



EFFECT OF SEED SIZE ON GERMINATION AND FIELD EMERGENCE IN SOYBEAN

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Abstract

Seed and seeding characters of soybean had genotypic differences. Within a cultivar, small seed had lower seedling length and dry matter but higher field emergence and field emergence index than seeds of other grades. The germination percentage was not influenced by seed size. Index score analysis showed that medium seed has best performance.

Keywords: Germination, field emergence, seedling length, test weight

Introduction

Germination and field emergence are the two most important bottlenecks in soybean (*Glycine max* (L.) Merrill) cultivation. These traits are influenced by genotype and seed size. Tiwari *et al.* (1978), Pachal & Ellis (1978) reported that small seeds show better germination whereas Fortes & Ohlrogge (1972) and Smith & Camper (1975) reported that large seeds show better germination, however, non-significant association (Johnson & Leudder, 1774) has also been reported. The present study was undertaken to determine the effect of seed size on germination and field emergence in soybean.

Materials and Methods

Seeds of six varieties (PKV-25, MACM-58, MACS-13 MAUS-61, JS-335 and MAUS-71) were size graded into large (> 6.25 mm) medium (> 5.46 mm but less than 6.25 mm) and small (< 5.46 mm) with the help of sieves. Observations on 100 seed weight, germination percentage, seedling length, seedling dry weight and field emergence were recorded from a random seed sample of each grade. Ungraded seeds were used as control. The experiment had four replications. Germination test was conducted at 25±2°C and 90±5% relative humidity according to ISTA to rules (7). Measurement of seedling length was taken on 8th day. Seedling dry weight of 10 normal seedlings was recorded after drying in an oven. 100 seeds per replication of each grade were sown with fertilizer dose of N:35 and P:200 kg/ha + Micronutrients (Boracol 50 and Satripe 250 kg/ha) Seeds were treated with thiram at the rate of 2.5gm/kg seeds and Rhizobium 250gm/15 kg seeds. A spacing of 30 X 10 cm was used. The number of seedlings emerged were counted on day emergence of seeds at 3.0, 4.5 and 6.0 cm depth was noted from a soil bed of 25 cm depth in the glass house. Soil moisture was kept at field capacity by controlled irrigation. Emergence of seeding was observed on 15th day after sowing. The percentage data were transformed to respective angles data were transformed to respective angles (arc sin) for statistical analysis. Emergence at different depth of sowing was compared by Duncan's Multiple Range test. Field emergence index (FEI) was calculated by the formula:

$$FEI(\%) = \frac{\text{Germination}(\%) - \text{Field emergence}(\%)}{\text{Field emergence}(\%) \times 100}$$

Results and Discussion

The study indicated that significant differences between grades cultivars for all the characters except germination (%).

The interaction was significant for all the characters except germination and field emergence. The mean values for various characters of different size grades are presented in table I and Fig I. Seed weight, seedling length and dry weight of large seeds were significantly higher than small seed. Hard seed percentage and field emergence were significantly lower in large seeds than small seeds. Performance of ungraded seed (control) was similar to the medium size seed for all the observed traits. Seed size was significantly and positively associated with seedling length and dry weight and had significant negative association with hard seed percentage and emergence (Table I) Germination percentage was not significantly associated with seed size.

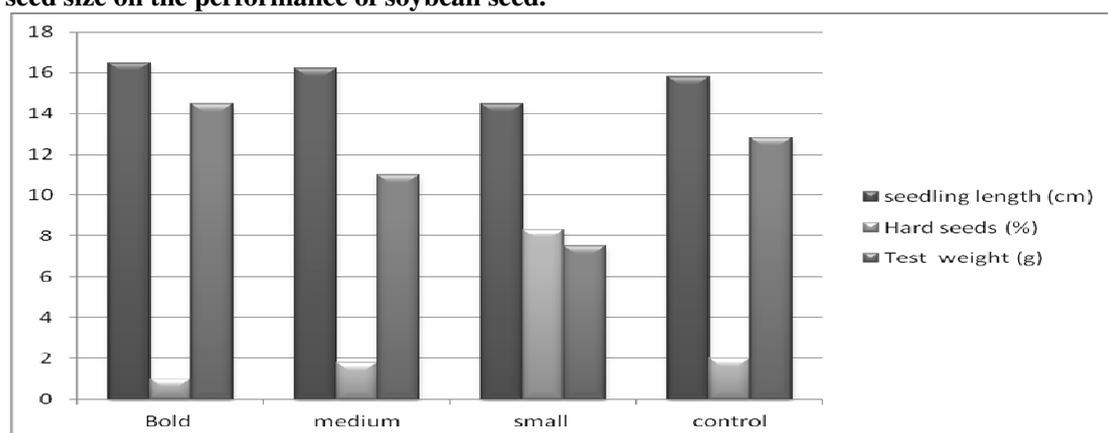
Bold seeded varieties MAUS-61 and JS – 335 having more than 12g seed weight (Table2) had low field emergence and hard seed percentage, but MACS-13 had field emergence and no hard seeds. Varieties with low test weight PKV-25, MACM-58 and MAUS-71 had higher field emergence and hard seed percentage but lower seedling dry weight than bold seeded varieties.

Ungraded seeds of varieties PKV-25 MACM-58 behaved as small, MAUS-71, JS-25 AND MACS-13 AS medium and MAUS-61 as bold size group. The total index score of all the genotypes and grades varied from 10-15 (Table 3). Bold seeds of PKV-25 with a total score of 15 was the best performer, whereas, small seeds of MAUS- 61 and JS-335 had the lowest total score. The overall picture of total index score indicated that medium seed was the best performance (81), followed by bold (80), ungraded (79) and small (78) seeds.

FEI of small sized seeds was higher followed by bold, medium and control (Table I). Small seeds were less sensitive to environmental conditions for emergence in field. Sowing of graded seeds at different depths (Table 4) showed that at 3.2 cm depth all the grades had similar performance, as the seed was place deeper the emergence particularly of bold was adversely affected. Bold Seeds of soybean with high germination percentage, seedling length and dry weight had poor field emergence.

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Influence of seed size on the performance of soybean seed.**Fig. 1 :** Influence of seed size on the performance of soybean seed.**Table 1:** Mean of observed characters in different grades of soybean seed.

Characters	Seed grades				CD at 5 %
	Large/Bold	Medium	Small	Control	
Seeds weight (g)	15.6	11.8	8.7	12.5	2.5
Germination (%)	80	81	78	79	Ns
Hard Seed (%)	0.98	1.90	8.75	2.45	2.1
Seedling Length (cm)	17.50	17.30	15.43	16.05	0.65
Seedling dry weight (mg)	400	306	257	324	42.3
Field emergence b. (%)	64	77	81	73	3.2
FEI (%)	28.86	7.76	3.57	11.0	3.3

a: association with test weight : b : calculation after arc-sin transformation

Table 2: Seed weight and other seedling characters of different soybean varieties in ungraded seed.

Characters	MAUS-61	MAUS-71	JS-335	PKV-25	MACM-58	MACS-13	CD at 5%
Seeds weight (g)	15.1	12.7	12.5	10.9	9.8	9.5	2.0
Germination (%)	78	77	81	79	78	83	18
Hard Seed (%)	0.16	0.7	0.0	2.8	2.4	7.9	1.21
Seedling Length (cm)	15.8	18.7	14.9	16.4	15.8	16.5	1.80
Seedling dry weight (mg)	370	398	316	308	289	249	54.8
Field emergence (%)	73	71	78	77	77	81	4.2

Table 3: Total index score for observed traits of different varieties and grades of soybean.

Varieties	Large	Medium	Small	Ungraded
M.A.U.S.- 61	14	14	11	14
M.A.U.S.-71	13	15	13	11
JS-335	13	13	11	12
PKV-25	16	15	13	12
M.A.C M-58	14	14	14	12
M.A.C.S-13	14	14	12	14
Total score	84	85	74	75

Table 4 : Effect of seed size and depth of sowing on the field emergence of soybean.

Depth of sowing (cm)	Large	Medium	Small	Ungraded	Mean
3.2	74 ^{a1}	75 ^{a1}	74 ^{a1}	72 ^{a1}	73.75
4.7	69 ^{a1}	72 ^{ab1}	76b1	72 ^{ab1}	72.25
6.2	52a2	61b2	73c2	66b2	63.0
Mean	65	69.33	74.33	70	69.66

Within row (abc) and column (1, 2, 3) followed by same letter not significantly different ($p < 0.05$, Duncan's multiple rang test).

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