Effect of different sowing dates and spacing on soybean varieties for seed quality during *rabi* season

ABSTRACT

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 field experiment was laid out in split-split plot design having three replications. Total nine treatment combinations were there, consisted 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 December, variety RSC 10-46 and spacing 45 x 10 cm. The minimum under size seed weight was recorded by sowing date 16 Dec. in variety RSC 10-46 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

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 determines 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.

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. mm

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. However, quality soybean seed with high germination and vigour can be obtained by sowing during November to December in *rabi* season. (Rehman and Hossain, 2013). 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.

Material 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 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 42.4^0C was recorded in April and minimum of 11.3^0C 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 December, 31 December and 15 January 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. In order to record the various biometric observations, five plants were selected randomly to present the population in each plot, labeled it and observations were recorded on them at periodic intervals. The data was analyzed statistically as per Panse and Sukhatme (1967).

Results and Discussion

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.

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 favourable weather encountered across different phenophases by this sowing date as compared to other.The similar result was reported by B. S. Ganiger *et al*., (2019), Anuradha *et al*., (2009)

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})

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

Interaction effect

It was revealed that an interaction between different sowing dates and varieties was

found significant. Treatment combination D_1V_2(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.

Under size seed yield (kg ha^{-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.

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}).

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})

Interaction effect

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

Treatment combination D_1V_2(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.

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 (Burris *et al.*, 1973).

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.* (2016) also reported significantly maximum graded 100 seed weight with

the sowing of soybean on 2nd December.

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.

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).

The variation in seed size among varieties might be accounted for varietals inheritance. Similarly, the differences in weight of graded 100 seed of different varieties were also reported by Parmar and Nema (2002).

Interaction effect

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

References

Anuradha, R., Balamurugan,P., Srimathi,P. and Sumathi,S. 2009. Influence of seed size on seed quality of chickpea (Cicer arietinum L.). Legume Research International Journal, 32:133-135.

Burris J.S., Edje, O.T. and Wahab, A.H. (1973). Effects of seed size on seedling performance in soybeans: II. Seedling growth and photosynthesis and field performance.Crop Science.13: 207–210.

Ganiger, B. S., Basave, Gowda., Umesh, Hiremath., Lokesh, G. Y. and Rekha, L. 2020. Seed Size Studies in Relation to Quality Attributing Parameters in Chickpea Variety GBM-2. International journal of current microbiology and applied sciences. App. Sci. 9(07): 1694-1702. doi: https://doi.org/10.20546/ijcmas.2020.907.195

Parmar, A. and Nema, V. P. 2002. Effect of plant densities on growth, yield attributing parameters and productivity of soybean [Glycine max (L.) Merrill] genotypes. M.Sc. (Ag.) Thesis, J.N.K.V.V., Jabalpur.

Partha, K.K., Roy, T.S. Khan, Md. and Mazed, H.E.M. 2016. Effect of sowing date on yield and yield quality of soybean. Journal of Agriculture and Ecology Research Institute. 9(4):1-7.

Rehman, M. M. and M. M. Hossain, 2013. Effect of Sowing Date on Germination and Vigour of Soybean (Glycine max (L.) Merr) Seeds. The Agriculturists. 11 (1): 67-75

Panse, V.G. and Sukhatme, P.V. (1967). Statistical Methods for Agricultural Workers, ICAR, New Delhi, pp. 359.

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
D_1 - 16 Dec.	946.03	1240.07	664.81	30.94	22.13	40.53
D_2 - 31 Dec.	791.41	1030.10	568.04	44.65	32.13	58.11
D_3 - 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**		