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Influence of Seed Size on Seed Quality, Yield and Yield Contributing Characters in Soybean (*Glycine max* L. Merrill)

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ABSTRACT: *The medium seed size variety JS 335 performed better than all small and bold seed variety in respect of yield and yield contributing characters. Medium seed size recorded significantly higher germination percentage (94.95%) followed by small and bold seed size. Medium seed size (JS 335) showed maximum vigour index (18.78) than the other seed sizes. The root length and shoot length was significantly superior in bold seed size as compared with small and medium seed size genotypes. The medium seed cultivar reported the highest number of pods per plant and test weight as compared to small and bold seed cultivar. The highest seedling fresh weight, highest seedling dry weight, higher root length (cm) and shoot length (cm) was recorded by bold seed size variety TAMS 38 than rest of the seed size. Most of the characters like grain yield per plant, test weight, germination percentage, root length, shot length and vigour index are decreased with decrease seed size. Hence, it is advisable to use bold and medium seed sizes for better seed quality.*

Keywords: *Soybean, Seed Size, Seed Quality, Yield*

INTRODUCTION

Soybean has proved to be highly promising oilseed crop under different agro-climatic zones of India because of its high yielding potential, wide adoptability, drought resistance and short duration. It has been now established as oilseed as well as pulse crop and emerged as cheapest alternate source of high quality protein food and edible oil. It is a triple beneficiary crop, which contains about 20 per cent of oil which is high in essential fatty acids (Omega-6 and Omega-3) and 38 to 42 per cent high quality protein with 6.4 per cent lysine (Norman, 1963). It also contains phytochemicals known as isoflavones, which have been found to posses health benefits, as they exhibited properties like cancer preventing, combating menopausal problem and helping to recover fast from diabetes.

Lack of availability of quality seed at proper time is one of the important reasons for low productivity in soybean. At present the seed replacement ratio in Maharashtra is only up to 40 per cent. In Marathwada region alone, the requirement of soybean seed is around 52,500 tones @ 0.75 qtls/ha. One of the reasons for non-availability of quality seed is negligible contribution from private seed industries due to its high volume and low price factor. In India the area and production of soybean has extensively increased but unfortunately there has been no significant increase in the productivity. As compared to the productivity of United States of America, Brazil, Argentina and China, India's productivity is still very low. The main reasons for low yield are the adoption of poor yielding varieties, non-availability of quality seeds and inadequate extension support. Also, soybean seed deteriorates faster than those of other crops. Soybean seeds are more prone to imbibitions injury, which may results in significant economic losses. During recent years, selection of suitable and high yielding varieties of soybean for cultivation in different states has been carried out mostly from exotic collection.

MATERIALS AND METHODS

The experiment "Effect of seed size on yield and seed quality traits in soybean *(Glycine max* L. Merrill.)" was conducted at experimental and research field of Agricultural Botany and Seed Technology Research Unit, Department of Agricultural Botany, Dr.

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Panjabrao Deshmukh KrishiVidyapeeth, Akola (M.S.) during *kharif*, 2013-14 in four replications with Randomized Block Design (RBD). The experimental material consisted six genotypes *viz*.,NRC 37, JS 97-52, JS 93-05, JS 335, TAMS 98-21 and TAMS 38 was obtained from Soybean Research unit, Regional Research center, Amravati. The seed of each genotype had further divided into three different grades of seed sizes *i.e.* small, medium and bold all the 18 combinations of genotypes and seed sizes were sown in separate plots having 8 rows of each genotype at the spacing of 45 cm x 5 cm. The nine (09) characters *viz*., Number of pods per plant, seed yield per ha (qt/ha), test weight, seed germination, root length, shoot length, seedling fresh weight, seedling dry weight and vigour index were studied.All the recommended cultural practices and plant protection measures were followed during the crop growth period.

RESULT AND DISCUSSION

The character wise results obtained are presented as follows.

Seed Germination (%)

The variety JS 335 recorded highest seed germination (94.95%) followed by JS 97-52 (93.18%), TAMS 98-21 (92.75%), NRC 37 (92.83%), JS 93-05(92.73%) and TAMS 38(92.58). Medium seed size recorded significantly higher germination percentage (94.95%) followed by small and bold seed size. The bold seed size observed less germination percentage (92.58%) indicates that the germination is quick in medium and small sized seeds compared to bold seed. The six genotypes under study maintained seed germination over and above the minimum seed certification standard of above 70 per cent. These findings are in agreement with those reported by Singh (2007), Anuradha *et al.* (2009) and Reddy *et al.* (2009). Mandanzi *et al.* (2010) concluded that the large seeds have an advantage for germination when planted at deeper level but small and medium cannot emerge out when sown at deeper level.

Vigour Index

Vigour index in genotypes JS 335,TAMS 98-21 and JS 97-52 were found to be at par (around 18.50) and significantly superior compared to other genotypes. Medium seed size (JS 335) showed maximum vigour index (18.78) than the other seed sizes. It may be due to seed germination and vigour components are directly proportional to endosperm content of seed as the bold and medium seed size contains more amount of starch, lipid granules and protein globules as they showed best results for better germination and more vigour components. Hence, germination and vigour are proportional to seed size and decreased with storage time with the decrease being found greatest in the small seed as compaired to medium and bold seed size cultivar. The seedling vigour components are the major aspects deciding higher productivity because plant population depends upon healthy and vigorous growth of seedlings which is possible mainly by the use of better quality seeds for the sowing purpose.

These findings are in agreement with those reported byAnuradha *et al.* (2009), Padua *et al.*, (2010) and Mandanzi *et al.*, (2010).

Root Length and Shoot Length

The root length differed significantly due to different seed size cultivar. The highest root length (cm) was recorded by bold seed size genotype TAMS 38 (12.53 cm) fallowed by JS 93-05 (12.40cm), JS 335 (11.73cm), NRC 37 (11.73cm), JS 97-52 (9.78cm) and TAMS 98-21 (9.60cm). The root length was significantly superior in bold seed size as compared with small and medium seed size genotypes. These findings are in agreement with those reported by Pereira *et al.*, (2009) andTidke (1997) revealed that root length were higher in small seed grade cultivars in soybean.

The maximum shoot length was observed in bold seed size cultivar TAMS 38 (16.45 cm) followed by TAMS 98-21 (15.88cm), JS 93-05 (15.15cm), JS 97-52 (13.35cm), NRC 37 (13.05cm) and JS 335 (13.03cm).The shoot length differed significantly due to different seed size genotypes. However, highest shoot length was recorded by bold seed genotype *viz,* TAMS 38 and TAMS 98-21 than the medium and small seed size cultivars. The similar findings were reported by Pereira *et al.,* (2009) and Tidke (1997) revealed that shoot length were higher in small seed grade cultivars in soybean.

Seedling Fresh Weight (g)

The highest seedling fresh weight was recorded by bold seed size the genotype TAMS 38 (7.28 g) followed by JS 93-05 (6.23 g), JS 97-52 (5.88 g), NRC 37 (5.23 g), TAMS 98-21 (5.10 g) and JS 335 (4.78 g). The seed crop harvested from bold seed size was found to be superior for seedling fresh weight than small and medium seed size. These findings are in agreement with those reported byCalton *et al.* (1970), Charjan and Tarar (1997), Tidke (1997) and Mehetre

Table 1
Different yield contributing traits influenced by seed sizes on different genotypes

Characters	*Germination Percentage (%)*	*Vigour Index*	*Root length (cm)*	*Shoot length (cm)*	*Seedling fresh weight (g)*	*Seedling dry weight (g)*	*No. of pods per plant*	*Test weight (g)*	*Seed yield/ ha (qt/ha)*
Genotypes									
NRC 37	92.83	17.90	11.70	13.05	5.23	0.44	39.28	9.40	21.25
JS 97-52	93.18	18.75	9.78	13.35	5.88	0.42	42.35	8.60	22.20
JS 93-05	92.73	16.88	12.40	15.15	6.23	0.52	38.23	11.53	20.48
JS 335	94.95	18.78	11.73	13.03	4.78	0.45	44.75	10.38	23.75
TAMS 98-21	92.75	18.68	9.60	15.88	5.10	0.52	41.13	10.50	21.35
TAMS 38	92.58	16.85	12.53	16.45	7.28	0.53	40.33	12.55	19.10
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m)±	0.47	0.21	0.27	0.34	0.11	0.01	1.23	0.18	0.30
CD (P = 0.05)	1.32	0.64	0.80	1.01	0.34	0.02	3.71	0.53	0.93

et al. (2006). Burris *et al.* (1971) revealed that the percentage of cotyledonary dry weight loss was inversely related to seed size. However, the ratio of embryo growth to cotyledonary loss was not significantly different between sizes. Also, Paul and Ramaswamy (1979) studied the relationship between the seed size and quality attributes in cowpea and found that seed weight exhibited linear relationship with seed size and significant differences were recorded for length of shoot, hypocotyl and vigour as these parameters positively correlated with seed weight.

Seedling Dry Weight (g)

The highest seedling dry weight was recorded by bold seed size genotype TAMS 38 (0.53 g) followed by theJS 93-05 (0.52 g), TAMS 98-21 (0.52 g), JS 335 (0.45 g), NRC 37(0.44 g) and JS 97-52 (0.42 g). The seedling dry weight was found to be superior for bold seed size (0.53 g) than all other seed sizes. The similar observations were reported by Harper and Obeid (1967), Kaufmann and Guitard (1967), Calton*et al.* (1970), Evans and Bhatt (1977), Whitehead (1980),Charjan and Tarar (1997), Tidke (1997) and Mehetre *et al.* (2006).

Number of Pods Per Plant and Test Weight

Significantly highest number of pods per plant was found in medium seed size JS 335 (44.75), followed by JS 97-52 (42.35), TAMS 98-21 (41.13), TAMS 38 (40.33), NRC 37 (39.38) and JS 93-05 (38.23). The medium seed cultivar reported the highest number of pods per plant as compared to small and bold seed cultivar. The similar results were reported by Singh *et al.* (1972) that medium seed size has a significant influence on the number of pods per plant as compared to small and bold seed cultivar. The number of pods per plant was by far the most important yield component influenced by seed size. EL- Zahab and Zahran (1976) concluded that the large seeds produced more number of pods per plant as compared with small and medium seeds.

Significantly highest test weight is observed in bold seed size genotype TAMS 38 (12.55 g) and medium seed size genotype JS 93-05 (11.55 g),genotypes followed by TAMS 98-21 (10.50 g), JS 335(10.38 g),NRC 37 (9.40 g) and JS 97-52 (8.60 g). The highest test weight is observed in bold seed size and less test weight is observed in small seed size as compaired with small and medium seed sizes. These results are in agreement with those reported by Singh *et al.* (1972).

Reddy *et al.* (2009) and Paul andRamaswamy (1979) that test weight were found to be increased with increase in seed size.The medium seed size genotype JS 335 with recorded highest seed yield per ha (23.75 qt/ha) as compaired with small and bold seed cultivars.

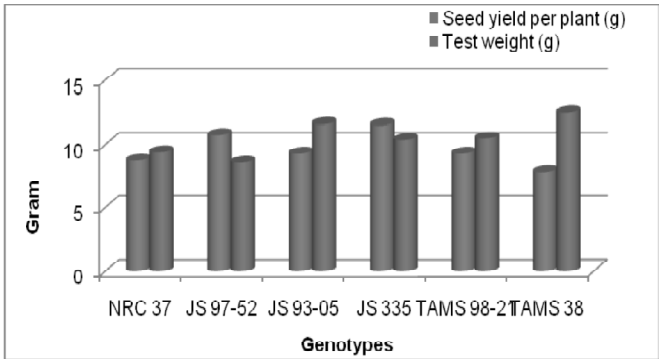

Figure 1: Seed yield per plant and test weight influenced by seed sizes on different cultivars of soybean

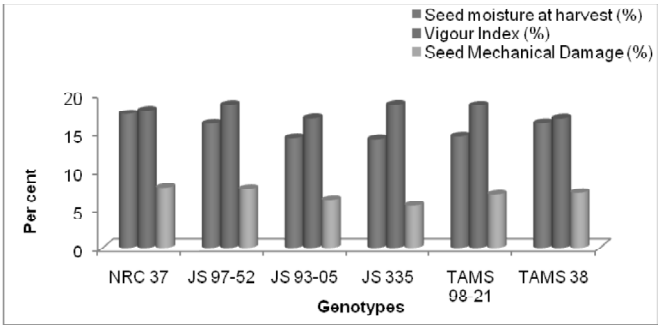

Figure 2: Seed moisture at harvest, Vigour index and seed mechanical damage influenced by seed sizes on differentcultivars of soybean

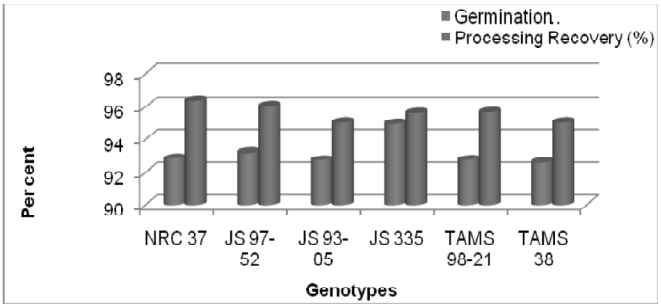

Figure 3: Germination percentage and Processing Recovery influenced by seed sizes on different cultivars of soybean

CONCLUSION

The medium seed size variety JS 335 performed better than all small(NRC 37 and JS 97-52) and bold (TAMS 98-21 and TAMS 38) seed variety in respect of yield and yield contributing characters. Medium seed size recorded significantly higher germination percentage (94.95%) followed by small and bold seed size.Vigour index in genotypes JS 335, TAMS 98-21 and JS 97-52 were found to be at par (around 18.50) and significantly superior compared to other genotypes. Medium seed size (JS 335) showed maximum vigour index (18.78) than the other seed sizes. The root length and shoot length was significantly superior in bold seed size as compared with small and medium seed size genotypes. The medium seed cultivar reported the highest number of pods per plant and test weight as compared to small and bold seed cultivar. The highest seedling fresh weight, highest seedling dry weight,higher root length (cm) and shoot length (cm) was recorded by bold seed size variety TAMS 38 than rest of the seed size.

REFERENCES

Anuradha, R., P. Balamurugan, P. Srimthi and S. Sumathi, (2009), Influence of seed size on seed quality of chickpea (*Cicerarietinum* L). *Legume Res*., 32(1) : 133-135.

Charjan, S. K. U. and J. L. Tarar, (1991), Influence of seed size on germination and seedling vigour in soybean varieties. Institute of science, Nagpur, Maharashtra, India, 1 (2): 165-168.

E.L. Zahab, A. A. A. and M. Zahran, (1976), Zeitechrifit for acker undpflanzonbhau. 143(2): 148-165.

Evans, L. E. and G. M. Bhatt (1977), Influence of seed size, protein content and cultivar on early seedling vigour in wheat. *Can. J. plant Sci*., 57 (3): 929-936.

Harper, J. L. and M. Obeid (1967), Influence of seed size and depth of sowing on the establishment and growth of varieties of fibres and oilseed. *Crop. Sci*., 7: 527-232.

Kaufmann, M. L. and A. A. Guitard (1967), The effect of seed size on early plant development in barley.*Can. J. Plant Sci*., 47:73-78.

Mandanzi, T., C. R. Chiduza and S.T. Kageler, (2010), Effect of planting method and seed size on stand establishment of soybean. *Soil and Tillage Research,* 106(1): 171-176.

Padua, G. P., R. K. Zito, N. E. Arantes and J. B. F. Neto, (2010), Influence of seed size on physiological seed quality and soybean yield. *Revista Brasileria de, semerts*., 32(1) : 9-16.

Panse, V. G. and P. V. Sukhatme, (1967), Statistical methods for agricultural workers. I.C.A.R., New Delhi, Publication.

Paul, B. and Ramaswamy, (1979), Relationship between seed size and seed quality attributes in cow pea (*Vignasinensis* L. savi). *Seed Res*., 7(1) : 63-70.

Pereira, A. W., F. L. Savio, A. Borem, Dias and D. C. F. Santos, (2009), Influence of seed arrangement number and size of soybean seed on seedling length. *J. of seed*., 31(1) : 113-125.

Reddy, S., B. M. Reddy, A. Padmalatha, Y. and P. Shakunthala, (2009), Influence of seed size in different varieties of groundnut on its productivity. *Legume Res.,* 32(4): 298-300.

Singh, A. L., (2007), Study seed size effect in soybean. *Legume Res*., 30(1): 33-36.

Singh, J. N., S. K. Tripathi and P. S. Negi, (1972), Note on the effect of seed size of soybean (*Glycine max* (L.) Merrill). *Indian J. Agric. Sci*., 42 (1):83-86.

Tidke, A. N., (1997), Studies on seed quality in soybean (*Glycine max* (L.)Merill) M. Sc. (Agri) Thesis.*Mara.Agri. Uni. Parbhani, India.*