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ORIGINAL ARTICLE

Seed quality improved by different Seed processing methods on seed quality of onion cv. Arka Kalyan

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ABSTRACT

Quality seeds can be achieved through better post harvest operations apart from maintaining seed quality by adopting effective principles of seed production. In this regard seed processing is an important segment of seed industry and plays a vital role in improving overall seed quality either for further storage, production or marketing of seeds. Hence an experiment was conducted to study the effect of different seed processing methods on seed quality during 2015-16 and 2016-17. The experiment consisted of eight different treatment combinations of air screen cleaner, specific gravity separator and indent cylinder. The experiment was laid out in Complete Block Design (CBD). The experimental results revealed the significant effect of different seed processing methods. Significantly highest values were recorded for the parameters like seed germination (97.90 %), speed of germination (44.26), seedling growth rate (2.67), seedling dry weight (24.47 mg), shoot length (12.32 cm), root length (9.66 cm), seedling vigour index-I (2,152), seedling vigour index-II (1,904), field emergence (93.79 %) and less electrical conductivity (0.578 dS/m) was recorded in combination of all three equipments i.e air screen cleaner, specific gravity separator and indent cylinder (P_7) followed by combination of P_1+P_2 (air screen cleaner + specific gravity separator) (P_4) compared to in ungraded bulk (P_8).

***Key words**: Air screen cleaner, Onion, Seed processing, Specific gravity separator*

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INTRODUCTION

Onion (*Allium cepa L.*) is one of the major spice bulb crops of the world and India. It has great economic importance due to its medicinal and dietetic values. Onion is a biennial crop. It completes vegetative phase with bulb production in the first year. The bulbs are used as planting material for production of true seed in the second year. The demands of quality true seeds are increasing day by day and the price of quality seeds is also high. Seed processing is a vital part of the seed production and important segment of seed industry required to move the improved genetic materials of the plant breeder into commercial channels for feeding the rapidly expanding world population. In fact, many seed lots contain weed or crop seed or inert material that make them unfit for sale without processing. Crop seed also frequently have stems, awns, clusters or other structures, which prevent from flowing through the drill freely.

Physical characteristics used to separate seed include size, length, weight, shape, surface texture, colour, affinity for liquids and electrical conductivity. Seed processing can broadly be divided into various steps. As the seed is received into the processing plant, it goes either directly into the cleaning process or into storage to await processing. Drying may be necessary. As processing begins, the first phase (conditioning and pre-cleaning) consists of scalping, debearding, shelling or any other operation necessary to make the seed flow easily. The second phase (cleaning and grading) includes the removal of inert materials, weed seed, other crop seed and broken seed that are larger or smaller than the crop seed and obtain the seed mass in the uniform size range of perforations of top and bottom screen. After the desired purity is obtained, seed enters the final processing phase of separation based on the specific characteristics like length, weight etc and treating and packaging. Processed seed is stored for later sale.

Further, density grading of seed lots can also aid in the up gradation of seed quality. Comprehensive information on upgrading of onion seeds by using density growing will be helpful to the onion seed growers. Keeping these aspects in view, it was considered worthwhile to evaluate the performance of the specific gravity separation for enhancement of seed quality and planting value in onion [8]. Keeping all these above facts in view, the present investigation "Seed quality improved by different seed processing methods on onion cv. Arka Kalyan" was undertaken.

MATERIALS AND METHODS

The experiment was conducted at Seed Processing Unit, Seed Unit, University of Agricultural Sciences, Dharwad, Karnataka state during 2016 and 2017 to study the effect of eight different methods of seed processing involving three equipments either individual or in combination with four replications as detailed in treatment details i.e., P_1: Grading through air screen cleaner, P_2: Specific gravity separator, P_3: Indent cylinder, P_4: Combinations of (P_1+P_2), P_5: Combinations of (P_1+P_3), P_6: Combinations of (P_2+P_3), P_7: Combinations of (P_1+P_2+P_3), P_8: Ungraded *i.e*. bulk control. The laboratory experiment was carried out in Completely Randomized Design (CRD) with four replications.

Seedling vigour index-I (SVI-I): The seedling vigour index was computed using the formula suggested by Abdul-Baki and Anderson [1] and expressed as whole number.

Vigour index-I = Germination percentage x [Root length (cm) + Shoot length (cm)]

Seedling vigour index-II (SVI-II)

The seedling vigour index was computed by multiplying germination percentage with dry weight of seedlings and expressed as whole number.

Vigour index-II = Germination (%) × Dry weight of seedling (mg)

Speed of germination: The Speed of germination was calculated by using the formula as suggested by Hydecker [5].

$$GRI = \frac{G_1}{T_1} + \frac{G_2}{T_2} \ldots\ldots\ldots + \frac{Gn}{Tn}$$

Where, GRI is germination rate index and G_1, G_2 ……. Gn is the number of seeds germinated at T_1, T_2……Tn time intervals respectively.

Electrical conductivity of seed leachate

The electrical conductivity of the seed leachate was measured in the digital conductivity bridge with a cell constant of 1.0 and the mean values were expressed in desisimons per metre (dS/m).

RESULTS AND DISCUSSION

The data on physical purity (%), thousand seed weight, seed recovery (%), seed rejection (%), and germination (%) of onion cv. Arka Kalyan during the year 2016, 2017 and in pooled over two years due to effect of different seed processing methods are presented in Table (1 to 5). On an average, all physical quality parameters were more in 2017 than in 2016 year, over processing methods.

Irrespective of the processing methods, the pooled results showed the significant variations on physiological quality parameters due to the different seed processing methods. Significantly more seed germination (97.90 %), speed of germination (44.26), seedling growth rate (2.67), seedling dry weight (24.47 mg), shoot length (12.32 cm), root length (9.66 cm), seedling vigour index-I (2,152), seedling vigour index-II (1,904), field emergence (93.79 %) and less electrical conductivity (0.578 dS/m) was recorded in combination of all three equipments (P_7) followed by combination of P_1+P_2 (P_4) and significantly lower seed germination (80.92 %), speed of germination (30.81), seedling growth rate (1.88), seedling dry weight (21.94 mg), shoot length (10.35 cm), root length (7.89 cm), seedling vigour index-I (1,529), seedling vigour index-II (1,840), field emergence (81.34 %) and more electrical conductivity (0.670 dS/m) in ungraded (P_8). Similar trend was followed during the individual years of 2016 and 2017.

It might be due to consistent seed quality could be achieved by efficient use of processing machines *viz.,* air screen cleaners (seed pre-cleaner and seed grader) and specific gravity separator (SGS), irrespective of initial quality of the seed lot. The product and reject of these machines were evaluated for seed quality parameters. The physical purity of wheat seed lot was upgraded from 76.35 % to 99.14 % and germination was improved from 80.92 % to 97.90 %, which made the seed lot acceptable as per the Indian Minimum Seed Certification Standards. Other seed quality parameters *viz*. test weight (3.07 g to 4.12 g), speed of germination (30.81 to 44.26), vigour index - I (1,529 to 2,152) and vigour index - II (1,840 to 2,396) were also improved. Air screen machine were found effective in improving physical purity and specific gravity separator improved the germination and vigour of the wheat seed lot as

observed by Rabindra and Brijendra [7]. The higher germination in larger seeds might be due to the higher amount of food reserves [2] and increased activity of redox-enzyme in the seeds helping in breaking down of the complex food reserve materials into simple soluble sugars [4].

Table 1: Effect of different processing methods on seed germination and speed of seed germination in onion cv. Arka Kalyan

Treatment	Seed germination (%)			Speed of germination		
Processing methods (P)	**2016**	**2017**	**Pooled**	**2016**	**2017**	**Pooled**
P_1 : Grading through air screen cleaner	86.76	87.61	**87.19**	33.75	35.02	**34.39**
P_2 : Specific gravity separator	89.85	90.70	**90.28**	35.08	36.64	**35.86**
P_3 : Indent cylinder	85.76	86.61	**86.19**	32.45	33.72	**33.09**
P_4 : Combinations of (P_1+P_2)	95.74	96.59	**96.16**	42.00	43.27	**42.64**
P_5 : Combinations of (P_1+P_3)	91.60	92.45	**92.03**	37.13	38.58	**37.85**
P_6 : Combinations of (P_2+P_3)	93.41	94.26	**93.84**	39.38	40.83	**40.10**
P_7 : Combinations of (P_1+P_2+P_3)	97.48	98.33	**97.90**	43.63	44.90	**44.26**
P_8 : No grading i.e. bulk (control)	80.75	81.09	**80.92**	30.00	31.63	**30.81**
Mean	**80.15**	**80.85**	**80.50**	**32.60**	**33.84**	**33.22**
S. Em.±	**0.66**	**0.63**	**0.64**	**0.34**	**0.37**	**0.35**
C. D. (P=0.01)	**1.84**	**1.77**	**1.79**	**0.96**	**1.02**	**0.98**

Note: Grading through air screen cleaner (screen aperture size in mm) (top screen 3.80 mm round and bottom screen 2.00 mm round)

Table 2: Effect of different processing methods on seedling growth rate and seedling dry weight in onion cv. Arka Kalyan

Treatment	Seedling growth rate			Seedling dry weight (mg) of 10 seedlings		
Processing methods (P)	**2016**	**2017**	**Pooled**	**2016**	**2017**	**Pooled**
P_1 : Grading through air screen cleaner	1.85	2.35	**2.10**	22.75	23.00	**22.88**
P_2 : Specific gravity separator	1.99	2.52	**2.25**	22.94	23.19	**23.07**
P_3 : Indent cylinder	1.71	2.22	**1.97**	22.38	22.63	**22.50**
P_4 : Combinations of (P_1+P_2)	2.35	2.88	**2.61**	23.96	24.21	**24.09**
P_5 : Combinations of (P_1+P_3)	2.10	2.60	**2.35**	23.33	23.58	**23.45**
P_6 : Combinations of (P_2+P_3)	2.22	2.73	**2.47**	23.75	24.00	**23.88**
P_7 : Combinations of (P_1+P_2+P_3)	2.44	2.90	**2.67**	24.35	24.60	**24.47**
P_8 : No grading i.e. bulk (control)	1.63	2.13	**1.88**	21.82	22.07	**21.94**
Mean	**1.81**	**2.26**	**2.03**	**20.59**	**20.81**	**20.70**
S. Em.±	**0.037**	**0.040**	**0.038**	**0.120**	**0.120**	**0.120**
C. D. (P=0.01)	**0.10**	**0.11**	**0.11**	**0.34**	**0.34**	**0.34**

Note: Grading through air screen cleaner (screen aperture size in mm) (top screen 3.80 mm round and bottom screen 2.00 mm round)

Table 3: Effect of different processing methods on shoot length and root length in onion cv. Arka Kalyan

Treatment	Shoot length (cm)			Root length (cm)		
Processing methods (P)	**2016**	**2017**	**Pooled**	**2016**	**2017**	**Pooled**
P_1 : Grading through air screen cleaner	10.80	11.63	**11.21**	8.49	9.89	**9.19**
P_2 : Specific gravity separator	10.86	12.35	**11.61**	8.54	9.94	**9.24**
P_3 : Indent cylinder	10.70	11.47	**11.09**	8.43	9.81	**9.12**
P_4 : Combinations of (P_1+P_2)	11.05	12.15	**11.60**	8.75	10.08	**9.42**
P_5 : Combinations of (P_1+P_3)	10.92	11.76	**11.34**	8.58	9.98	**9.28**
P_6 : Combinations of (P_2+P_3)	10.98	12.00	**11.49**	8.63	10.03	**9.33**
P_7 : Combinations of (P_1+P_2+P_3)	12.01	12.62	**12.32**	9.04	10.29	**9.66**
P_8 : No grading i.e. bulk (control)	10.04	10.66	**10.35**	7.63	8.15	**7.89**
Mean	**9.71**	**10.51**	**10.11**	**7.56**	**8.69**	**8.12**
S. Em.±	**0.086**	**0.167**	**0.082**	**0.071**	**0.071**	**0.043**
C. D. (P=0.01)	**0.24**	**0.47**	**0.23**	**0.20**	**0.20**	**0.12**

Note: Grading through air screen cleaner (screen aperture size in mm) (top screen 3.80 mm round and bottom screen 2.00 mm round)

Table 4: Effect of different processing methods on seedling vigour index-I & II in onion cv. Arka Kalyan

Treatment	Seedling vigour index-I			Seedling vigour index-II		
Processing methods (P)	**2016**	**2017**	**Pooled**	**2016**	**2017**	**Pooled**
P_1 : Grading through air screen cleaner	1673	1885	**1779**	1975	2016	**1995**
P_2 : Specific gravity separator	1743	2021	**1882**	2061	2103	**2082**
P_3 : Indent cylinder	1641	1844	**1742**	1919	1960	**1940**
P_4 : Combinations of (P_1+P_2)	1896	2147	**2021**	2294	2339	**2316**
P_5 : Combinations of (P_1+P_3)	1786	2010	**1898**	2137	2180	**2158**
P_6 : Combinations of (P_2+P_3)	1832	2077	**1954**	2219	2262	**2240**
P_7 : Combinations of (P_1+P_2+P_3)	2052	2253	**2152**	2373	2419	**2396**
P_8 : No grading i.e. bulk (control)	1474	1585	**1529**	1820	1859	**1840**
Mean	**1566**	**1758**	**1662**	**1866**	**1904**	**1885**
S. Em.±	**15.73**	**22.12**	**17.01**	**19.81**	**20.01**	**19.91**
C. D. (P=0.01)	**44.01**	**61.87**	**47.56**	**55.40**	**55.98**	**55.69**

Note: Grading through air screen cleaner (screen aperture size in mm) (top screen 3.80 mm round and bottom screen 2.00 mm round)

Table 5: Effect of different processing methods on field emergence and electrical conductivity in onion cv. Arka Kalyan

Treatment	Field emergence (%)			Electrical conductivity (d S/m)		
Processing methods (P)	**2016**	**2017**	**Pooled**	**2016**	**2017**	**Pooled**
P_1 : Grading through air screen cleaner	84.25	85.83	**85.04**	0.679	0.656	**0.667**
P_2 : Specific gravity separator	88.31	89.89	**89.10**	0.676	0.653	**0.665**
P_3 : Indent cylinder	84.79	86.47	**85.63**	0.680	0.657	**0.668**
P_4 : Combinations of (P_1+P_2)	92.00	93.58	**92.79**	0.668	0.644	**0.656**
P_5 : Combinations of (P_1+P_3)	90.03	91.71	**90.87**	0.673	0.650	**0.661**
P_6 : Combinations of (P_2+P_3)	90.88	92.46	**91.67**	0.670	0.647	**0.658**
P_7 : Combinations of (P_1+P_2+P_3)	93.20	94.39	**93.79**	0.660	0.639	**0.650**
P_8 : No grading i.e. bulk (control)	80.50	82.19	**81.34**	0.683	0.657	**0.670**
Mean	**78.22**	**79.61**	**78.91**	**0.599**	**0.578**	**0.588**
S. Em.±	**0.36**	**0.38**	**0.37**	**0.001**	**0.001**	**0.001**
C. D. (P=0.01)	**1.02**	**1.05**	**1.03**	**0.003**	**0.002**	**0.002**

Note: Grading through air screen cleaner (screen aperture size in mm) (top screen 3.80 mm round and bottom screen 2.00 mm round)

In bulk seeds though recovery percentage was very high but physical and physiological quality were inferior due to the higher proportion of shriveled and immature seeds, diseased and inert material resulting from incomplete seed development [3] which resulted in poor germination (80.92) and vigour index (1,529). Pollack and Roos [6] also expressed the association of high vigour with large sized seeds due to the occurrence of higher proportion of matured embryo and adequate nutrient reserves for contributing the physiological stamina residing in it. It emphasized the necessity of processing, and showed positive impact of separation process in all the three machines. Moreover, the reject of screen grader was also unfit as per Indian Minimum Seed Certification Standards, justifying the need of collective use of all the three processing machines.

CONCLUSION

Processing study revealed that seed processing through single equipment can't improve overall seed quality, one must use the combinations of different machines after seed threshing. Seed are to be subjected to processing machines for cleaning and grading in a sequence of combination of machines *viz.,* under different machines combinations *viz*., air screen cleaner, specific gravity separator and indent cylinder improves higher percentage of physical purity, germination and other quality parameters with satisfactory seed recovery which was followed by combinations of both air screen cleaner and specific gravity separator.

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