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Short Communication

Influence of Seed Size Grading and Spiral Separator on Seed Quality of Soybean var. DSB 21

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Seed being a basic and crucial input, plays an important role in crop production. Hence, the use of quality seed is an effective means of improving the crop yield. Seed processing being one of the important components, which plays an important role in improving the seed quality. The size grader is equipment composed of several flat perforated metal plates with round holes that sorts seeds by size (width). Spiral separator operates by gravity and separates the seeds according to their shape, density, degree of sphericity and ability to roll [1], removing from the seed batch those ones irregularly shaped, empty, attacked by insects or that have had their shape compromised. Soybean seeds are especially vulnerable to rough treatment. The soybean seed varies greatly in size among different cultivars and within each cultivar. Uniformity of size in soybean seed allows the correct adjustment of the plant population in the field. Determination of optimum sieve size and type of screen is one of the criteria in the Minimum Seed Certification standard (MSCS) for seed approval by Govt. of India. The sieve size (4.0 mm) recommended for processing different crop seeds under the minimum seed certification standard appear more general and not appropriate for all the newer varieties resulting in poor seed recovery. Therefore, it is desirable to determine the optimum sieve size and proper seed processing equipment which promote better germination, growth, vigour and yield.

At present, routinely used seed processing machine for processing of soybean is seed grading machine (Air screen cleaner). Use of different machineries in combination help in getting physically pure, uniform and healthy sound seeds. However, there is less work was done on use of isolated and combination of processing machines and their impact on seed quality and storability. Hence, an effort is made under this study to find out the effective and economical seed processing to get maximum recovery with better quality of seeds and effect of these processing combinations during storage.

The laboratory experiment was conducted to study the influence of seed size grading on seed quality of soybean {*Glycine max* (L.) Merrill} at Seed Quality and Research Laboratory, National Seeds Project, University of Agricultural Sciences, Dharwad during 2017-18. Seeds obtained after size grading with different sieve size are collected as per treatment details mentioned below and seed quality parameters were tested.

T_1: Good seeds obtained from spiral separator after processed through seeds grader from recommended sieve size - 4.00 mm.

T_2: Seeds obtained from spiral separator after processed through seeds grader from recommended sieve size - 4.00 mm. (Rejected)

T_3: Good seeds obtained from spiral separator after processed through seeds grader from below recommended sieve size - 3.75 mm.

T_4: Seeds obtained from spiral separator after processed through seeds grader from below recommended sieve size - 3.75 mm. (Rejected)

T_5: Good seeds obtained from spiral separator after processed through seeds grader from above recommended sieve size - 4.80 mm.

T_6: Seeds obtained from spiral separator after processed through seeds grader from above recommended sieve size - 4.80 mm. (Rejected)

T_7: Unprocessed seeds (Bulk seed) control.

Physical Purity: The seeds were drawn at random from each bags (Treatment) at 100 grams, these seeds were taken on Purity working board and observed for pure seeds, other crop seeds, weed seeds and inert matter present in seed sample and weighed separately and expressed in percentage.

Seed Recovery: Seed recovery percentage due to various grading methods was determined by using the following formula and expressed in percentage.

$$\text{Seed recovery (\%)} = \frac{\text{Wt. of seeds obtained after processing}}{\text{Wt. of seeds before processing}} \times 100$$

Germination Percentage: Hundred seeds in four replications were drawn at random from each treatment and the germination test was conducted by using between paper towel method as described by International Seed Testing Association (ISTA) procedure [2]. The temperature of 25±1 ^{0}C and 90±5 per cent relative humidity was maintained during the germination. The number of normal seedlings were counted manually at the end of 8th day of seed germination test and expressed in percentage.

Seedling Vigour Index: The Seedling vigour indices was calculated by adopting the method suggested by Abdul Baki and Anderson [3] and expressed in number by using the following formula.

Vigour index = Germination percentage × Seedling length in centimetre

Mechanical Damage: One hundred seeds were drawn randomly from each treatment in four replications. These seeds were soaked in 20 per cent solution of ferric chloride ($FeCl_3$). Black stained seeds were separated within 5 minutes after addition of solution. Separation was continued until 15 minutes after addition of solution to seeds. Separation of seeds should not be done after the 15 minutes. The seeds with cracks or streaks stained black and swelled seeds were separated and recorded as mechanically damaged seeds and expressed in percentage based on number of stained seeds Mc. Donald [4].

The design of the experiment adopted was Completely Randomized Design with three replications. The data collected in respect of various parameters on seed quality attributes, were analysed statistically as described by Gomez and Gomez [5]. The critical difference (CD) values were calculated at 1 per cent (p = 0.01) probability level, where 'F' test was found significant for laboratory experiments using OPSTAT software.

Non availability of quality seed is one of the major constraints in increasing the productivity of agricultural crops. Seed processing is an integral part of seed production for enhanced planting value. Seed size grading and processing exerted a significant influence on the seed recovery per cent (Table 1), germination (%), seedling vigour index, physical purity (%) and mechanical damage (Table 2). Seed size grading is a common method to upgrade the seed quality with

Table 1. Influence of seeds grading and spiral separator on seed recovery of soybean. Var. DSB 21

	Seed Recovery		
Sieve size (r)	Good (kg)	Rejected (kg)	Percentage
4.00 mm	467.28	4.72	93.45
3.75 mm	476.21	5.78	95.24
4.80 mm	414.80	10.20	82.96

Table 2. Influence of seeds grading and spiral separator on seed quality of soybean. Var. DSB 21

Treatment	Physical purity (%)	Germination (%)	Vigour Index-I	Mechanical damage (%)
T_1	99.67	86.00	3357	10.33
T_2	25.84	60.00	1674	26.67
T_3	99.78	88.33	3502	9.00
T_4	20.41	63.00	1796	23.00
T_5	99.69	83.67	3129	11.33
T_6	27.35	57.00	1470	28.67
T_7	94.31	77.33	2764	7.67
Mean	66.72	73.62	2527	16.67
SEm(±)	0.21	0.95	45	0.42

maximum recovery. An attempt is made to know the effect of size grading followed by spiral separator on seed quality and recovery.

The seeds graded with 3.75 mm sieve size recorded higher seed recovery of 95.24 per cent compared to seeds graded with 4.00 mm and 4.80 mm sieve (Figure 1). The reduction in seed recovery in 4.00 and 4.80 mm may be due to bold and bigger in seed size than seeds retained on 3.75 mm sieve and presence of more amounts of small seeds in seed lot. In spiral separator, less amount of seeds are rejected, as it processed based on texture and roundness and removes other crop seeds, weed seeds and other inert material. As the screen size decreased from 4.80 to 3.75 mm, the per cent seed recovery was increased. This is in conformity with the findings of in chickpea [6], greengram [7] and soybean [8].

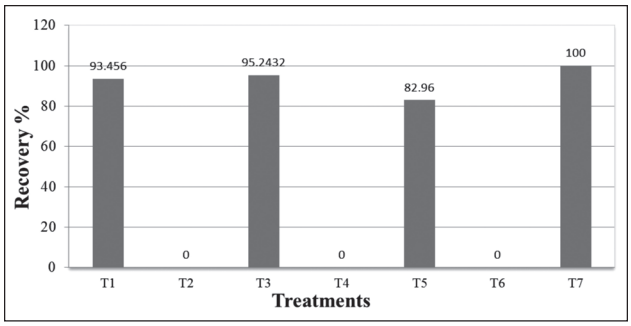

Figure 1. Influence of seed grading and spiral separator on seed recovery (%) of soybean

Among the graded seeds, variation in physical purity may be due to the removal of shrivelled seeds, soil particles during grading and weed seeds, other crop seeds and other impurities in spiral separator, which otherwise might not have been possible during threshing. Significantly, higher physical purity was recorded in, processed seeds *i.e.* seeds retained on sieves (T_3, T_1 and T_5) as compared to bulk seeds and rejected seed lot of different sieves (T_7 and T_2, T_4, T_6, respectively) due to effective processing, as during processing all impurities are removed and whereas rejected seed lot contains almost impurities so less physical purity was observed. Similar observations of improved physical purity have been reported by Ganiger *et al*. [7] in green gram and soybean.

Soybean seed with thin seed coat will be susceptible to the mechanical damages during processing. In the present study, it was observed that mechanical damage was more (10.67%) when seeds processed with above recommended sieve size of 4.80 mm because of a greater intensity and impact of the processing equipment's felt by the large size seeds due to its larger diameter than the small size seeds. In spiral separator, seeds are moved along sheet-metal flights wound on a central tube in the form of a spiral, chance of mechanical damage was more than isolated seed grading and less was observed than using specific gravity separator. The small and spherical seeds generally escape mechanical injury during harvesting, handling and processing and tend to suffer less damage, whereas larger or irregularly shaped and elongated seeds are likely to be extensively damaged. Greater per cent damages have been reported for varieties having bold seed size [9, 10].

The seeds processed through different sieve size during grading followed by spiral separator exhibited significant variation in seed quality. The higher seed germination, root length, shoot length, vigour index, field emergence and viability per cent was observed more in seeds processed through 3.75 mm sieve which might be due to smaller in seed size and lesser mechanical damage. The variation in percentage of germination and field emergence among sieve size used during processing may be due to amount of mechanical damage caused during grading and physical purity percentage obtained. Variation in germination and field emergence within sieve size used may be due to controlled conditions in germination chamber than during field emergence. According to Negi *et al.* [11] large seeds had more breaks in embryonic axis and other important seed parts than the small seeds had and therefore showed poor germination and viability. Small seeds had better germination uniformity and getting reserves more and faster than larger ones to seedlings in soybean cv. Katul [12]. Viability per cent also recorded highest in seeds processed through 3.75 mm sieve than 4.00 and 4.80 mm which might be due to smaller seed size and less mechanical damage.

Significantly higher shoot length, root length and vigour index in seeds graded with 3.75 mm sieve size is probably due to the difference in the rate of growth of seedlings, wherein the small size (seeds graded with 3.75 mm sieve size) seeds required less moisture than the large size (seeds graded with 4.00 and 4.80 mm sieve size) seeds and would have completed the process of imbibitions earlier than the large size seeds [13]. Thus,

the seeds graded with 3.75 mm sieve size would have put fourth longer seedlings and higher germination resulted higher values for vigour index.

Thus, the study inferred that, a sieve size of 3.75 mm in seed grader followed by spiral separator registered recovery (95.24%), physical purity (99.78%) germination (88.33%), and vigour index (3502) which is above the minimum seed certification standards. Hence, the soybean variety DSB 21 can be processed using 3.75 mm sieve in seed grader followed by spiral separator for better seed recovery and quality.

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