



جامعة الملك سعود
كلية الزراعة
قسم الإنتاج النباتي

دراسات بيئية على إنبات بذور القطف ونمو بادارته وتأسيسها وبقائها
**Ecological studies on germination and seedling growth, establishment
and survival of *Atriplex halimus* L.**

قدمت هذه الرسالة استكمالاً لمتطلبات درجة ماجستير في المراعي والغابات
قسم الإنتاج النباتي كلية الزراعة - جامعة الملك سعود

إعداد

خالد بن عبد العزيز بن عبد الرحمن العقيل

الإشراف الأكاديمي

المشرف الرئيس : د. عبد العزيز بن محمد السعيد
أستاذ بيئة المراعي المشارك

المشرف المساعد : د. عبد الله بن عبد العزيز الدوس
أستاذ تربية المحاصيل المشارك

SUMMARY

Atriplex halimus has great potential for rangeland revegetation in Saudi Arabia because of its high forage production and nutritive value. Success of revegetation projects in deteriorated desert rangelands depends on several factors. Factors controlling range plant survival and establishment in natural plant communities include edaphic and environmental factors. Several experiments were conducted to (i) assess the effect of constant temperature (5, 10, 20, 25, 30° C); (ii) alternate temperature (5-15, 10-20, 15-25, 20-30° C); (iii) water potential (0, -0.4, -0.8, -1.2, -1.6, -2.0 MPa) on seed germination of *A. halimus* in a controlled environment; (iv) evaluate seedling emergence in response to initial rainfall (5, 10, 20, 30 mm) in a controlled pot experiment; and (v) evaluate seedling growth, survival and establishment in response to different amount of rainfall (120, 240, 360 mm) and time of sowing (mid-November, mid-December, mid-January) for seedlings grown in barrels under natural conditions. All germination experiments involved four replicates (50 seeds per Petri dish) in completely randomized design. Polyethylene glycol (8000) solutions were used for the water potential experiment. Final germination percentage and germination rate were determined. The total amounts of water equivalent to tested amounts of initial rainfall were applied once to the soil surface. The experiment was replicated four times in a completely randomized design. Final seedling emergence and the rate of emergence were determined. Evaluation of seedling growth, survival and establishment in response to different amounts of rainfall and sowing time was conducted in metal barrels (60 cm diameter and 120 cm deep) under natural conditions. Excessive seeds were sown and all treatments were irrigated with an amount of water equivalent to 30 mm the first time. Emerging seedlings were thinned to 20 seedlings in each barrel. The remaining amounts for each level of rainfall were distributed evenly every fortnight for six months. Seedlings were left without irrigation for two months thereafter before the final harvest. The experiment was laid-out

as a split plots while the levels of rainfall treatments were assigned to the sub-plots. Results can be summarized as follows:

1- Effect of temperature on germination

Atriplex halimus germinated in a wide range of temperatures. Maximum germination (92%) was attained at a constant 25° C. Germination rate increased with temperature and reached a maximum level at 30° C. Alternating temperatures of 15-25° C gave the highest germination percentage (92%) while the rate of germination was highest (9.2) at alternating temperatures of 20-30° C.

2- Effect of water potential on germination

Water potential below -0.4 MPa decreased total germination and germination rate of *A. halimus* compared to the distilled water control treatment. At a water potential of -2.0 MPa total germination and germination rate were 59% and 3.8 respectively.

3- Effect of initial amount of rainfall on seedling emergence

Results indicated that a minimum amount of 10 mm of initial rainfall would be necessary to assure sufficient emergence and hence seedling recruitment of *A. halimus*.

4- Effect of amount of rainfall and time of sowing on seedling growth, survival and establishment

Increasing the amount of rainfall was reflected positively on seedling growth characters. Dry weight percentage, shoot biomass, root biomass, shoot/root ratio, rooting depth, crude protein, crude fiber, phosphorus and potassium contents and total ash all increased with increase in the amount of rainfall leading to vigorous *A. halimus* seedlings that had the potential to survive and establish.

Sowing *A. halimus* early (mid-November) resulted in positive seedling growth responses except for root dry weight, crude fiber and phosphorus indicating that early emerging seedlings

will benefit from soil moisture availability during the rainy season thus will have the potential to survive the dry season and establish in the community.

Correlation coefficients between seedling growth between seedling growth parameters and their survival and establishment were determined. These coefficients indicated that some growth characters have significant correlation (+0.85 and 0.75 respectively) with seedling establishment of *A. halimus*.