

Genetic influence of seed quality & physiological traits in soybean (*Glycine Max [L.] merrill*)

Abstract

The broad sense heritability of seed quality traits namely germination (%), 100 seed weight and ABA content (μM) were studied in the RBD experiment conducted during Kharif 2008 with 9 soybean genotypes AGS 334, Bhatt, T-49 and their 6 F_1 s. The broad sense heritability of ABA content (μM), germination percentage and 100 seed weight were quite high, 90.61, 84.03 and 81.01 per cent, respectively, indicating that these characters are mainly controlled by the additive gene effects. High genetic advance were recorded for germination per cent (25.84) and ABA content (18.38). Magnitude high genetic advance and high heritability as observed for ABA content and germination indicated additive gene effects. Therefore, high genetic gain is expected from selection for the improvement of these traits.

Keywords: soybean, seed physiological traits and seed quality, genetics, heritability, genetic advance, ABA content, germination and 100 seed weight

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Introduction

Abcisic acid (ABA) is a naturally occurring plant hormone which involved in plant growth and development.¹ In mature seeds, relatively higher levels of ABA have been found in some species and its occurrence resulted in dormancy and inhibition of germination.^{2,3} Earlier studies suggested that acquisition of desiccation tolerance is correlated with increase in ABA content of the embryo, lower water potential and the induction of number of specific genes.⁴ Accordingly desiccation tolerance has been considered as a switch to suppress the transcription of genes developmental proteins and to induce that the germination program. So, in particularly soybean the ABA content in mature seeds is influence the germination capacity of the seed. So, there is need to know the heritability of the germination trait. Few investigations are reported on heritability of seed quality traits in general soybean in particular.⁶ The genotypes with good and poor germinability are found. So, the character is heritable, hence the investigation on its heritability is necessary. The present investigation is to study broad sense heritability of seed quality traits viz. germination (%), 100 seed weight and ABA content (μM).

Materials and methods

Three soybean genotypes viz., AGS 334, Bhatt and T-49, were selected on the basis of their performance for seed longevity test. These selected genotypes viz., AGS 334, Bhatt and T-49 were crossed in full diallel fashion which included both direct and reciprocal crosses and selfed parents and were evaluated in RBD under field condition. The recommended package and practices were followed to raise the good crop. The random sample from resulted six F_1 s and their parents were used estimates the ABA content, germination percentage and 100 seed weight during 2007. The observations were recorded for 100-Seed weight (g), germination percentage and ABA content. Heritability in broad sense (h^2_{bs}) was estimated as the ratio of genotypic variance to phenotypic variance.⁷ Here heritability estimates were calculated as follows:

$$h^2_x = \frac{\sigma^2_{g_x}}{\sigma^2_{p_x}}$$

Where,

 h^2_x = Heritability of character x

 $\sigma^2_{g_x}$ = Genotypic variance of the character

 $\sigma^2_{p_x}$ = Phenotypic variance of the character

The expected genetic advance under selection for the different characters was estimated as suggested by **Allard (1960)**.

$$GA = h^2_b \times \sigma p_i \times K$$

where,

GA = Expected genetic advance

 $h^2(b)$ = Heritability in broad sense

 σp_i = Phenotypic standard deviation for i^{th} character

K = Intensity of selection, the value of which is 2.06 at 5%,

ABA content in Sample was measured by indirect ELISA according to Walker-Simmons⁸ & Norman *et al.*,⁹ with some modifications. ELISA was carried out in Crop Physiology Laboratory, G.K.V.K., University of Agriculture Sciences, Bangalore.

Results and discussion

The analysis of variance for mean squares for different character is presented in Table 1. The mean squares due to genotypes studied were found to be highly significant in different characters. The phenotypic coefficients of variation for ABA content (75.61) was maximum followed by 100 seed weight (17.85) and germination percentage (16.64). The genotypic coefficients of variation followed by the same pattern (Table 2). However, environmental coefficients of variation for germination percentage (1.99) were maximum followed by 100 seed weight (1.57) and for ABA content (0.93). Heritability estimates (percentage) in broad sense was highest for ABA content (90.61) followed by germination (84.03) and 100 seed weight (81.01), respectively. The highest genetic advance was recorded for germination per cent (25.84), followed by ABA content (18.38) and 100 seed weight (4.60), respectively.

Table 1 Analysis of variance for seed quality and physiological characters in soybean

Source of variation	D. F.	Mean Square		
		Germination (%)	100-seed weight (g)	ABA content (μM)
Replication	2	4.335	0.054	0.009
Genotype	8	502.167**	16.131**	247.259**
Error	16	29.915	1.169	8.251

** Significant at 1 % probability level.

Table 2 Estimates of broad sense heritability for seed quality and physiological characters

Characters	Genotypic coefficient of variation	Phenotypic coefficient of variation	Environmental coefficient of variation	Heritability(bs) (%)	Genetic advance
Germination (%)	16.52	16.64	1.99	84.03	25.84
100-seed weight (g)	17.78	17.85	1.57	81.01	4.6
ABA content (μM)	75.61	75.61	0.93	90.61	18.38

The present study revealed that the broad sense heritability estimates for ABA content, germination percentage and 100 seed weight were quite high, 90.61, 84.03 and 81.01, respectively. It means that the error coefficient of variation were quite low. The high values broad sense heritability estimates indicate that these are less influence by environmental factors. The study indicates that high heritability for ABA content and germination percentages were associated with high genetic advance indicating additive genetic control in the inheritance these traits. Therefore, high genetic gain is expected from selection for the improvement these traits. Similar result were also reported by Alam *et al.*;¹⁰ Sharma *et al.*;¹¹ Jangale *et al.*;¹² & Roy and Roquib.¹³ However, the low heritability estimates for 100 seed weight was associated with low genetic advance indicating non additive genetic control in the inheritance of this character. Therefore low genetic gain expected from selection in such a situation and the results found in this study for 100 seed weight did not agree with the finding of Karnwal and Singh.¹⁴⁻¹⁶ Thus, on the basis of heritability and genetic advance it can be suggested that during selection main emphasis should be given for ABA content and germination percentage for genetic enhancement for seed germinability in soybean.

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Conflicts of interest

The authors declared there is no conflict of interest.

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