



Variation in Seed Quality Parameters of Off-Season Soybean of Different Planting Dates and Varieties

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The work was carried out to assess the effect of varieties and dates of sowing on seed quality parameters of soybean seed produced during off-season i.e., *Rabi* at Rajendranagar. The seeds of varieties AISb-50, Basara and JS-335 were used for estimation of seed quality parameters which were sown on 15th December and 15th January. The seed quality parameters differed significantly

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due to dates of sowing and varieties. The treatment sum of squares revealed a significant difference in germination, seedling vigour index-I, seedling dry weight, speed of germination and field emergence, whereas seedling length was non-significant for varieties. While the seedling vigour index-II and electrical conductivity showed non-significant variation in the interaction between varieties and dates of sowing. The 15th December sown crop showed higher germination (91.11%), seedling length (27.63 cm), seedling vigour index-I (2518), dry weight (95.90 mg), seedling vigour index-II (8713), speed of germination (25.05) and field emergence (89.22%). The variety JS-335 exhibited higher germination (92.83%), seedling length (27.55cm), vigour index I (2558), speed of germination (28.25%), while higher seedling dry weight and vigour index II was exhibited by Basara (94.86 mg and 8097). The amount of leachates was found in Basara with electrical conductivity of 23.82 $\mu\text{Scm}^{-1}\text{g}^{-1}$. The interaction between dates of sowing and varieties revealed that the variety JS-335 of 15th December sown exhibited higher germination (95.33%), seedling length (28.43 cm), seedling vigour index I (2711), speed of germination (29.97) among other varieties. The variety Basara of 15th December sown crop showed higher seedling dry weight (103.93 mg) and seedling vigour index II (8936). The electrical conductivity was higher in case of Basara of 15th January (24.59 $\mu\text{Scm}^{-1}\text{g}^{-1}$).

Keywords: Germination; seed production; seed quality.

1. INTRODUCTION

Soybean (*Glycine max* L. Merrill) is one of the major oilseed crops and it is recognized as pulse as well as oilseed crop. Soybean is known as miracle crop as being a rich source of protein, oil, carbohydrates and other nutrients for humans and animals.

India is the fifth major soybean growing country in the world and it occupies an area of 12.92 m hectares with a production of 12.61mt and productivity of 976 kg ha⁻¹ [2]. Basically, it is a tropical crop but extends to subtropics and temperate climates. Soybean is short day plant and it is grown in a temperature range between 25-45°C. Soybean seed quality deteriorate very quickly due to various constraints. The different varieties of soybean are sensitive to changes in environmental conditions where the crop is being grown [1]. Quality seed is prerequisite for exploiting full potential of crop and it ensures genetic purity, physical purity, germination (%) and seed vigour [3]. which resulted in better crop production.

Soybean seed quality is being affected by sowing time and hotter environmental conditions that associates with lower seed quality. In order to assess the best dates of sowing and varieties during off-season in Telangana State the present study was taken up to assess the seed quality parameters of soybean seed produced during off-season at Rajendranagar location.

2. MATERIALS AND METHODS

The experiment was conducted at Rajendranagar with three varieties viz., AISb-50, Basara and JS-335 and two dates of sowing (15th December and 15th January) during *Rabi* 2021-22 at Seed Research and Technology Centre, Rajendranagar. The seed collected from two dates of sowing were used to assess the seed quality parameters. Laboratory experiment was conducted at Seed Research and Technology Center, Rajendranagar in FCRD with three replications. The observations were recorded for germination (%), seedling length (cm), seedling vigour index-I, seedling dry weight (mg), seedling vigour index-II, speed of germination, field emergence (%) and electrical conductivity ($\mu\text{Scm}^{-1}\text{g}^{-1}$). Germination test was conducted as per ISTA using between paper method, the number of normal seedlings were counted on 8th day by following formula.

$$\text{Germination \%} = \frac{\text{(Number of normal seedlings)}}{\text{(Total number of seeds placed)}} \times 100$$

And seedling vigour index-I and seedling vigour index-II was calculated as per the formula given by Abdul-Baki and Anderson [4] and expressed in whole number.

$$\text{SVI-II} = \text{Germination (\%)} \times \text{Seedling dry weight (mg)}$$

$$\text{SVI-I} = \text{Germination (\%)} \times \text{Seedling length (cm)}$$

The data were subjected to statistical analysis as per the method given by Panse and Sukhatme [5].

3. RESULTS AND DISCUSSION

The mean sum of squares disclosed significant differences for germination, seedling length, seedling vigour index-I, seedling dry weight, seedling vigour index-II, Field emergence among dates of sowing (Table 1). While the germination, seedling vigour index-II and electrical conductivity showed non-significant variation in the interaction between varieties and dates of sowing.

Significant variation was observed for dates of sowing and varieties with mean varied from 88.11% to 91.11% and 85.34% to 92.83% respectively (Table 2 and Fig. 1). Among the varieties, significantly higher percent of germination was recorded in JS-335 (92.83%) over Basara (85.34%), while it was found to be on par with AISb-50. Germination was significantly high in 15th December (91.11%) over 15th January (88.11%). The higher germination % noticed on 15th December is due to congenial weather conditions during the crop period. The significant superiority among the interactions was exhibited by JS-335 of 15th December over Basara of 15th January.

The results on seedling length as influenced by varieties and dates of sowing were represented in Table 2. For this trait, varieties showed non-significant difference whereas for dates of sowing, 15th December exhibited significant superiority (27.63cm) over 15th January (25.93 cm). The interaction effects were found to be on par with each other except 15th January with Basara. The higher seedling growth in 15th December sown crops is due to higher test weight or seed size which might due to adequate food reserves to resume embryo growth. Similar reports were found by Doddagoudar et al. [6] in cotton.

These findings are in conformity with Uem and Unioeste [7] who reported that seeds from optimum sowing dates had higher percentage of germination than delayed planting because of more favourable climatic conditions during seed development in soybean.

Significant increase in shoot length might be due to higher seed index, which might have supplied adequate food reserves to resume embryo

growth. These findings are in accordance with those of Kumar et al. [8] who reported that in niger seed quality parameters like germination percentage and seedling length were observed to be lower in the delayed planting.

The results indicates that the varieties and dates of sowing mean ranged from 2226 to 2558 and 2287 to 2518 respectively for seedling vigour index-I (Table 2). The variety JS-335 (2558) exhibited significant superiority for this trait. Significant difference was shown by the crop sown on 15th December (2518) over 15th January. Among the interactions effects, the variety JS-335 (2711) of 15th December registered significant superiority compared to other interactions studied. Influence of sowing dates on seedling dry weight was significant at initial stage with mean ranges from 799.50 to 959.00 mg, with the highest dry weight in 15th December sown crop (Table 2). The variety Basara (948.60 mg) showed significant superiority compared to JS-335 but it was on par with AISb-50. Among the interactions the variety Basara of 15th December (1039.30 mg) was found to be significantly high over other interactions studied except AISb-50 with December 15th sowing.

Seedling vigour index differed for dates of sowing, varieties and its interactions. Significantly higher vigour index-II was observed in Basara (80968) over JS-335 and in case of dates of sowing 15th December exhibited superiority (87134) over 15th January. The interaction between dates of sowing and varieties revealed that all the three varieties of 15th December were found to be significantly superior when compared to varieties with 15th January sowing. The highest vigour index was exhibited by Basara of 15th December (89364) while least was observed in JS-335 of 15th January (Table 2). These results are in accordance with the findings of Rahman et al. [9] who reported that optimum time of sowing had high vigour index.

The results revealed that for varieties the means ranged from 20.85 to 28.25 (Table 2) and the variety JS-335 (28.25) showed significantly higher speed of germination compared to other two varieties. Effect of dates of sowing and varieties on speed of germination revealed that JS-335 of 15th December was found to be significantly superior over other interactions.

Table 1. Analysis of variance for seed quality parameters of off-season soybean sown at Rajendranagar

Source of variation	Df	Germination (%)	Seedling length (cm)	Seedling vigour index I	Seedling dry weight (mg)	Seedling vigour index II	Speed of germination	Field emergence (%)	Electrical conductivity ($\mu\text{Scm}^{-1}\text{g}^{-1}$)
Dates of sowing (A)	1	40.50*	13.00*	239662.70**	11452.90**	127660700.00**	0.98	234.72*	0.03
Varieties (B)	2	89.38**	3.31	167341.60**	3320.08**	7640633.00	83.36**	296.05**	41.84**
A × B	2	5.16	8.64*	59513.55*	306.59	3238792.00	10.05*	90.05	9.70
Error (B)	12	6.22	1.51	14411.72	342.95	2558395.00	2.07	41.27	4.36
Total	17	17.89	3.24	50959.63	1342.45	40595310.00	12.51	88.36	9.14

*, ** Significance at 5% level

Table 2. Effect of sowing dates and varieties on seed quality parameters of off-season soybean sown at Rajendranagar

Treatment	Germination (%)	Seedling length(cm)	Seedling vigour index I	Seedling dry weight (mg)	Seedling vigour index II	Speed of germination	Field emergence (%)	Electrical conductivity ($\mu\text{Scm}^{-1}\text{g}^{-1}$)
D ₁	91.11	27.63	2518	95.90	8713	25.05	89.22	20.74
D ₂	88.11	25.93	2287	79.95	7029	24.58	82.00	20.82
V ₁	90.67	26.74	2424	88.86	8057	25.34	88.20	19.47
V ₂	85.34	26.07	2226	94.86	8097	20.85	77.70	23.82
V ₃	92.83	27.55	2558	80.07	7460	28.25	91.00	19.07
D ₁ V ₁	92.00	26.37	2426	94.23	8668	24.67	90.33	20.89
D ₁ V ₂	86.00	28.10	2417	103.93	8936	20.50	85.67	23.05
D ₁ V ₃	95.33	28.43	2711	89.54	8536	29.97	91.67	18.29
D ₂ V ₁	89.33	27.10	2421	83.48	7446	26.00	86.00	18.04
D ₂ V ₂	84.67	24.03	2035	85.78	7257	21.20	69.67	24.59
D ₂ V ₃	90.33	26.67	2405	70.59	6384	26.53	90.33	19.84
GM	89.61	26.78	2403	87.92	7871	24.81	85.62	20.78
CD @5%								
D	2.56	1.26	123.30	6.01	519.51	1.48	6.60	2.15
V	3.14	1.55	151.01	7.37	636.27	1.81	8.08	2.63
DxV	4.44	2.19	213.56	10.42	899.82	2.57	11.43	3.72
C.V. (%)	2.78	4.60	5.00	6.66	6.43	5.81	7.51	10.05
S. Em.(±)	1.44	0.71	69.31	3.38	292.03	0.83	3.71	1.21
SE.d.	2.04	1.01	98.02	4.78	41.99	1.18	5.25	1.71

D₁- Sown on 15th December, D₂- Sown on 15th January
V₁-Aisb-50, V₂-Basara, V₃-JS-335

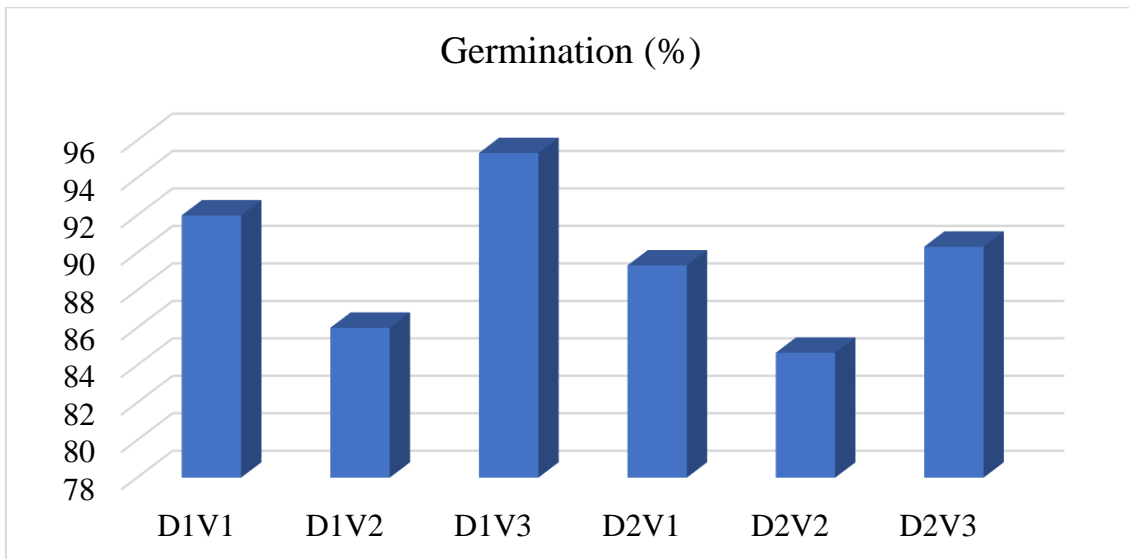


Fig. 1. Effect of dates of sowing and varieties on germination (%) of soybean seed produced during off-season at Rajendranagar

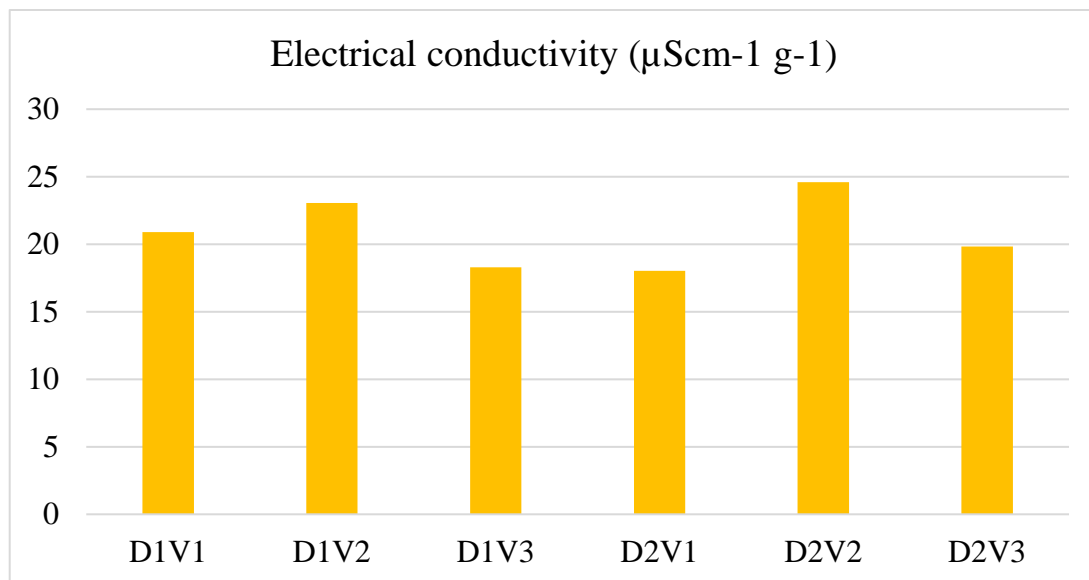


Fig. 2. Effect of dates of sowing and varieties on electrical conductivity (µScm⁻¹g⁻¹) of soybean seed produced during off-season at Rajendranagar

The field emergence exhibited a range from 82.00% to 89.22% for the dates of sowing and 77.70% to 91.00% for varieties (Table 2). The highest and lowest field emergence was observed in JS-335 (91.00%) and Basara (77.70%) respectively. The crop of 15th December recorded significant superiority over 15th January. All the interaction effects were found to be on par with each other except Basara of 15th January which exhibited lowest field emergence. Field emergence recorded to be higher in JS-335 followed by AISb-50, which

might be due to bold sized seed associated with higher vigour. Similar observations were noticed by Indrakumar et al. [10] who reported that seed size and test weight positively related to field emergence in pea.

The electrical conductivity at initial stage ranges from 19.07 to 23.82 µScm⁻¹g⁻¹ and 20.74 to 20.82 µScm⁻¹g⁻¹ for dates of sowing and varieties respectively with general mean of 20.78 µScm⁻¹g⁻¹ (Table 2 and Fig. 2). The variety Basara exhibited higher EC, whereas JS-335

(19.07 $\mu\text{Scm}^{-1}\text{g}^{-1}$) and AISb-50 (19.47 $\mu\text{Scm}^{-1}\text{g}^{-1}$) recorded lower values. In case of dates of sowing this trait was found to be non-significant. Among the interactions, Basara of 15th January showed high EC which indicates larger leakage of leachates from seed and poor quality.

5. CONCLUSION

The interaction between dates of sowing and varieties significantly affects the seed quality parameters. The seed of 15th December sown crop is having good seed quality. The variety JS-335 was found to have good seed quality in most of the traits. Among the interactions the crop sown on 15th December of variety JS-335 showed good seed quality parameters among all the varieties.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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