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Influence of Seed Conditioning to Improve Genetic Purity in Eggplant

S N Vasudevan [1+], Rakesh C Mathad [2], S B Patil [2] Lokeshappa B L [3] and Doddagoudar S R [2]

[1,2] Dept. of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Raichur-584102, India

[3] Govt. of Karnataka, India

Abstract. The hybridity or genetic purity of a seed lot can be improved using seed conditioning when the seed sizes of the inbred lines used for producing hybrid seed vary significantly. In hybrid seed production of eggplant (*Solanum melongena* L.) with a leading hybrid No.1461734 the seed sizes of male and hybrid seed were comparatively bigger than the female parent. After production of the hybrid seed, the seed lot subjected to plant grow out test where in the lot recorded the lowest genetic purity. The physical purity test of the lot show 20 % of smaller seeds which was removed from the seed lot. The seed sample which is having small seed size after sorting had different isozyme banding pattern when subjected to molecular genetic purity test than the male and hybrid seed, but similar to seed of female inbred line. This clearly indicated the admixture of selfs in the hybrid seed. With the objective of removing these smaller seed to improve hybridity of the seed lot 10 different screen sizes were tried at the bottom of a gravity separator. The seed sorted using screen aperture size 4.0 mm (Round) top: 3.5 mm (Round)middle: 0.9 mm (Slotted) bottom screen recorded significantly higher hybridity or genetic purity (95.97 %) when re-tested in the PGO test compared to other screen sizes of bottom screen and control (85.76%).While the 2.0 mm (Round) at the bottom screen significantly increased of germination (79 %) and usable transplants (76%) which is also the recommended screen size for sorting this hybrid compared other bottom screen sizes and control (59%).

Keywords: Hybridity, Seed Conditioning, Seed Sorting

1. Introduction

Seed conditioning is one of the important operations of the shop floor in any seed processing and conditioning plant. The separation of good seeds using appropriate screens is an effective method to ensure yield potential and quality. This operation is the basic post-harvest operation of any seed crop and pre-requisite for marketing (Agrawal, 1996) [1]. The efficiency of processing determines the performance of the hybrid in the market and also in making payments to the seed grower.

The seed processing is done to ensure that the highest seed quality as in physiological maturity stage before storage. Though the precision sorting to improve germination is debatable fact, but to improve hybridity or genetic purity of seed is yet to be known. Since the hybridity is biological and it cannot be increased by physically, but it can be used effectively for sorting the seeds where there is a significant difference in seed size between the parental lines and the hybrid.

In eggplant (*Solanum melongena* L.) hybrid seed production more and more diversified germplasm were used and the seed sizes of the parental inbred lines and the hybrid varied significantly. In eggplant hybrid seed production, since the flower profusely, there is possibility of selfing. These selfed flowers need to be removed from the female parent, otherwise these will further develop into selfed fruits and get mixed up with the crossed ones .As it is difficult to identify the selfed fruits from the crossing block at the time of

[+] Corresponding author. S N Vasudevan Tel.: + 919448300046 ; fax: +918532-224411
E-mail address: vasumanasa@rediffmail.com

harvesting these selfed fruits will also be harvested along with the crossed ones which will result in mechanical admixture of the main seed lot. This will result in low genetic purity in the plant grow out or molecular genetic purity test. Since the hybrid seeds of egg plant are too costly there is a need to find out some of the methods for separating the selfed one from the hybrid seed which can be tested for both genetic purity and germination one more time after thorough separation. So in the similar lines an attempt was made at Department of Seed Science and Technology, UAS, Raichur, for improving the hybridity of a popular hybrid of a leading company by precision sorting method. This particular seed lot was declared having low genetic purity and germination than the required standard.

2. Experimental Methods

The seed lot of eggplant hybrid no-1461734 was obtained with total weight of 33.4 kgs. The genetic purity and germination percentage of the lot were 80.4 % and 59 % respectively before the precision sorting, which is taken as control. The physical characters of the seed such as seed sizes of male, female and the hybrids were analysed using MARVIN Digital Seed Analyser (GTA Sensorik GmbH, Germany). The size of the male parent (2.0 to 2.2 mm) and the hybrid are similar (2.0 to 2.3 mm) but the seed sizes of the female parent were smaller than (1.8-2.0 mm) the hybrid. This indicates clearly that there is strong possibility of the admixture of selfs instead of crossed seed. A comparison of physical purity analysis of eggplant seed before after precision grading was given fig 1.The treatments for screen aperture size were imposed by keeping the top and middle sieves as constant sizes of 4.0 (Round) and 3.5 mm (Round) respectively and the bottom screen aperture were changed from 1.7 mm +0.1mm increments, up to 2.1mm (round) and from 0.8 mm +0.1 mm increments up to 1.2 mm (slotted).

The seed lot was then sorted using Agrosaw vegetable seed air screen cleaner with 3 long screen layers for continuous flow separation installed in the mini-processing plant of UAS, Raichur. The seed separated in each of the sieve were quantified. The seed quality parameters like hybridity %, germination % and usable transplants % were quantified for each of the lot using the ISTA (2011) [2] seed testing procedures by roll towel method, Soil Germination Test and Plant Grow out Test respectively. Then the data was statistically analysed as per Panse and Sukhatme (1967) [3] for F test of significance for undertaking the level of significance between the grades.

3. Results and discussion

The results of the study showed that the seed sorted using the bottom screen-0.9 mm (Slotted) given higher hybridity of 95.57 % in the PGO test, followed by bottom screen-0.8 mm (Slotted) screen (table 1). The hybridity percentage in seed sorted using other round bottom screens, ranged between 81 to 85 % which is a marginal improvement over the control. This is mainly because in round bottom screens the effect of sorting the small sized seeds was not observed. In case of other slotted bottom screens the small seeds get clogged which result in less recovery of small seed. The selfed seed remain in the seed lot and thereby low hybridity in PGO test. Though the hybridity % was improved using bottom screen-0.9 mm (Slotted) screen but the germination and usable transplants was increased significantly using bottom screen-2.0 mm (Round), which were recorded as 79 and 76 % respectively. This screen aperture size was recommended for sorting this hybrid seed.

The positive association observed between the seed size and seed quality parameters as reported by Srimathi and Vanangamudi (1993) [4] in cowpea and Kalavathi and Vanangamudi (1990) [5] in cluster beans. The study also support the fact that the seed sorting can be very useful in improving certain seed quality parameters such as germination by precision seed sorting (Hanumaiah and Andrews, 1973) [6] and the bolder seed size directly influences the seed quality both in field and storage (Pandita and Randhawa, 1995) [7]. This study also support the observation by Komba *et al*.,(2007) [8] on effect of seed size within a seed lot on germination.

Though the study re-established the positive association between the seed size and germination or recovery of usable transplants but a very little to use seed sorting for improving hybridity. There were no prior findings on this aspect but it offers a practical solution in hybrid vegetable seed production involving

inbred lines which produce different seed sizes (figure. 1). The possibility of improving hybridity using precision seed sorting can be used in blending of smaller seed lots and to reduce the number of batches. Reduction in number of batches helps in reducing costs of inventory management, testing and storage. Fewer batches can be tested by molecular genetic purity test, which is otherwise a bit expensive (current costs $ 150 / seed lot), in India. There is possibility of using this application in future for tomato, winter cauliflower, broccoli and cabbage. These seeds express diversified seed sizes and precision sorting can be a solution.

Table 1: Effect of seed processing on genetic purity, germination and recovery of usable transplants

Treatments	Hybridity %	Germination %	Usable Transplants % ##
S1: Bottom Screen -1.7 (Round) mm	82.93	61	61
S2: Bottom Screen- 1.8 (Round) mm	83.87	67	67
S3: Bottom Screen- 1.9 (Round) mm	84.07	73	72
S4: Bottom Screen- 2.0 (Round) mm	84.80	79	76
S5: Bottom Screen- 2.1 (Round) mm	85.07	65	65
S6: Bottom Screen- 0.8 (Slotted) mm	91.57	67	63
S7: Bottom Screen- 0.9 (Slotted) mm	95.57	72	70
S8: Bottom Screen- 1.0 (Slotted) mm	86.33	68	67
S9: Bottom Screen- 1.1 (Slotted) mm	84.77	60	60
S10: Bottom Screen- 1.2 (Slotted) mm	83.23	61	61
S11: Control (Before Seed Sorting)	81.00	61	59
Mean	**85.76**	**67**	**65**
S.Em	**0.46**	**1.35**	**1.45**
CD (0.05) *	**1.35**	**3.97**	**4.28**
CV %	**0.92**	**3.49**	**3.84**

* **CD - Critical difference value**-The difference of two means between or within treatments compared using F-test and computed at 5 % probability (Panse and Sukhatme, 1967).

Usable Transplant %- The percentage of healthy, well grown, saleable seedlings or transplants obtained per gram / ounce of seed after 10-14 days of sowing.

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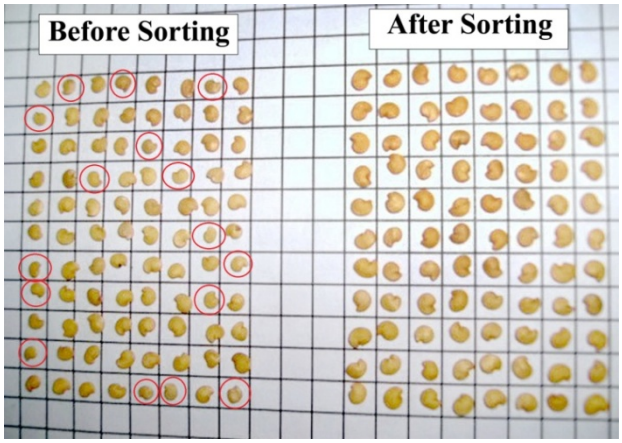

Fig. 1: Eggplant seed before and after seed conditioning (Seed encircled red are probable selfs)