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Standardization of Salt Solution Concentration for Upgrading CORH 3 Hybrid Rice and its Parental Line Seeds by Floatation Technique

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Studies were under taken to standardize the concentration of salt solution for upgrading CORH 3 hybrid rice and its parental line seeds through floatation technique in the Department of Seed Science and Technology, Tamil Nadu Agricultural University Coimbatore. Considering the various seed quality attributes such as seed recovery (68.6 %, 93.6 % and 71.4 % in A line, R line and hybrid respectively), separation of split husk seeds (1.2 %, 0.06 % and 4.2 % in A line, R line and hybrid respectively), seed germination (85 %, 93 % and 92 % in A line, R line and hybrid respectively) and vigour (2822, 3352 and 3329 in A line, R line and hybrid respectively), grading the seeds by floatation method using six per cent sodium chloride salt solution was found to be the optimum for seed quality up gradation in CORH 3 hybrid rice and its parental lines for various physical and physiological attributes studied.

Key words: Hybrid rice seed, upgrading, seed quality, floatation technique

India is the second largest hybrid rice growing country in the world after china. Area under hybrid rice in India has increased from 10,000 ha in 1995 to more than 7,50,000 ha by 2005 with concomitant increase in seed production from mere 200 tonnes to 12,000 tonnes. It is expected that the hybrid rice will be cultivated in an area of around three million hectares in India by 2015 requiring about 50,000 tonnes of hybrid seeds (Subbaiah, 2006). In hybrid rice seed production, initial seed quality is important for obtaining uniform, healthy and vigorous crop stand. Among the seed quality attributes, seed size and weight (density) are most important. Seed processing using cleaner-cum-grader separates the seed on the basis of seed size. However, this grader cannot entirely separate ill-filled light seeds from the mature heavy seeds. Hence, size grading alone may not give satisfactory result since hybrid rice seeds are highly varied in density due to the presence of ill-filled, immature and split husk seeds. Separation of good quality vigorous seeds can be achieved by floatation methods, where the heavy seeds irrespective of their size are separated from the lighter ones. Better seedling vigour from heavier or larger seed was also attributed to better availability and mobilization of reserve food (Pollock and Roos, 1972). The superiority of density graded seed lots had been well established in several crops (Patil and Sarode, 1988 in wheat; Baudet and Misra, 1991 in maize, Podlaski and Wzorek, 1993 in barley and Vimala and Ponnuswamy, 2002 in rice). Comprehensive information on upgrading hybrid rice seeds by using density variations will help the hybrid rice growers in improving the planting value of seed lot. Hence, an experiment was conducted to standardize the concentration of salt solution for upgrading CORH 3 hybrid rice and its parental line seeds through floatation technique

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Materials and Methods

Cleaned and graded seeds of CORH 3 hybrid rice and its parental line seeds were upgraded using different concentrations of salt solutions *viz*., 0, 4, 5, 6 per cent, prepared using sodium chloride (common salt) dissolved in water. About 500 g of seed sample was placed into the solution of each concentration separately and stirred well. Upon settling, the floating fraction was collected using sieve and the sinkers were collected after decanting the solution. The floaters and sinkers were then washed thoroughly with water to remove all the traces of salt adsorbed on the seeds. The seeds of both the fractions were then dried back to their original moisture content and the seed recovery and split husk seeds percentages were recorded as follows (Kamaraj, 2001).

$$\text{Seed recovery (per cent)} = \frac{\text{Weight of sinkers (g)}}{\text{Total weight of seeds (g)}} \times 100$$

$$\text{Split husk seed (per cent)} = \frac{\text{Weight of seeds with split hust (g)}}{\text{Total weight of seeds (g)}} \times 100$$

Table 1. Effect of floatation method of seed grading with different concentrations of salt solution on seed recovery and split husk seeds in CORH 3 rice hybrid and its parental lines.

Lines (V) / Salt conc. (%) (C)	Seed recovery (%)								Split husk seeds (%)							
	Sinkers				Floaters				Sinkers				Floaters			
	A line	R line	Hybrid	Mean	A line	R line	Hybrid	Mean	A line	R line	Hybrid	Mean	A line	R line	Hybrid	Mean
0 (water)	77.2	95.9	85.7	**86.2**	22.8	4.0	14.2	**13.7**	3.0	1.3	7.0	**3.8**	67.2	8.7	68.4	**48.1**
	(61.48)	(78.32)	(67.78)	**(68.19)**	(28.52)	(11.54)	(22.14)	**(21.72)**	(10.97)	(6.55)	(15.34)	**(11.24)**	(55.06)	(17.15)	(55.80)	**(43.91)**
4	76.2	94.9	84.8	**85.3**	23.7	5.2	15.2	**14.7**	2.2	0.7	5.4	**2.7**	70.0	10.0	71.6	**50.5**
	(60.50)	(76.69)	(67.05)	**(67.46)**	(29.13)	(13.18)	(22.95)	**(22.54)**	(8.53)	(4.80)	(13.44)	**(0.46)**	(56.79)	(18.43)	(57.80)	**(45.29)**
5	72.2	94.6	82.5	**83.1**	27.7	5.4	17.5	**16.8**	1.5	0.4	5.0	**2.3**	71.8	16.0	72.4	**53.4**
	(58.18)	(76.65)	(65.27)	**(65.73)**	(31.76)	(13.14)	(24.73)	**(24.20)**	(7.03)	(3.63)	(12.92)	**(8.72)**	(57.92)	(23.58)	(58.33)	**(46.89)**
6	68.6	93.6	71.4	**77.9**	31.4	6.3	28.5	**22.0**	1.2	0.06	4.2	**1.8**	73.4	18.0	74.2	**55.2**
	(55.92)	(75.33)	(57.67)	**(63.36)**	(34.08)	(13.54)	(32.27)	**(27.97)**	(6.26)	(1.04)	(11.83)	**(7.71)**	(58.95)	(25.10)	(59.47)	**(47.98)**
Mean	**73.5**	**94.8**	**81.1**	**-**	**26.4**	**5.2**	**18.8**	**-**	**2.0**	**0.66**	**5.4**	**-**	**70.6**	**13.2**	**71.6**	-
	(59.02)	**(76.82)**	**(64.23)**		**(30.92)**	**(13.18)**	**(25.70)**		**(8.13)**	**(4.66)**	**(13.44)**		**(57.17)**	**(21.300**	**(57.80)**	
Bulk	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	16.1 (23.66)	1.6 (7.27)	19.2 (25.99)	**12.3 (20.53)**	**-**	**-**	**-**	**-**

	Seed recovery (%)						Split husk seeds (%)					
	Sinkers			Floaters			Sinkers			Floaters		
	V	C	VC	V	C	VC	V	C	VC	V	C	VC
SEd	0.28	0.32	0.56	0.28	0.32	0.56	0.13	0.16	0.27	0.26	0.30	0.53
CD (P=0.05)	0.56	0.65	1.13	0.56	0.65	1.13	0.28	0.32	NS	0.53	0.61	1.07

(Figures in parentheses are transformed values)

Four replicates of 100 seeds each were taken at random from each treatment and placed for germination in roll towel medium and kept in the germination room maintained at a temperature of 25±1°C and 95±3 % relative humidity (RH) and the seedlings were evaluated on the 14th day. All the normal seedlings were counted and expressed as germination percentage (ISTA, 1999). The vigour index of the seedling was computed using the following formula suggested by Abdul-Baki and Anderson (1973) and expressed in whole number.

Vigour index = Germination (%) x Mean seedling length (cm).

Results and Discussion

The results on standardization of salt solution concentration for up gradation of hybrid rice and its parental line seeds revealed the significant variation among the physical and physiological attributes studied. The recovery of sinkers decreased with increase in concentration of salt solution. At four percent salt concentration, the recovery of sinkers was about 85.3 per cent, which reduced to 83.1 at 5 per cent concentration and 77.9 per cent at 6 per cent concentration. The maximum seed recovery of 86.2 per cent as sinkers was obtained in water. Among the parents and hybrid, CB87R recorded the highest recovery.

The occurrence of split husk seeds also revealed significant differences due to salt solution concentration. Use of water alone did not separate split husk seeds, But, the higher concentration of salt solution (6 %) lead to increased removal of split husk seeds (55.2 %). This result clearly indicated that the split husk seeds could be effectively separated by higher concentration of salt solution due to the lower seed weight of split husk seeds than the normal seeds. The better efficacy of salt solution over water is due to the higher specific gravity (<1) of salt solution. Sinker seeds contain significantly lesser split husk seeds than the floaters.

Table 2. Effect of floatation method of seed grading with different concentrations of salt solution on seed germination and vigour index in CORH 3 rice hybrid and its parental lines

Lines (V) / Salt conc. (%) (C)	Seed germination (%) Sinkers A line	Sinkers R line	Sinkers Hybrid	Sinkers Mean	Floaters A line	Floaters R line	Floaters Hybrid	Floaters Mean	Sinkers A line	Sinkers R line	Sinkers Hybrid	Sinkers Mean	Floaters A line	Floaters	Floaters	Floaters
0 (water)	81	82	81	**81**	3	5	4	**4**								
	(64.16)	(64.90)	(64.16)	**(64.46)**	(10.97)	(12.92)	(11.54)	**(11.54)**	2544	2847	2745	**2712**	55	111	86	**84**
4	83	86	86	**85**	6	8	7	**7**	2710	3140	3024		130	207	178	
	(65.65)	(68.03)	(68.03)	**(67.21)**	(14.18)	(16.43)	(15.34)	**(15.34)**				**2958**				**172**
5	84	88	87	**86**	6	8	8	**7**	2769	3298	3105	**3057**	147	232	200	**193**
	(66.42)	(69.73)	(68.87)	**(68.03)**	(14.18)	(16.43)	(16.430	**(15.34)**								
6	85	93	92	**90**	10	11	11	**11**	2822	3352	3329	**3234**	251	357	322	**310**
	(67.61)	(74.66)	(73.57)	**(71.57)**	(18.43)	(19.37)	(19.37)	**(19.37)**								
Mean	83	87	87	-	6	8	7	-	2711	3209	3051	-	146	227	197	-
	(65.65)	(68.87)	(68.87)		(14.18)	(16.43)	(15.34)									
Bulk	79	81	80	**80**	**-**	**-**	**-**	**-**	2442	2832	2733	**2669**	**-**	**-**	**-**	**-**
	(62.73)	(64.16)	(63.43)	(63.43)												

	V	C	VC	V	C	VC	V	C	VC	V	C	VC
SEd	0.62	0.72	1.25	0.46	0.53	0.93	33.33	38.49	66.67	13.98	16.14	27.96
CD (P=0.05)	1.26	1.46	NS	0.93	1.08	NS	67.03	77.40	NS	28.11	32.46	NS

(Figures in parentheses are transformed values)

In other wards, the split husk seeds were less (5.3 %) in sinkers than in the floaters (51.8 %), irrespective of the lines and hybrid and concentration of the solution (Table 1). Kamaraj (2001) reported that split husk seeds possessed lesser weight, germination and vigour than the normal seeds. Among the varieties, CB 87 R recorded lesser of split husk seeds (0.66% in sinkers and 13.2% in floaters) than TNAU CMS 2A (2% in sinkers and 70.6% in floaters) and CORH 3, (5.4% in sinkers and 71.6 % in floaters) probably due to as a result of outcrossing. These results are in agreement with earlier report by Ramanadane (2003).

In the present study, the germination of seeds graded by different salt concentration also showed significant differences. The germination of sinkers increased with increasing salt concentration. The maximum germination of 85%, 93% and 92% in A line, R line and hybrid seeds, respectively was recorded by the sinkers of 6% salt solution concentration with the corresponding vigour improvement ((Table 2). Besides, the superiority of sinkers over floaters and ungraded bulk had been well exhibited in all the concentration of salt solution as well as varieties. Heavy seeds were found to perform better than light seed in terms of vigour index also. Better seedling vigour from heavier seeds might be attributed to the better availability and mobilization of reserve food.

These results are in conformity with earlier reports of Tomar and Prasad (1993) in rice and Vimala and Ponnuswamy (2002) in hybrid rice. The performance of floaters was significantly poor with regard to all the parameters studied. The better performance of sinker over floater might be attributed to better filling and maturity of the seeds (Fergusan and Turner, 1971) which provided the higher initial capital (Hewston, 1964). Roy *et al.* (1996) found that in rice, mean seed weight, germination rate and seedling vigour increased with increasing seed weight and therefore

suggested to select larger seeds to achieve good stand establishment.

Besides germination and vigour improvement, the lusture of hybrid rice seed was significantly improved by salt upgradation due to the removal of ill-filled, immature, insect infested and split husk seeds as floaters. Even though the seed recovery was less when upgraded using six per cent salt solution, considering the various seed quality parameters such as removal of split husk seeds and improvement in seed weight, germination, vigour and lusture six per cent, salt solution could be used for grading the seeds of A parental lines and hybrid studied. The loss in seed recovery could be compensated by the recovery of high quality seeds with lesser split husk seeds along with high vigour and viability. Hence, it could be suggested that for seed quality upgradation in CORH 3 hybrid rice and its parental lines through floatation method, six per cent sodium chloride salt solution was found to be optimum.

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