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ASPECTS OF SELECTION IN BARLEY UNDER SALINE IRRIGATION

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ABSTRACT

Genetic correlation of tolerance and mean productivity with one another and with yield in saline and non-saline environments were calculated in terms of ratio of genetic variances and the genetic correlations between yield in stress and non-stress environments. Selection for mean productivity showed high positive genetic correlation to yield in both the environments. For increased yield in saline environment,one should go for selection for mean productivity. Selection for tolerance will decrease both mean productivity and mean yield in both the environments.

INTRODUCTION

Selection for yield or production traits in stress and non-stress environments is a problem which continues to perplex plant breeders. Salt tolerance is usually assayed in terms of absolute or relative growth or yield. Since, relative growth or yield can be used to express stability of performance, both absolute and relative criteria may have important economic significance (Rosielle and Hamblin 1981). In breeding crop varieties for stress environments, it must be decided whether to select directly in stress, or indirectly, in a non-stress environment.

This paper examines two selection aspects a) selection environment on the basis of relative effectiveness of indirect versus direct selection for a trait such as yield under saline irrigation and b) consiquences of selection under stress and non-stress conditions when following two selection criterion are taken into account:

(i) Selection for tolerance to stress when tolerance is defined by a small difference in productivity between stress and non-stress environments, and

(ii) Selection for mean productivity in stress and non-stress environments.

MATERIAL AND METHODS

Forty eight diverse genotypes of barley were grown at Central Soil Salinity Research Institute, experimental farm, Sampla (Haryana) with saline irrigation (EC_{iw}=20 dSm^{-1}) and canal irrigation (EC_{iw}=1.2 dSm^{-1}) in randomized block design with 3 replications. Each genotype was grown in 3m long 3 rows spaced 23 cm apart. In addition to pre-sowing irrigation, the irrigation of saline and canal water was

applied at active tillering, vegetative and flowering stage and salinity build up in root zone was monitored (Table 1). Yield per plot of all the varieties with canal water irrigation and saline water irrigation was recorded and analysed for analysis of variance to know the heritability of yield in stress (h^2 s) and non-stress environment (h^2 ns) and genetic correlation (rG) between yield in stress and non-stress environment for predicting selection response (Falconer 1981). Genetic correlations of tolerance and mean productivity with one-another and with each of their components in terms of ratios of genetic variances in stress and non-stress environments and the genetic correlation between yield in stress and non-stress environments were calculated according to Rossielle and Hamblin 1981.

Table 1. Salinity build-up in the root zone at different growth stages in barley under saline and canal water irrigation

Growth stage	Soil salinity (dSm^{-1})	
	Canal water irrigation	Saline water irrigation
Presowing	4 2	4.5
Vegetative stage	4.0	7.8
Harvesting stage	3.8	9.8

RESULTS AND DISCUSSION

The salt stress environment reduced yield 16% compared to non-stress environments. The genetic correlation between (Table 2) yield in stress and non-stress environment was 0.81 and estimate of heritability of yield under non-stress environment was greater than saline environment. Predicted ratio of correlated and direct response to selection (CR/R) was more in saline as compare to non-saline environment. Non-saline environment would be judged superior if heritability were the only criteria available for use in deciding which environment was best for selection. However, low predicted ratio of correlated and direct response to selection (CR/R) resulted large predicted advantage for direct selection in saline environment. These results can be interpreted that selection for yield in saline environment should be done direcitly to have larger response to selection. Direct selection was reported superior in Oat (Atlin and Fray 1989) also under phosphorus and heat stress environments.

Table 2. Heritability and the genetic correlation between yield in stress and non-stress environments and the predicted ratio of correlated and direct response to selection under stress

Type of environment	Mean yield kg/ha	Genetic variance	h^2	rG	CR/R
Saline	3105	1556.49	51.44	0.81	0.96
Non-saline	3717	379.71	72.07		0.68

Consequences of selection for tolerance and mean productivity on mean yield in stress and non-stress environment is presented in Table 3. Tolerance to stress has high negative genetic correlation to mean yield in stress and non-stress environments while mean productivity in stress and non-stress environments has positive correlation to mean yield in stress and non-stress environments. Tolerance and mean productivity are negatively correlated. The results indicate that for getting high mean yield in stress and/or non-stress environments, one should go for selection for mean productivity and not for selection for tolerance. Similar results were reported earlier (Rossielle and Hamblin 1981) and have advocated that selection for mean productivity will increase mean yield in both stress and non-stress environments except when the genetic correlation between yield in stress and non-stress environment is highly negative. Tolerance to stress and mean productivity is expected to show negative relationship because genetic variance is generally low in stress environment. A necessary condition for lines to show a positive relationship between tolerance and mean productivity is that genetic variance in stress environment is greater than in non-stress environments and this does not appear to be a common occurrance (Johnson and Frey1967; Mederski and Joffers 1973). Selection for tolerance to stress generally increase mean yield in stress environment (Rosielle and Hamblin 1981) except when both the environment are highly positively correlated.

Table 3. Genetic correlations : Tolerance to stress vs yield in stress and non-stress and tolerance to stress vs mean productivity (in stress and non-stress environment)

	Mean yield in stress environment	Mean yield in non-stress environment	Mean productivity (in stress and non-stress environment)
Tolerance to stress	-0.94	-0.57	-0.90
Mean productivity in stress & non-stress environment	0.90	0.98	

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