



Effect of Different Sowing Dates and Spacing on Soybean Varieties for Seed Quality during *Rabi* Season

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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

Soybean, the number one oil seed crop in the world has recently occupied an important place in the edible oil and agricultural economy of the country. Lack of good quality seed is one of the major problems encountered in soybean production. Soybean as commercial crop is successful in *kharif* season as the agro-climatic conditions are found suitable. But climatic conditions may cause the adverse effect on seed production of different soybean varieties in *kharif* season. Hence, to fulfill the demand of quality soybean seed, efforts has been made to produce the soybean in *rabi* season. The research trial on *rabi* season soybean seed production was conducted during 2021-22 at the Research Farm, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The

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field experiment was laid out in split-split plot design having three replications. Total nine treatment combinations were there, consist of three sowing dates viz., 16 Dec, 31 Dec and 15 Jan in main plot and three spacing as 30 x 10 cm, 45 x 10 cm and 60 x 10 cm in sub plot and three varieties are AMS 100-39, RSC 10-46 and KDS-753 in sub-sub plot.

It can be revealed from the experimental results that graded seed yield (kg ha^{-1}) and weight of graded 100 seed (g) were extensively greater in early sown crop of 16 Dec., variety RSC 10-46 and spacing 45 x 10 cm. Sowing date 16 Dec recorded minimum under size seed weight. In variety RSC 10-46 recorded minimum under size seed weight followed by variety AMS-100-39 (44.96 kg ha^{-1}) and spacing of 45 x 10 cm. Treatment combination D_1V_2 (sowing on 16 Dec. and variety RSC 10-46) recorded minimum under size seed yield. Significantly maximum weight of graded 100 seed was recorded by sowing date 16 Dec. (10.44 g), variety RSC 10-46 and spacing 45 x 10 cm.

Keywords: Soybean; spacing; varieties; seed quality; graded seed; under size seed.

1. INTRODUCTION

Soybean growth is influenced by several factors like the genetic makeup of the cultivars, soil type, water regime and climatic parameters (temperature, humidity, rainfall, radiation etc. seasonal and daily variations in weather determine cropping practices and are major determinants of yield, diseases and quality of production throughout the country. The seasonal patterns in rainfall, temperature and solar radiation influence the growth of crops. Crop models are used in a dynamic framework to generate hypothesis and to investigate causal relationships, such as reasons for weather and management effects on yield. Soybean is one of the classical short-day plants. The variation of photoperiod sensitivity among soybean genotypes allows the crop to grow successfully across a wide range of latitudes [1-3].

For increasing the productivity of agricultural crops quality seed is major input. Lack of good quality seed is one of the major problems encountered in soybean production. Seed after harvesting contains many undesirable materials like seeds of other crops, weed seeds, immature seeds, damaged seeds, seeds which are too small or too large, plant materials and other inert matters. To separate these different kinds of material, many equipment's have been developed which exploit the differences between the physical characteristics of the various components of the seed mixture. Seed size exerted a significant influence on the graded seed yield, undersized seed yield, seed diameter, 100 seed weight and germination (%) which result into quality seed production.

Soybean as commercial crop is successful in *kharif* season as the agro-climatic conditions are found suitable. But climatic conditions may cause

adverse effect on seed production of different soybean varieties in *kharif* season. However, quality soybean seed with high germination and vigor can be obtained by sowing during November to December in *rabi* season [4]. Even maintaining the minimum germination standard (70%) till next season becomes difficult as these factors affect seed germination and vigour severely. The seed requirement of soybean is high as compare to seed multiplication ratio in soybean, which forms the major bottleneck in augmenting the availability of quality seed.

2. MATERIALS AND METHODS

The experiment was conducted to evaluate the performance of soybean varieties under different sowing dates and spacing for seed production during *rabi* season of 2021-22 at the Research Farm of Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.

The soil of the experimental field was clayey in texture, low in organic carbon (0.57%) and available nitrogen (217.9 kg ha^{-1}), low in available phosphorus (15.89 kg ha^{-1}) and high in available potassium ($364.23 \text{ kg ha}^{-1}$). The soil was slightly alkaline in reaction (pH 8.6). Total rainfall received during the crop growth period was 42.6 mm over 1 rainy day during 52 MW. The average monthly maximum temperature of 42.4°C was recorded in April and minimum of 11.3°C was in the month of January.

An experiment was laid out in split-split plot design with three replications. The experiment consists of twenty-seven treatment combinations, comprising of three sowing dates viz., 16 Dec., 31 Dec. and 15 Jan. in main plot, three spacing like 30 x 10 cm, 45 x 10 cm and 60 x 10 cm in sub plot and three varieties which are AMS 100-39, RSC 10-46 and KDS-753 in sub-sub plot in

the experiment. The recommended dose of fertilizers 30:60:30 kg N: P₂O₅: K₂O ha⁻¹ was applied through vermicompost and phosphorus rich organic manure.

The sowing of soybean was carried out as per the treatment. Seeds were drilled as per the spacing in treatments and at the time of thinning expected plant stand was achieved maintaining plant to plant distance of 10 cm. As required gap filling was done on 6th and thinning on 10th day after each sowing so as to maintain intra plant spacing of 10 cm. The most important differences are in size, shape and density. Separations based on these characteristics are made by standard size perforated sieves of 3.75 mm. The hand weeding and hoeing were given to keep the experimental plots weed free and aerated. The seeds were graded with slotted sieves of size 3.75 mm. The seeds retained on the sieves were analyzed for other seed quality parameters. The seeds below the sieve were treated as under size seed yield [5].

3. RESULTS AND DISCUSSION

3.1 Graded Seed Yield (kg ha⁻¹)

Seed grading is an integral part of seed production for enhanced planting value. In addition to obtain uniform seed size within a variety, size grading is essential.

3.2 Effect of Sowing Dates

Sowing date 16 Dec recorded significantly maximum graded seed yield (1058.34 kg ha⁻¹) whereas lowest graded seed yield (564.71 kg ha⁻¹) was recorded by 15Jan. This may be due to favorable weather encountered across different phenophases by this sowing date as compared to other. The similar result was reported by B. S. Ganiger et al., [5], Anuradha et al., [6]

3.3 Effect of Spacing

The different spacings significantly differed graded seed yield (kg ha⁻¹), wherein spacing of 45 x 10 cm recorded significantly higher graded seed yield 985.21 and as compared to 30 x 10 cm (797.93 kg ha⁻¹) and 60 x 10 cm (639.35 kg ha⁻¹).

3.4 Effect of Varieties

The significantly highest graded seed yield (950.30 kg ha⁻¹) was recorded in variety RSC 10-

46 followed by variety AMS-100-39 (796.52 kg ha⁻¹) and the lowest graded seed yield (675.67 kg ha⁻¹) was recorded by variety KDS-753.

It might be due to potential yield of the variety as a varietal inheritance.

3.5 Interaction Effect

It was revealed that an interaction between different sowing dates and varieties was found significant. Treatment combination D₁V₂ (sowing on 16 Dec. and variety RSC 10-46) recorded maximum graded seed yield (1240.07 kg ha⁻¹) and other treatment combinations were not significant.

3.6 Under Size Seed Yield (kg ha⁻¹)

3.6.1 Effect of sowing dates

Different sowing dates significantly influenced the under size seed yield kg ha⁻¹.

Sowing date 16 Dec. recorded significantly lowest under size seed yield (31.46 kg ha⁻¹) whereas highest under size seed yield (57.38 kg ha⁻¹) was recorded by 15 Jan. This may be due to a greater number of graded seed in early sowing as compare to late sown soybean. The highest seed quality (Germination %, Seed viability and seed vigour) of soybean was recorded with soybean sown on 15th September with variety JS-93-05 [7].

3.6.2 Effect of spacing

The different spacings significantly differ in under size seed yield where in spacing of 45 x 10 cm recorded significantly lower under size seed yield 36.44 as compared to 30 x 10 cm (42.67 kg ha⁻¹) and 60 x 10 cm (52.29 kg ha⁻¹).

3.6.3 Effect of varieties

Different varieties were significantly influenced the under size seed yield kg ha⁻¹.

The significantly lowest under size seed yield (31.20 kg ha⁻¹) was recorded in variety RSC 10-46 followed by variety AMS-100-39 (44.96 kg ha⁻¹)

3.6.4 Interaction effect

The interaction effect between different sowing dates and varieties on under size seed yield kg ha⁻¹ was found significant.

Treatment combination D₁V₂ (sowing on 16 Dec. and variety RSC 10-46 recorded minimum under size seed yield (22.13 kg ha⁻¹) and other treatment combinations were not significant.

3.7 Weight of Graded 100 Seed (g)

The weight of 100 graded seed (g) trait is one of the yield components of soybean and is generally positively correlated with quality of seed and yield.

3.7.1 Effect of sowing dates

Significantly maximum weight of graded 100 seed was recorded by sowing date 16 Dec.

(10.44 g) followed by 31 Dec. (8.86 g). Lowest weight of graded 100 seed was recorded for 15 Jan. sowing (5.74 g). This might be due to the short vegetative growth period and long reproductive and grain filling period that significantly raised the weight of graded 100 seed. Partha et al. [8] also reported significantly maximum graded 100 seed weight with the sowing of soybean on 2nd December.

3.7.2 Effect of spacing

Spacing 45 x 10 cm observed significantly higher weight of graded 100 seed than spacing 30 x 10 cm and 60 x 10 cm.

Table 1. Graded seed yield (kg ha⁻¹) and under size seed yield (kg ha⁻¹) of soybean as influenced by sowing dates, spacing and varieties

Treatment	2021		
	Graded seed yield (kg ha ⁻¹)	Under size seed yield (kg ha ⁻¹)	Weight of graded 100 seed (gm)
I) Main plot treatments A) Sowing Dates			
D ₁ - 16 Dec.	1058.34	31.46	10.44
D ₂ - 31 Dec.	799.44	42.56	8.86
D ₃ - 15 Jan.	564.71	57.38	5.74
S. E. (m) ±	8.17	0.68	0.11
C. D. at 5%	23.46	1.95	0.32
II) Sub plot treatments B) Spacing			
S ₁ - 30 X 10 cm	797.93	42.67	8.14
S ₂ - 45 X 10 cm	985.21	36.44	9.21
S ₃ - 60 X 10 cm	639.35	52.29	7.70
S. E. (m) ±	15.99	1.01	0.12
C. D. at 5%	49.28	3.12	0.38
III) Sub-sub plot treatments C) Varieties			
V ₁ - AMS 100-39	796.52	44.96	8.10
V ₂ - RSC 10-46	950.30	31.20	9.14
V ₃ - KDS-753	675.67	55.24	7.81
S. E. (m) ±	18.19	1.24	0.13
C. D. at 5%	71.42	4.87	0.50

Table 2. Interaction effect of different sowing dates and varieties on graded seed yield and under size seed yield (kg ha⁻¹) of soybean

Sowing Dates	Varieties					
	Graded seed yield (kg ha ⁻¹)			Under size seed yield (kg ha ⁻¹)		
	V ₁	V ₂	V ₃	V ₁	V ₂	V ₃
	AMS-100-39	RSC 10-46	KDS-753	AMS-100-39	RSC 10-46	KDS-753
D₁ - 16 Dec.	946.03	1240.07	664.81	30.94	22.13	40.53
D₂ - 31 Dec.	791.41	1030.10	568.04	44.65	32.13	58.11
D₃ - 15 Jan.	660.87	904.85	461.28	52.09	40.12	73.52
S.E. (m)±	14.15			17.07		
C.D. at 5 %	40.63			49.01		

3.7.3 Effect of varieties

Variety RSC 10-46 recorded significantly maximum weight of graded 100 seed (9.14 g) followed by variety AMS 100-39 (8.10 g) and KDS-753 (7.81 g).⁴

The variation in seed size among varieties might be accounted for varieties inheritance. Similarly, the differences in weight of graded 100 seed of different varieties were also reported by Parmar and Nema [9].

3.7.4 Interaction effect

Interaction effect was not significant for weight of graded 100 seed.

4. CONCLUSION

It was concluded from the present investigation that, the sowing on 16 Dec. with the spacing 45 x 10 cm and the variety RSC 10-46 found to be best for quality seed production as a graded seed yield of *rabi* soybean.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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