

## Standardization of Screen Sizes for French bean Seed Processing<sup>1</sup>

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**ABSTRACT** An attempt was made to standardize the screen size for grading French bean varieties *viz.*, Arka Komal and Burpee Stringless. About 17 to 18 per cent more good seeds could be saved in Arka Komal by replacing the present recommended screen size 4.75 mm (s) by 4.50 mm (s). For Burpee Stringless seeds, present recommended screen size 4.75 mm (s) can be continued. Seed quality parameters *viz.*, 100-seed weight, germination, field emergence, seedling length, vigour index were found to improve significantly with increase in sieve size in both the varieties at marginal expense of processing recovery. Investigation reveals the need for revision of screen size for grading of French bean varieties in order to minimize the processing loss and to meet the demand for good quality seeds for farming community.

**Keywords:** French bean, screen size, processing recovery, germination

Seed size is an important parameter of seed vigour as it influences the performance of seed in soil. Seed bulk at harvest contains a wide range of seed sizes but these may not all be of equal value for sowing. Farmers have always realized the necessity of using uniform seeds of good viability to obtain high emergence and growth. Present method of grading aims to remove the non-viable seeds and to obtain uniform size, which will give rise to optimum plant population and higher yields.

The influence of seed size on seedling vigour and crop productivity has drawn the attention of researchers since long time [1, 2, 3]. Optimum sieve size in French bean is much required to achieve proper seed recovery and economical seed yield so as to realize the maximum benefit. Several researchers have reported contradictory results on the effect of seed size [2, 4]. The sieve size recommended for processing different crop seeds under the minimum seed certification standards appear more general and not appropriate for all the newer varieties resulting in poor seed recovery [1]. At present common screen size of 4.75 mm

slotted (S) has been suggested by seed certification agency to process the french bean seeds [5]. It is often observed that processing loss through screen rejection ranges from 25 to 40 per cent as a result farmers are reluctant to take up contract seed production programme. Therefore present study was undertaken to standardize the screen size for grading of french bean varieties *viz.*, Arka Komal and Burpee Stringless.

### MATERIALS AND METHODS

The seeds of french bean varieties *viz.*, Arka Komal and Burpee Stringless produced during early *rabi* were subjected to grading by using hand screen of different sizes *viz.*, 4.50 mm, 4.75 mm and 5.00 mm slotted (s). The seeds retained over each screen were collected separately and analyzed for processing recovery, graded seed yield and seed quality parameters such as 100-seed weight, germination, field emergence, seedling length, seedling dry weight and vigour index.

Germination test was conducted by between paper method as per the procedure outlined by

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Table 1. Per cent seed recovery and seed quality parameters as affected by screen sizes in French bean varieties

Screen size	Seed recovery (%)			Graded seed yield (q/ha)			100 seed weight (g)			Germination (%)			Field emergence (%)		
	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean
Unprocessed seed	100.0	100.0	100.0	16.36	15.75	16.06	29.55	37.52	33.54	89.75	91.33	90.40	78.08	84.41	81.25
4.50mm (s)	92.00	98.83	95.37	14.98	15.56	15.27	32.00	38.34	35.17	91.66	92.56	92.11	81.58	85.66	83.62
4.75mm (s)	75.76	95.91	85.33	12.09	15.05	13.57	34.56	39.24	36.90	92.83	93.25	92.65	83.91	87.66	85.79
5.00mm (s)	49.08	78.47	63.79	7.81	12.21	10.01	39.01	40.65	39.83	96.80	94.08	95.50	87.30	91.25	89.37
Mean	71.95	91.02	81.50	12.81	14.64	13.73	33.78	38.93	36.36	92.08	93.50	92.63	82.77	87.25	85.01
				S.Em±	CD(P=0.05)		S.Em±	CD(P=0.05)		S.Em±	CD(P=0.05)		S.Em±	CD(P=0.05)	
Screen size(S)				0.14	0.41		0.44	1.24		0.70	2.00		1.05	3.00	
Varieties (V)				0.10	0.29		0.30	0.86		0.50	NS		0.75	2.15	
SxV				0.20	0.57		0.62	2.46		1.00	NS		1.50	NS	

Varieties; V<sub>1</sub>-Arka Komal V<sub>2</sub>-Burpee Stringless S - Screen Size

ISTA [6]. Vigour index was calculated by multiplying per cent germination and seedling length [7]. Four hundred seeds from each treatment were subjected to accelerated ageing in an ageing chamber at temperature of  $40 \pm 1^\circ\text{C}$  and 100 per cent RH for a period of 72 hours and samples were dried to original moisture content under shade and were subjected to germination test and per cent germination after accelerated ageing (GAA) was determined [8]. Processing recovery and graded seed yield was calculated by expression in equations (1) and (2) respectively.

$$\text{Processing recovery (\%)} = \frac{\text{Weight of graded seeds}}{\text{Wt. of graded seeds} + \text{Wt. of rejected seeds}} \times 100 \quad (1)$$

$$\text{Graded seed yield/ha} = \text{Processing recovery (\%)} \times \text{Unprocessed seed yield/ha} \quad (2)$$

Data was analyzed by following completely randomized design by adopting "Fishers Analysis of Variance Technique". Critical difference values were calculated at 5 per cent probability level wherever F test was significant (9).

## RESULTS AND DISCUSSION

The processing seed recovery decreased drastically with increase in screen size from 4.50 mm (s) (95.35%) to 5.0 mm (s) (63.79%). The Burpee Stringless had highest per cent seed recovery (91.02%) compared to Arka Komal (71.95%) irrespective of

screen size used, but drastic reduction in per cent seed recovery in Arka Komal was observed with increase in screen size from 4.50 mm (s) (92.2%) to 5.00 mm (s) (49.08%). Recommended screen (4.75 mm (s)) size gave 74.76 per cent seed recovery. In case of Burpee Stringless per cent seed recovery did not vary much between 4.5 mm (s) (98.83%) and 4.75 mm (s) (95.91%). However, with 5.00 mm (s) screen 78.47 per cent seed recovery was observed (Fig. 1). The difference in per cent seed recovery was mainly due to difference in sieve size. Malarkodi *et al.* [10] in Yam bean and Kausal *et al.* [11] in redgram, soybean, greengram, blackgram and sorghum observed difference in seed recovery with difference in sieve sizes.

Graded seed yield per hectare decreased considerably with increased screen size from 4.5 mm (s) (15.20 q/ha) to 5.00 mm (s) (10.01 q/ha) irrespective of varieties (Table 1). Burpee Stringless had higher graded seed yield (14.64 q/ha) due to its higher 100 seed weight (38.93 g) compared to Arka Komal (12.81 q/ha) with lower 100 seed weight (33.78 g), even though the ungraded seed yield in Arka Komal was higher (16.30 q/ha) than Burpee Stringless (15.75 q/ha). In Burpee Stringless the graded seed yield was slightly lower in 4.75 mm (s) (15.05 q/ha) than that of 4.50 mm (s) (15.56 q/ha) and unprocessed seeds (15.75 q/ha). But 12.21 q/ha graded seed yield was retained on 5.00 mm (s) screen size which accounts for 22.5 per cent yield reduction. In case of Arka Komal

Table 2. Seed quality parameters as affected by screen sizes in French bean varieties

Screen size	Seedling length (cm)			Seedling dry weight (mg)			Vigour index			GAA (%)		
	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean
Unprocessed seed	24.82	27.39	26.111	36.8	191.2	164.0	2176	2450	2313	65.58	70.66	68.12
4.50mm	26.82	28.10	27.46	147.1	196.2	171.6	2439	2542	2490	72.50	77.08	74.79
4.75mm	29.38	29.31	29.35	177.4	208.7	193.1	2736	2689	2712	76.66	79.08	77.89
5.00m	31.84	31.83	31.85	194.4	222.5	208.4	3001	3034	3018	83.41	84.75	84.08
Mean	28.22	29.17	28.69	163.9	204.7	184.3	2588	2679	2633	74.54	77.89	76.21
		S.Em±	CD(P=0.05)		S.Em±	CD(P=0.05)	S.Em±	CD(P=0.05)	S.Em±	CD(P=0.05)		
Screen size		0.31	0.86		2.50	7.25	37.5	108		0.75	2.25	
Varieties (V)		0.22	0.61		1.82	5.13	27.5	75		0.53	1.50	
SxV		0.43	1.21		3.63	10.25	52.5	150		1.08	3.00	

Varieties; V<sub>1</sub>-Arka Komal V<sub>2</sub>-Burpee Stringless S - Screen size

maximum graded seed yield was obtained in 4.50 mm (s) screen size (14.98 q/ha), which was due to higher seed recovery (92.00%). Seeds graded with 5.00 mm (s) screen size resulted in maximum reduction in seed yield (7.81 q/ha) which accounts for 47.86 and 52.56 per cent reduction over seeds retained on 4.50 mm (s) screen and ungraded seeds respectively. Seeds retained on 4.75 mm (s) also resulted in considerable decrease in graded seed yield (12.09 q/ha), which accounts for 24.24 per cent processing rejection. Reduction in graded seed yield beyond 4.50 mm screen size in Arka Komal was mainly due to its smaller seed size. Graded seed yield obtained on 4.75 mm (s) and 5.0 mm (s) screen size are not certainly economical since per cent seed recovery was only 75.76 and 49.08 per cent. While, higher seed recovery was noticed in 4.50 mm (s) (92.00%).

Seed quality parameters *viz.*, 100-seed weight, germination, field emergence, seedling length, vigour index and germination after accelerated ageing (GAA) increased linearly with increase in screen size from 4.50 mm to 5.00 mm (s) irrespective of varieties. The germination percentage did not vary between varieties. However, seed quality parameters were highest in Burpee Stringless compared to Arka Komal (Table 1 & 2). Such quality difference due to genotype was observed [12] in french bean and gram [13]. The quality parameters in Arka Komal showed increased trend with increase in screen size from 4.5 mm to 5.00 mm (s). However, germination and field emergence did not vary significantly between seeds retained on 4.5 mm (s) and 4.75 mm (s). In case of

Burpee Stringless the seeds retained on 4.50 mm (s) and unprocessed seeds did not vary significantly between each other. However seeds retained on 4.5 mm (s), 4.75 mm (s) and 5.00 mm (s) vary distinctly among each other. Interaction due to screen sizes and varieties differed significantly for seed quality parameters except germination and field emergence. Highest seed quality parameters were recorded in Burpee Stringless seeds retained on 5.00 mm (s) screen and it was least in Arka Komal seeds retained on 4.5 mm (s) screen. Doijode [14], Paul and Ramaswamy [15] and Praveen Kumar [16] working with french bean concluded that higher seed size produced large and vigorous seedlings.

Germination after accelerated ageing (GAA) increased linearly with increase in screen size from 4.5 mm (74.79%) to 5.0 mm (s) (84.06%) irrespective of varieties. However, it was least in ungraded seeds (68.12%). Between varieties maximum GAA was recorded in Burpee Stringless (77.89%) than Arka Komal (74.54%). Interaction due to screen sizes and varieties differed significantly, highest GAA was recorded in Burpee Stringless seeds retained on 5.00 mm screen size (84.75%) and was least in unprocessed seeds of Arka Komal (65.58%) (Table 2). Such varietal difference in germination after ageing was observed by Borthakur and Barua [17], Doijode [18] and Singh *et al.*, [19]. Higher germination after ageing in seeds retained on 5.00 mm screen size may be due to more food reserves and higher protein content in bigger seeds. Differences in germination after ageing due to difference in seed size was also observed by Estevez and Castillo [20] and Malarkodi *et al.*, [10]. Thus it can be inferred that seeds retained on larger

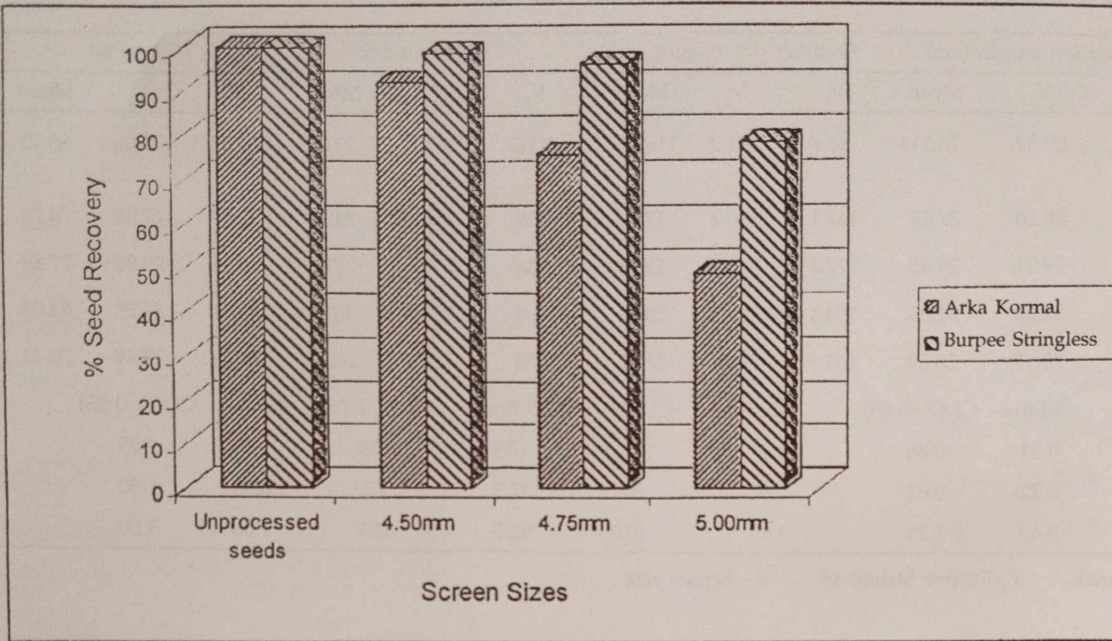


Fig 1. Per cent seed recovery as affected by screen sizes in French bean varieties

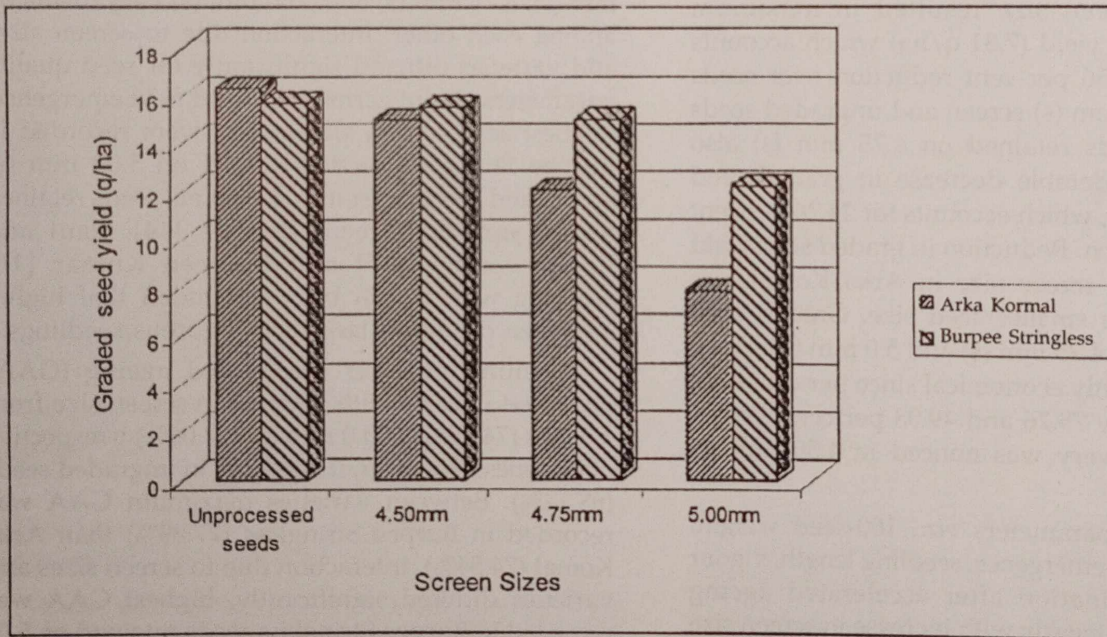


Fig 2. Graded seed yield (q/ha) as affected by screen sizes in French bean varieties

screen (5.00 mm [s]) resulted in bigger seed size and had higher relative storability followed by seeds retained on 4.75 mm (s) and 4.5 mm (s). It is better to use bigger seeds for carry over purpose to preserve seed viability and vigour.

Sieve size of 4.75 mm (s) recommended for grading of french bean seeds under minimum seed certification standards were not appropriate for all the newer varieties. Seeds of Arka Komal retained on 4.50 mm (s) gave high per cent seed recovery (92%) with high germination (91.66%) and field emergence (81.58%), germination per cent was above the prescribed limit by seed certification agency, Karnataka, India. While, drastic reduction in per cent seed recovery ranged from 49.08 to 74.76 per cent with 5.00 mm and 4.75 mm (s) respectively was notice although the seed quality parameters were not affected much. Whereas, in Burpee Stringless recommended screen size (4.75 mm(s)) gave 95.9 per cent seed recovery. Thus by reducing screen size from 4.75 to 4.50 mm (s), 17.24 per cent seed could be saved in Arka Komal, but for Burpee Stringless present recommended screen size (4.75 mm[s]) could be used.

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