in the halophyte *Suaedafruticosa* [*S. vera*]. These results indicate that nitrogen and tao lesser extent phosphorus are the most growth limiting nutrients for culture under sea water. Biomass production of plants grown on sea water amended with phosphorus and nitrogen only, is similar to that of plants cultivated under full nutrient solution. Hence, it appears that all the essential minerals except nitrogen and phosphorus are available in sea water for the optimum growth of halophytic plants (Noomeneand Chedly, 2002).

It was suggested for establishment of *A. canescens*,that seeds should be scarified before germination, 30- to 70-d-old plants should not be irrigated with saline water and that no more than 50% of the plant height should be cut yearly (Aldon and Cavazos Doria, 1995).

4 DISCUSSION

According to (Hamed, et al. , 2014), all the halophytes reported in this study (6 species) belong to xero-halophytes, where all of them grow in sabkhat of desert. Four species *Atriplexhalimus*, *Atriplexleucoclada*, *Atriplexnummularia*and *Kochia indica*excrete the salt with evaporation water, where the salt crystals remain visible on the leaf surface. These species are used to remediate the salt-contaminated soils, also provide fodder, and industrial raw material and increase the income of the farmers owning salt-affected lands. These halophytic species decreased the soil salinity of saline sodic soil (Nasir, 2009).

Most the halophytes reported in this study are obligate halophyte, which actually needs salt to survive. These plants sustain under water-stressed conditions on sodic or saline soil. de Souza, et al. (2012) reported that anatomical changes shown by the halophyte *A. nummularia* grown under different soil moisture conditions can contribute significantly to the management of soil and water in semiarid regions.

Kernick (1986) and (Shamsutdinov, et Al. 2000) studied the assessment of vegetation resources suitable for the development and reclamation of saline lands in different areas of the world, where the following species are recommended for development of fodder lands and their complex utilization:*Atriplex spp.* and *Kochia spp*.

Global experience shows that halophytes are the most important biological means for utilization of saltwater and parallel production of fodders. Halophytes well develop when irrigated with saltwater, they absorb salt and do not damage soil (Mamedov, et al., 2009). Results of many experiments proved the fact that fodders shrubs and semishrubs of Chenopodiaceae are extremely acceptable to be used in ecological restoration and fertility enhancement of vast areas of saline lands and pasture lands in arid regions of the world (Mamedov, et al., 2009). In our study, four species are reported belonging to the Chenopodiaceaefamily:*Atriplexhalimus, Atriplexleucoclada, Atriplexnummularia,*and*Kochia indica*.

Using semi woody cuts in propagation of *A.nummularia*recorded highest number of formed roots and using a basic cuts or intermediate cuts providedhighest number of formed roots/plant.This is agreement with (Gomez & Gomez, 1984) whofound that rooting of the new growth of *A.nummularia* was higher than rooting of the old growth plant. It is concluded that vegetative propagation of *A. nummularia*, by stem cuttings, is likely. The optimum method for cuts position on stem of *A. nummularia*, by using terminal stem cuttings (10 to 15 cm) preserved the cuttings with 3 g.kg-1 IBA and The optimum method for cuts position on stem of *A. nummularia*, by using terminal stem cuttings (10 to 15 cm) preserved the cuttings with 3 g.kg-1 IBA and the suitable season for plantation is in the late autumn or spring in the late autumn or spring.Using semi woody cutsnoted highest of affected number of new leaves/plant and using basic cuts or intermediate cuts produced highest of affected number of new leaves/plant. De Kock (1983) stated that it is likely to root stem cuttings of *A. nummularia*, but he did not enumerate the success degree. Also, (Malan &Rethman, 2010) found that rooting of the new growth of *A. nummularia* was more advanced than rooting of the old growth plant.

Grass seeds are usually not very tolerant of increased salinity (Khan &Ungar, 2001), and the maximum salt tolerance for germination usually ranges between 250 and 350 mmol/L NaCl (Morgan & Myers, 1989); (Gulzar & Khan, 2001). Seed germination percentages of *A. lagopoides* decreased from

75% in 75 mMNaCl to 5% in 375 mMNaCl (Shahriari, 2012). Also, salinity significantly reduced germination of *Panicumturgidum* at100 mMNaCI and completely inhibited it at 200 mM (Al-Shamisi, 2009).Halophytes have been tested as vegetable, forage, and oilseed crops in agronomic field trials. These species produce 10 to 20 t ha-1 of biomass by using seawater irrigation, equivalent to conventional crops.

5 CONCLUSION

The seeds of holophytic grasses are usually not very tolerant of increased salinity.

The best four halophytic species that naturally grow in Egypt and are of high potentialities as fodder producing plants are *Atriplexnummularia*, *Atriplexhalimus*,*Atriplexleucoclada* and *Panicumturgidum*. They are rich with their nutritive values and their water requirements are low. Thus, mass production of their vegetative yields will certainly help to maintain reasonable quantities of raw materials for fodder industries.

Using semi woody cuts in propagation of *Atriplex nummularia* recorded highest number of formed roots and using basic cuts or intermediate cuts provided highest of number of formed roots/plant. The best technique for rooting stem cuttings of *A. nummularia*, is by using terminal stem cuttings (10 to 15 cm) in length. The treating cuts of *A. nummularia* with ABA at rate of 10 ppm or NAA at rate of 10 ppm for 24 hour increased number of new leaves/ plant and number of branches/plant.

*Kochia indica*asan halophytes may be used not only as a tool for combating desertification in arid and semi-arid regions through depleting soil salts, but also offer new salt-tolerant forage crops that can grow better under organic agriculture.

RECOMMENDATIONS

When saline desert lands are developed based on using saltwater for irrigation, halophytes produce 8-15 t/ha of dry substance and 1,03,5 t/ ha of seeds. Thus, halophyte plant cultivation using saltwater (sea, collector-drainage, ground) can become a source for manufacturing high-protein energy fodders, hard forage, medicinal raw oil, as well as efficient tool for biotic reclamation.

The vegetative propagation of *A. nummularia* and *Sarcocorniafruticosa* by stem cuttings, is likely to be better than the other propagation methods. Transplanting nursery grown seedling is a fruitful method for founding these plants in arid regions.

Propagation of *P. turgidum* by sowing gave the highest yield, better than that by rhizomes or by transplantation (seedlings).

It is recommended that, before cultivation any site by fodder halophytes, the soil of the site should be analysed and the salinity degree of irrigation water should be determined in order to select the suitable halophytic species which will be cultivated.

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