



Influence of size grading on physiological parameters in Tephrosia (*Tephrosia purpurea*) MDU (KO)-1

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Abstract: Seed grading is an important practice for better crop establishment and to improve efficiency of planting ratio in field and also useful in separation of quality seed in a seed lot. The influence of seed size on physiological and biochemical seed quality characters were evaluated in Tephrosia seeds using seeds retained on 5.5/64", 6/64" and 7/64" sieves along with control. The estimations revealed that larger size seeds retained on 7/64" sieves recorded the maximum recovery (64 %), 100 seed weight (2.0 g), speed of germination (14.1) germination (86 %), root length (8.5 cm), shoot length (11.0 cm), dry matter production (15.92 mg seedlings⁻¹⁰), vigour index (1677) and protein (10.56 %) compared to BSS 5.5 / 64", BSS 6 / 64" and ungraded seeds.

Keywords: Germination, Seed weight, Sieve, Size grading, Tephrosia

INTRODUCTION

Non availability of green manure quality seed is one of the major constraints in increasing the productivity of agricultural crops. Seed grading is an integral part of seed production for enhanced planting value. Studies pertaining to seed grading based on seed size in relation to seed quality characters are warranted as amount of food reserve in seed is the basic requirement for its future expression as germination, and final establishment at field. In addition to obtain uniform seed size within a variety, size grading is inevitable. Seed size is one of the components of seed quality which affects the performance of crop (Ojo, 2000; Adebisi, 2004 and Adebisi *et al.*, 2011). Jute cv. JRO 524 AND JRO 8432 seeds size graded using BSS 16x 16 sieves recorded higher seed quality standards (Jerlin *et al.*, 2010). Large seeds produced the highest germination per cent, coleoptiles fresh weight, coleoptiles dry weight, radicle fresh weight and 1000 seed weights compared to other seed size in safflower (Sadeghi *et al.*, 2011). Therefore, studies were made in tephrosia to fix optimum sieve size to obtain the required seed quality characters for higher planting value.

MATERIALS AND METHODS

Genetically pure and freshly harvested tephrosia (*Tephrosia purpurea*) MDU (KO) – 1 seeds were formed the base material for the study. The pre-cleaned Kolingi seeds were size graded using sieve sizes 5.5/64", 6/64" and 7/64" wire mesh sieves. To calculate the recovery percentage, seeds retained in

each of the sieves were weighed and expressed as respective percentage of total quantity of seeds processed. The seeds retained in each sieve were subjected to the following quality estimation along the ungraded bulk (control).

Seed recovery: The weight of seeds obtained from each grades were weighed separately and seed recovery was worked out using the following formula and expressed in per cent.

Seed recovery (%) = Weight of graded seeds in each grade / Total weight of ungraded seed X 100

Hundred seed weight (g): Eight replications of one 100 seeds from each replication were chosen at random and their weight was recorded on electronic balance as per ISTA procedure (Anonymous, 1999) and average weight was expressed in g.

Speed of germination: The seeds showing plumule emergence were counted daily from third day after sowing until seventh day. The number of seeds germinated on each day was counted and the speed of germination was calculated using the following formula and the results were expressed in number (Maguire, 1962).

$$\text{Speed of germination} = \frac{X_1}{Y_1} + \frac{X_2 - X_1}{Y_2} + \dots + \frac{X_n - X_{n-1}}{Y_n}$$

X₁- Number of seeds germinated at first count

X₂- Number of seeds germinated at second count

X_n- Number of seeds germinated on nth day

Y₁- Number of days from sowing to first count

Y₂- Number of days from sowing to second count

Y_n- Number of days from sowing to nth count

Germination (%): Seeds were soaked in hot water for

30 minutes to break the dormancy. Germination test was carried out in quadruplicate using 100 seeds each with 4 sub replicates of 25 seeds, were carried out in rolled paper towel method (ISTA, 1999) in germination room maintained at $25 \pm 1^\circ\text{C}$ and RH $96 \pm 2\%$ with diffused light during the day. On tenth day of germination test, numbers of normal seedlings were counted and the average was expressed as per cent.

Root length (cm): Ten normal seedlings were selected randomly from the germination test and root length was measured from tip of primary root to base of hypocotyls and mean root length was expressed in cm.

Shoot length (cm): Ten normal seedlings chosen for measurement of root length were used for measurement of shoot length. It was measured from tip of primary leaf to base of hypocotyls and mean shoot length was expressed in cm.

Seedling dry matter production (mg/10 seedlings): Ten normal seedlings chosen earlier for measuring shoot and root lengths were used to determine seedling dry weight. The seedlings kept in paper cover and dried under shade for 24 h and hot air oven at $85 \pm 1^\circ\text{C}$ for 24 hours. And the average weight was expressed in milligram per ten seedlings.

Vigour index: Seedling vigour index was computed by adopting the following formula as suggested by Abdul-Baki and Baker (1973) and was expressed in whole number.

Vigour index = Germination (%) x Total seedling length (cm)

Protein content: Protein content was estimated by the colorimetric method as described by Alikhan and Young (1973). One hundred milligram of ground seed meal was taken in a 50 ml polyethylene screw cap bottle and 25 ml of 1N sodium hydroxide was added. The mixture was shaken for 15 minutes in a wrist shaker to disperse the protein. Then 10 ml of the suspension was poured into a graduated test tube and used as a blank to compensate for the difference in the amount of natural pigments extracted. To the remaining suspension in bottle, 0.25 ml of 10 per cent copper sulphate solution was added and the bottle was reshaken for five minutes to develop F the colour complex. The sample solution was then poured in to a separate test tube and kept overnight along with its blank to allow the dispersed material to settle

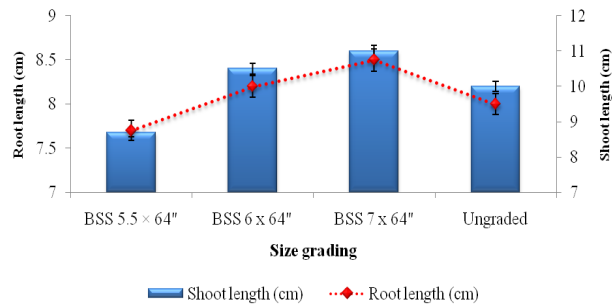


Fig. 1. Effect of size grading on shoot length (cm) and root length (cm) in *Tephrosia* seeds.

down. The optical density of the clean supernatant solution obtained after centrifugation at 3000 rpm for 10 minutes was measured in ELICO SL 150 spectrophotometer using a red filter (620nm) against their respective blank. From the optical density values, the protein content was calculated using the following formula and the mean value of five replications was expressed in per cent.

Protein content (%) = 3.78 + (61.6 x Optical density value)

RESULTS AND DISCUSSION

Seed recovery was significantly influenced by size grades. The seeds retained on BSS 7/64" sieves recorded the highest seed recovery of 64.0 per cent and the lowest was by the seeds passed through BSS 5.5 / 64" sieve (10.2 %). Size grades had significant influence on 100 seed weight. The seeds retained on BSS 7/64" sieve recorded the highest 100 seed weight (2.0 g) than those seeds passed through BSS 5.5/64", BSS 6/64" sieve and ungraded (1.1, 1.4 and 1.5 g, respectively) (Table 1). The 100 seed weight was also higher with the corresponding increase in seed size. Improved physical and physiological quality of graded seeds was reported in maize, which was revealed by higher germination percentage for large and medium sized seed (Silva and Marcos, 1979). Seeds retained in BSS 7/64" sieve were larger compared to other sieves. Hence, seeds retained by BSS 7/64" recorded higher speed of germination, germination (%), root length (cm) and shoot length (cm) (14.1, 86, 8.5 and 11.0, respectively) (Table 1 and Fig. 1) followed by the seeds retained by BSS 6/64". The higher germination

Table 1. Effect of size grading on seed recovery (%), 100 seed weight (g), speed of germination, germination, dry matter production (mg seedling⁻¹⁰), vigour index and protein (%) in *Tephrosia* seeds.

Seed size grade	Seed recovery (%)	100 seed weight (g)	Speed of germination	Germination (%)	Dry matter production (mg seedling-10)	Vigour index	Protein content(%)
BSS 5.5 / 64"	10.20(18.63)	1.126	10.3	56 (62.03)	11.98	918	9.73
BSS 6/64"	25.80(30.53)	1.460	14.1	82 (64.90)	14.25	1538	10.40
BSS 7/64"	64.00(53.13)	2.002	14.5	86 (68.03)	15.92	1677	10.56
Ungraded		1.590	13.7	78 (62.03)	13.72	1404	10.24
Mean	33.33(35.24)	1.544	13.2	76 (60.67)	13.97	1384	10.23
SE d	0.987	0.059	0.227	1.248	0.569	44.236	0.146
CD (P = 0.05)	2.414**	0.109**	0.524**	2.877**	1.235**	102.073**	0.317**

Figures in parentheses indicate arcsine values

of larger seeds might be due to the higher amount of food reserves and increased activity of redox-enzyme in the seeds helping in faster breakdown of the complex food reserve materials into simple soluble sugars. The results are in conformity with the findings of Ndor *et al.* (2012) in pumpkin and Ahirwar (2012) in *Alangium lamarckii* Thwaites.

The other seed quality parameters like dry matter production (15.92 mg seedlings⁻¹⁰) and vigour index (1677) also endorsed the superiority of large size seeds retained by BSS 7/64" and BSS 6/64" sieves (Table 1). The relative high vigour associated with large sized seeds could be ascribed to well matured embryo and adequate nutrient reserves, which contributed towards its physiological stamina and vigour factor residing in it (Pollock and Roos, 1972). In addition to the greater quantity of storage materials and food reserves available in larger seeds, the seedling fresh weight, seedling mitochondrial protein, mitochondrial and biochemical activity, respiration rate and energy (ATP) production were also reported to be positively than the smaller seeds. Similar findings were also reported by Farahani *et al.* (2011) in wheat and Ponmani (2015) in barnyard millet. The vigour index of large and medium sized seeds were significantly superior to small seeds. This may be due to differences in their seed weight, germination potential, seedling length and stored food reserves (Styer *et al.*, 1980). The protein content increased with increase in seed size and weight. The biochemical parameter like protein content (10.56 %) was maximum with larger size seeds which were retained in BSS 7/64", indicating the higher metabolic activity for germination of seeds.

Conclusion

Considering the higher recovery of seeds (64 %), germination (86 %), vigour parameters (1677) and protein content, Tephrosia MDU (KO)-1 seeds can be size graded using 7/64" sieve for getting good quality with higher planting value.

REFERENCES

- Abdul-Baki, A. A. and Baker, J. E. (1973). Changes in cellular organelles for membranes related to vigour loss in seed. *Seed Sci. & Technol.*, 1: 89-125
- Adebisi, M. A., Kehinde, T. O., Ajala, M. O., Olowu, E. F. and Rasaki, S. (2011). Assessment of seed quality and potential longevity in elite tropical soybean (*Glycine Max* L.) Merrill grown in Southwestern Nigeria. *Niger. Agric. J.*, 42: 94-103
- Adebisi, M. A. (2004). Variation stability and correlation studies in seed quality and yield components of sesame (*Sesamum indicum* L.). Ph. D. Thesis, University of Agriculture, Abeokuta, Nigeria
- Ahirwar, J. R. (2012). Effect of seed size and weight on seed germination of *Alangium lamarckii*, Akola, India. *Res. J. Recent Sci.*, 1:320-322
- Ali-khan, S.T. and Youngs, C.G. (1973). Variation in protein content of field peas. *Can. J. Pl. Sci.*, 53: 37-41.
- Anonymous. (1999). International Rules for Seed Testing. International Seed Testing Association. *Seed Sci. & Technol.*, 4: 3-177
- Farahani, H. A., Moaveni, P. and Maroufi, K. (2011). Effect of seed size on seedling production in wheat (*Triticum aestivum* L.). *Adv. In Env. Bio.*, 5(7): 1711-1715
- ISTA, (1999). International Rules for Seed Testing. *Seed Sci. & Technol.*, Supplement Rules, 27: 25-30
- Jerlin, R., Menaka, C., Raja, K. Moorthy, K.R. and Tamilkumar, P. (2010). Standardization of sieve size for grading of olitorius jute seeds. *Asian J. Agric. Res.*, 4: 15-19.
- Maguire, J. D. (1962). Speed of germination - Aid in selection and evaluation of seedling emergence and vigour. *Crop Sci.*, 2: 176-177
- Ndor, E., Dauda, N.S. and Chamman, H.B. (2012). Effect of ermination media and seed size on germination and seedling vigour of fluted pumpkin (*Telferia occidentalis*) Hook. *F. Adv. Environ. Biol.*, 2:113-115
- Ojo, D. K. (2000). Studies on soybean seed quality and longevity improvement in the humid tropics. Ph. D. Thesis, University of Agriculture, Abeokuta, Nigeria
- Pollock, B.M. and Roos, E.E. (1972). Seed and seedling vigour. In: *Seed Biology - I* (Ed. T.T. Kozlowski), Academic press New York Pp. 313-387
- Ponmani, T. (2015). Studies on foliar nutrients, seed development and maturation and post harvest seed handling of barnyard millet (*Echinochloa frumentacea* L.). M.Sc., (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.
- Sadeghi, H., Khazaei, F., Sheidaei, S. and Yari, L. (2011). Effect of seed size on seed germination behaviour of safflower (*Carthamus tinctorius* L.). *J. Agric. Biol. Sci.*, 6: 5-8
- Silva, W.R.D.A. and Marcos, F.J. (1979). Effect of weight and size of maize seeds on germination and vigour in the laboratory. *Revista Brasileira de Sementes*, 1:34-52
- Styer, R. C., Cantliffe, D. J. and Hannah, L.C. (1980). Differential seed and seedling vigour in shrunken - 2 compared to three other genotypes of corn at various stages of development. *J. of American Soc. for Hort. Sci.*, 105: 329-331