

**GERMPLASM POOLING AND MULTIPLE-TRAIT SELECTION FOR
CONSERVATION AND ENHANCEMENT OF ARABIAN ALFALFA
GERMPLASMS**

by

Abdullah Abdulaziz AL-Doss

A Dissertation Submitted to the Faculty of the

DEPARTMENT OF PLANT SCIENCES

In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF PHILOSOPHY
WITH A MAJOR IN AGRONOMY AND PLANT GENETICS

In the Graduate College

THE UNIVERSITY OF ARIZONA

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ABSTRACT

The development of regional germplasm pools to conserve genetic resources from a specific region has been suggested to increase germplasm utilization and to reduce maintenance costs. However, the effects of selection on genetic variability within germplasm pools have not been documented. This research attempted to study effects of germplasm pooling and multiple-trait selection on phenotypic and genetic variability within nondormant alfalfa (*Medicago sativa* L.) germplasm pools. Five germplasm pools differing in geographical representation were formed from 12 Middle Eastern ecotypes based on agronomical and morphological similarities. These germplasm pools included three restricted pools, representing variability among relatively similar ecotypes, and two broader-based pools. Syn-1 seed of germplasm pools were evaluated for blue aphid (*Acyrtosiphon kondoi* Shinji) resistance and forage yield in saline and non-saline environments in the greenhouse. Fifty six plants ($p=12.5\%$) were selected using Simple Weighted Index in each pool and in the 'Hejazi' ecotype, and interpollinated to form six Cycl-1 selected populations. These populations and six randomly selected populations were evaluated both in the greenhouse, to measure response to selection, and in the field, to measure effect of selection on phenotypic variability. The initial screening study indicated that all germplasm pools had low aphid resistance and good potential for increased yield in saline and non-saline environments. No significant differences were observed in the field between selected and random populations for any of the agronomical or morphological traits evaluated. This indicates that multiple-trait selection did not affect variability for traits not targeted by selection. Response to selection for aphid resistance was significant only in the restricted pools. Response to selection for forage yield in saline and non-saline environments was highest in the most broad-based pool. Half-sib analysis among 25 families indicated that genetic variability in selected

populations was dependent on the level of variability present in the base population. The results of this study indicate that development of single Arabian alfalfa germplasm pool may be adequate to conserve the genetic variability among the Arabian alfalfa ecotypes since most of the desired traits among the Arabian ecotypes are common to most ecotypes.

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