

Comparative germination studies in mature seeds of *Haloxylon salicornicum*

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Abstract— As native plants are better adapted to the local environment, can endure long spells of drought, withstand high soil salinity levels and provide a more natural effect to landscape projects, their use in landscape projects are gaining popularity. Standardization of seed germination methods and raising the hardened plants of selected native plants for their use in landscape projects will both conserve natural resources and produce sustainable greenery. In the present study *Haloxylon salicornicum*, a perennial herb with a potential use for urban greenery was selected for seed germination tests as there is an urgent need to mass multiply it for its large-scale use. The main outcome of this study is to provide information about the best propagation methods of *Haloxylon salicornicum* native plants to enhance the use of native plants in landscaping.

Keywords— dormancy, gibberelic acid, germination trays, vigor index s.

I. INTRODUCTION

THE world's arid ecosystems support only plants with minimum water requirement that are drought and salt tolerant. An ongoing program to introduce and screen plants from different regions of the world that have agro-climatic conditions which are similar to Kuwait is essential in developing and continually updating the plant palette. Over the years, the Kuwait Institute for Scientific Research has introduced and evaluated several plants from various sources for their adaptability and growth performance under Kuwait's harsh environmental conditions. Some of them were found to be promising in enhancing plant diversity, thereby allowing greater flexibility in plant selection, preventing visual monotony and increased aesthetic appeal to the local landscape and greenery activities. Water-efficient plants play an important role in conserving natural resources in the world's arid regions.

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Water conservation is a vital issue that is not only restricted to the desert countries but is also of international significance [5]. The native plants are disappearing from their habitat at an alarming rate. Although the introduced ornamental plants are essential in providing diversity in urban and suburban landscape projects, a majority of them require excessive irrigation water and maintenance to cope with the harsh summer weather conditions. Therefore, the use of a proper blend of exotic and native plant species could lead to the establishment of sustainable greenery in urban and sub-urban areas. The use of native plants in urban landscape/greenery will also reduce fertilizer, pesticide and insecticide usage, thereby minimizing threats to the local environment. It will also promote wildlife, and at the same time, conserve native vegetation. Therefore, the evaluation of native plants for their suitability for urban landscape has obtained very promising results. The ornamental introduction program, together with the evaluation of native plants, has led to the selection of several promising plants. These plants need to be mass multiplied for use in large-scale landscaping and greenery projects. Several native desert environment plants are being threatened and are facing danger of extinction due to anthropogenic causes [4].

Because sustainable greenery and landscaping are the needs of the day, particularly in countries that have limited natural resources, the propagation of native perennial vegetation makes efficient utilization of available natural resources in greenery. The natural designs are best adapted to the local conditions, require less maintenance, reduce environmental damage, benefit wildlife and require little maintenance. Moreover, the use of desert plants will expand the plant species' diversity, offering greater flexibility in urban landscape projects. Utilizing the native desert plants will also minimize the need for introducing the exotic ornamental plants, thereby reducing the chances of accidental introduction of new pests and diseases along with exotic plants. The desert plants provide seasonal interest and help preserve the local wildlife habitat. Sustainable landscape has long-term benefits as the plant species reseed themselves every season. Native plants in gardens can potentially aid conservation by contributing to the genetic diversity and buffer small and otherwise isolated populations from extinction [6].

Haloxylon salicornicum is a perennial shrub with a great potential for dune fixation, it promotes the biodiversity, as lizards and different kind of Fauna and flora are coexisting naturally with it. Flowering is during October to November, it is distributed in areas northeast of Kuwait and south of coastal areas [1],[3] and [7]. Seed germination of halophytic species is regulated by factors such as water, temperature, light, soil salinity, and their interactions [2]. *Haloxylon salicornicum* was selected for germination studies for its mass propagation through seeds. *Haloxylon* plant is an excellent sand binder [3] and is a native plant with a potential for urban greenery in Kuwait.

II. MATERIALS AND METHODS

The seeds of *Haloxylon salicornicum* used in this experiment were collected from Kuwait desert during December 2012 from Wadi Al-Batin, and it was stored in the seed bank of Kuwait Institute for Scientific Research from that time at 4°C temperature, another seed lot collected from National park on December 2012 was used directly without storing it in the seed bank.

Our experiment started on May 2013, The seeds of *Haloxylon salicornicum* underwent nine treatments with five sets of replications of each treatment. A total number of ten seeds were used in each replication and, hence, fifty seeds were used in each treatment. The seeds were incubated at 22°C, under continuous light and, 40% humidity. The nine treatments are:

- T1 -10 days dry heat (50°C)
- T2- 10 days dry heat (50°C) + 250 GA₃
- T3-10 days dry heat (50°C) + 500 GA₃
- T4-20 days dry heat (50°C)
- T5-20 days dry heat (50°C) + 250 GA₃

T6-20 days dry heat (50°C) + 500 GA₃

T7-250 GA₃

T8-500 GA₃

T9-Control

Pre-treated seeds were germinated in Petri dishes with moistened filter paper, thin layer of water was always maintained. Observations of seed germination and seedling vigor on 1 to 5 subjective scales with five being the most vigorous seedling were recorded. Data were compiled and analyzed using the Analysis of Variance procedures (ANOVA). As germination was poor, the same treatments were repeated with seed lot 2 after removing the wings. The results of the experiments are discussed below.

III. RESULTS AND DISCUSSIONS

The germination percentage and vigor index is presented in Table 1. Control/untreated seeds exhibited highest germination with highest number of vigor 5 seedlings. Treatment with 250 GA₃ also produced similar results. This indicates that germination of *Haloxylon salicornicum* was slightly reduced by pretreatment with 10d, 20d heat and GA₃ other than 250GA₃. Untreated seeds of *Haloxylon salicornicum* can germinate readily without any pretreatment.

The seeds of *Haloxylon salicornicum* exhibited less germination rate and percentage with high temperature treatments and high GA concentrations. Seed lot that was collected from the National Park, and wasn't stored in the seed bank, did not germinate easily because of dormancy.

Among the different treatments in *Haloxylon salicornicum* after the wings were removed, the control and 250 GA₃ produced the maximum germination (86%). The removal of wings in *Haloxylon salicornicum* before pretreatment is found to improve the germination.

Table 1. Germination and the Vigor Index Observed in *Haloxylon salicornicum* from Seed lot 2 (Seed Bank) under Different Treatments

Treatment	V1	V2	V3	V4	V5	Total Vigor	Germination (%)
T1 10 d heat (50°C)	0	1	3	8	22	34	68ab
T2 10 d heat (50°C) + 250 GA ₃	1	0	1	6	13	21	44.7c
T3 10 d heat (50°C) + 500 GA ₃	1	1	4	5	19	30	60bc
T4 20 d heat (50°C)	1	0	6	0	30	37	74ab
T5 20 d heat (50°C) + 250 GA ₃	1	1	1	5	29	37	74ab
T6 20 d heat (50°C) + 500 GA ₃	1	1	4	1	26	33	66ab
T7 250 GA ₃	0	1	1	0	41	43	86a
T8 500 GA ₃	0	0	0	2	36	38	76ab
T9 Control	0	0	0	1	42	43	86a

Note: V5:Excellent; V4: Very Good; V3: Moderately Good; V2:Average; V1: Poor. The means in the column followed by similar letters within column are not significant at $p \leq 0.01$.

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