Upgrading marginal seed lots of cotton cultivars by specific gravity separation

P. MURUGESAN AND K. VANANGAMUDI
Dept. of Seed Science and Technology, Tamil Nadu Agrl. Univ., Coimbatore - 641 003, Tamil Nadu.

Abstract: Marginal seed lots of popular cotton cultivars were upgraded by specific gravity separator (model-westrup). There was improvement in physical purity and germination to the range of 98-100 and 65.2 to 74 per cent, respectively in the product outlet after separation. Hence, portion of recovered (43-65%) heavy seeds in the product outlet surpassed the minimum certification standards of germination (65 per cent) and purity (98%). Among six cultivars tested, based on 100 seed weight, two hybrids (RCH-2 and RCH-20) classified as heavy, remaining varieties (MCU-5, LRA-5166 and LRK-516) as light except AKH-84635 which was medium in weight. The parameters of all the seed lots from the middling and rejection outlet were observed to be inferior in all the respect. There was no cultivar influence on seed quality except seed density.

Key Words: Gossypium hirsutum, Marginal seed lots, Seed density, Specific gravity separation, Seed quality, Product middling and Rejection outlet.

Introduction

The seed lot, as harvested contains seeds of widely varying size and quality (Gowda and Gowda, 1996). Separation of seed according to various physical properties (size, weight and density) have all resulted in some improvement of the seed quality as measured by germination (Ferguson and Turner, 1971). Air screen cleaner separate the seed on the basis of the seed size by making use of different seed size. However, it does not account for the separation of the seeds which are heavier and lighter from each other (Patil and Sarode, 1988). Seed weight provided the best relationship to seedling growth and cotyledon of the heavy seed provided more energy which could be used in the growth process (Leffler and Williams, 1983). When both germination and growth were considered together seed density was the most highly correlated with physical characters namely seed weight (Noggle, 1973) and density (Kurdikeri and Kurdikeri, 1988). This brought forth the need for grading of seed based on size, weight and density.

Krieg and Bartee (1975) evaluated the influence of seed density on various aspects of germination. When germination and growth were considered together, seed density was most highly correlated physical properties of cultivars. Since higher mean seed density might influence the seed lot performance. An evaluation of popular cotton cultivars of different initial seed quality was undertaken to encourage the use of specific gravity separation in mechanical seed processing plants for high seed quality. The results would give the potentiality of these popular hybrids/varieties being sold by private agencies which would be useful to all the seed quality control agencies and researchers.

Materials and Methods

The size graded delinted cotton seeds of two hybrids (6 seed lots) and four varieties (16 seed lots) were obtained from different sources and the details are furnished in Table 1.

The seed samples drawn from the seedlots of different hybrids and varieties were evaluated initially for purity, 100 seed weight, moisture content, germination, root length, shoot length (ISTA, 1999). Vigour index was commuted by multiplying total shoot length with germination per cent (Abdul-Baki and Anderson, 1973).

Based on 100 seed weight the hybrids and varieties were classified into different classes as heavy, medium and light. The variety having 100 seed weight less than 8.0 g seed was considered as light; 8-9 g as medium and greater than 9.0 g as heavy based on the procedure

Table 1. Details of cultivars and their source

Name of the hybrid/ variety	No. of seed lots tested	Name of the source
RCH-1	4	Rasi Seeds (P) Ltd., Athur, Salem
RCH-20	2	Rasi Seeds (P) Ltd., Athur, Salem
MCU-5	4	Thudiayalur, Co-operative Agricultural Society, Coimbatore
LRA 5166	4	Consolidated Seed Company, Coimbatore
AK 84635 (Rajath)	4	Consolidated Seed Company, Coimbatore
LRK 516 (Anjali)	2	Consolidated Seed Company, Coimbatore
Total	20	

Table 2. Initial seed quality characteristics of different cultivars before gravity separation

Name of hybrid/ variety	Seed lots	Purity (%)	Moisture content (%)	Germi-nation (%)	Root length (cm)	Shoot length (cm)	Vigour index	100 seed weight (g)
RCH-1	1	97.0	11.7	57.7	16.9	11.8	1658	9.273
	2	98.0	12.0	62.7	16.4	12.2	1795	9.071
	3	98.2	11.8	56.2	16.4	12.2	1607	9.311
	4	98.1	12.4	60.7	16.7	13.5	1835	9.338
RCH-20	1	95.6	12.0	58.5	16.7	12.9	1734	9.468
	2	97.5	12.6	60.2	16.9	14.7	1907	9.665
MCU-5	1	98.9	11.4	58.5	13.7	13.2	1580	7.573
	2	92.0	11.5	61.7	13.9	11.6	1574	7.286
	3	91.9	11.7	55.2	15.6	14.1	1639	7.306
	4	96.0	11.4	60.5	14.9	12.4	1652	7.562
LRA 5166	1	95.8	11.4	55.2	17.1	14.1	1725	7.360
	2	96.1	11.4	61.7	17.1	13.3	1882	7.297
	3	96.6	11.2	59.0	15.2	11.5	1578	7.108
	4	95.3	11.5	60.0	15.3	12.4	1661	7.380
AKH 84635	1	96.5	11.9	54.0	11.6	11.8	1264	8.392
	2	94.0	11.9	56.0	12.2	11.2	1315	8.415
	3	95.1	11.6	57.2	14.2	12.04	1501	8.354
	4	95.5	11.5	62.5	16.6	11.2	1740	8.048
LRK 516	1	97.7	11.2	56.0	13.0	12.3	1419	7.096
	2	97.9	11.5	61.5	16.4	12.1	1756	7.109
CD (P=0.05)		8.38	NS	3.32	1.38	0.76	101.59	0.99

Table 3. Classification of seed (according to 100 seed weight) of cotton cultivars

Hybrid / Variety	Class
RCH-2	Heavy
RCH-20	Heavy
MCU-5	Light
LRA 5166	Light
AKH 84635	Medium
LRK 516	Light

< 8 g / 100 seed – light, 8-9 g/100 seed – medium, > 9 g/100 seed – heavy

Table 4. Changes in seed quality characteristics in the product outlet

Name of hybrid/ variety	Seed lots	Purity (%)	Recovery (%)	Moisture content (%)	Germination (%)	Root length (cm)	Shoot length (cm)	Vigour index	100 seed weight (g)
RCH-1	1	98.0	57.0	11.8	66.5	14.1	14.9	1929	9.509
	2	100.0	64.0	12.0	70.0	13.5	13.9	2000	9.223
	3	999.0	43.0	11.9	65.7	11.9	14.0	1702	9.637
	4	100.0	68.0	12.4	70.5	15.6	18.5	2404	9.810
RCH-20	1	99.8	54.0	11.8	67.2	14.1	17.7	2137	9.560
	2	99.8	51.0	12.4	70.7	15.1	19.1	2397	9.843
MCU-5	1	99.9	52.5	11.2	68.5	15.6	14.6	2068	7.831
	2	99.8	52.7	11.2	72.3	13.7	14.1	2007	7.652
	3	99.6	59.0	11.3	72.5	14.8	19.1	2458	7.757
	4	99.6	50.0	11.3	65.3	12.5	17.2	1936	7.831
LRA 5166	1	99.7	62.0	11.9	65.7	14.4	15.3	1951	7.735
	2	99.3	65.0	11.9	65.7	14.0	17.2	2050	7.686
	3	100.0	59.0	11.3	68.5	12.6	16.3	1980	7.657
	4	100.0	62.0	11.5	66.0	12.5	14.7	1795	8.449
AKH 84635	1	99.3	60.8	11.8	69.7	12.0	15.1	1889	8.774
	2	99.2	56.0	11.6	66.6	11.9	14.4	1752	8.685
	3	98.4	61.0	11.9	65.2	12.8	14.2	1755	8.685
	4	99.7	59.0	11.9	71.0	11.4	17.0	2016	8.481
LRK 516	1	100.0	60.0	11.8	66.0	12.0	13.5	1683	7.881
	2	100.0	58.0	11.9	74.0	12.6	15.9	2109	7.175
CD (P=0.05)		6.29	-	1.64	6.17	0.96	0.875	110.92	0.85

prescribed by Bartee and Krieg (1974). This is to know the weight status of cultivars tested in this study.

The size graded delinted seeds were upgraded using the specific gravity separator (Model Westrup). The specific gravity deck was adjusted as per the normal setting which gives maximum performance.

After feeding the samples, the deck was put into action till the seed on the deck was exhausted. In this way, the seed was separated through the high, medium and low spouts of each seed lots. The light fraction of seed at the lower ends of the deck was considered as rejection. Heavier fraction in the middle spouts was considered as middlings and the

Table 5. Changes in seed quality characteristics in the middling outlet

Name of hybrid/ variety	Seed lots	Purity (%)	Recovery (%)	Moisture content (%)	Germi-nation (%)	Root length (cm)	Shoot length (cm)	Vigour Index	100 see weigh (g)
RCH-1	1	98.0	35.00	11.5	62.2	12.0	11.9	1488	8.886
	2	98.5	23.00	11.8	67.0	13.3	11.5	1662	8.845
	3	98.0	33.00	11.0	65.2	14.3	11.4	1676	8.739
	4	97.0	30.00	11.6	66.7	16.0	14.1	2008	9.221
RCH-20	1	97.0	36.00	11.5	63.5	16.3	12.9	1854	9.111
	2	97.5	33.00	11.5	64.5	18.8	13.0	2051	8.998
MCU-5	1	96.3	31.75	11.2	65.2	13.6	13.8	1795	7.004
	2	97.1	33.24	11.4	66.0	12.4	13.0	1676	7.007
	3	96.5	23.00	11.2	65.5	16.5	13.6	1971	7.100
	4	96.9	36.00	11.3	60.5	16.2	11.6	1682	7.010
LRA 5166	1	97.3	34.60	11.9	60.2	14.3	120	1584	7.120
	2	97.5	34.00	10.9	60.5	15.9	11.7	1670	7.113
	3	98.1	39.00	11.4	62.0	15.4	11.1	1643	6.846
	4	96.1	37.00	11.3	60.2	13.7	11.1	1493	6.916
AKH 84635	1	95.3	32.90	11.5	66.0	14.6	10.6	1663	6.814
	2	97.0	29.50	11.5	58.7	12.8	10.9	1392	6.812
	3	96.3	31.00	11.7	60.0	12.2	10.3	1350	8.015
	4	98.0	34.00	11.5	66.0	15.9	10.4	1736	7.289
LRK 516	1	98.0	32.00	11.7	58.0	11.5	11.1	1311	8.074
	2	98.6	26.00	11.3	67.5	14.8	11.6	1782	6.525
CD (P=0.05)		5.89	-	NS	3.59	0.84	0.739	112.08	0.48

heaviest fraction fallen in the upper end formed the product outlet. After separation, samples drawn from the product, middling and rejection outlet were evaluated for seed quality parameters including recovery percentage. All the data were analysed for statistical significance using analysis of variance.

Results and Discussion

Initial seed quality before gravity separation

Initial evaluation of seed lots indicated that all the seed lots showed germination per cent below the minimum seed certification standards (65.0%). Similar observation was also noticed with respect to purity (below 98%) except three lots of RCH-1 and one lot from MCU-5 (Table 2).

Among the seed lots, the per cent lag in germination and purity was 2.3 to 11 and 0.1 to 6.1 respectively. There was no significant difference observed with regard to moistur content irrespective of cultivars and lot numbers Though, significant difference observed for th parameters namely root length, shoot lengtl and vigour index, it was unable to distinguisl those differences on cultivar basis. Unlike abov characters, statistically significant cultivar effec existed with regard to 100 seed weight. The seeds of two hybrids used in this study classified as heavy and other three cultivars were grouped under light except AKH 84635 which has formed medium category (Table 3). Bartee and King (1974) observed heavy and light groups in 10 cultivars of delinted seeds as per similar classification.

Seed quality changes in product outlet

The seed quality improved significantly in the product outlet for all the seed lots which registered 50-68% recovery except one lot from RCH-2 which had recorded only 43%. The

germination and purity standards have been increased to (65.2 and 74 and 98-100%) more than certification standards which was proportionate to initial values observed before gravity separation. Kaushal (1996) reported 11 to 12 per cent of improvement in germination using gravity separator in WHH-4 cotton cultivar. As expected, the improvement of parameters like root length, shoot length and vigour index was specific to the initial germination and other characters of each seed lots, their values were not identical to hybrid/variety as a whole. In contrast, the hybrids registered comparatively significant higher 100 seed weight. Better seedling vigour from heavier or larger seed was attributed to better availability and mobilization of food reserve (Pollack and Roos, 1972).

The results of moisture content obtained showed no inference. Though, there were increased record of values with regard to 100 seed weight, he existence of cultivar effect (heavy, medium nd light) remained unchanged in the product utlet (Table 4).

Patil and Sarode (1988) reported that eavier seed lots produce much vigorous seedlings han lighter seeds and also found that bajra eed quality could be improved by subjecting he seeds to specific gravity. The superiority f density grading of seed lots had been well stablished in several crops (Hodgson, 1980).

eed quality changes in middling outlet

Although, there were marked improvement in purity, germination and other parameters commensurate with initial values of lots, their increase could not be compared with product outlets.

Majority of seed lots from hybrids and LRK 516 has crossed certification standards of purity. Out of total 20 seed lots, seven alone had reached minimum germination requirement which represented all the cultivars except RCH 20 and LRA 5166. The seeds trapped in the middling outlets were in the range of 23-29 per cent and with a rough average recovery of 30 per cent as a whole (Table 5). The role of seed density in predicting seed quality was emphasized by Krieg and Bartee (1975) and reported that cultivar had no direct relationship with density separation and density germination relationship.

Seed quality changes in rejection outlet

The quality obtained from rejection outlet was inferior in all respects and had very low purity (84 to 94%), germination (30.2 to 56.5%), recovery (1.0 to 15.75%), root length (10.4 to 18.2 cm), shoot length (9.4 to 12.1 cm) and vigour index (740 to 1525). Significant differences for all the parameters were existed among all the seed lots. Low density seed generally putforth less germination and normally produce less vigorous seedlings. Moreover, rejection outlet had some inert materials, cracked seeds and discoloured seeds along with normal seed, hence resulted in inferior performance (Table 6).

Conclusions

The results obtained in this experiment indicated that heavier seeds obtained in the product outlet had higher recovery, 100 seed weight, germination and vigour index. By using specific gravity separator the purity and germination could be improved to the range of 98-100 and 65.2 to 74 per cent respectively, which surpassed the certification standards in the product outlet. The seeds obtained from middlings rejection outlets could not be used further for sowing. Thus, seed lots of marginal quality could be successfully separated into three fractions based on density.

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Table 6. Seed quality change in rejection outlet

Name of hybrid/ variety	Seed lots	Purity (%)	Recovery (%)	Moisture content (%)	Germination (%)	Root length (cm)	Shoot length (cm)	Vigour Index	100 seed weight (g)
RCH-1	1	92.3	8.0	11.3	45.2	12.0	11.8	1077	7.805
	2	93.1	13.0	11.7	55.0	12.6	11.0	1298	7.091
	3	93.3	24.0	11.2	53.0	13.6	10.4	1272	7.055
	4	92.0	2.5	11.2	50.7	15.2	12.1	1384	8.341
RCH-20	1	91.0	10.0	11.5	43.5	15.3	11.8	1179	7.093
	2	94.0	16.0	11.7	50.0	18.2	12.3	1525	7.051
MCU-5	1	90.2	15.7	11.2	51.7	12.1	12.1	1251	6.032
	2	90.3	14.0	11.05	55.5	11.3	11.3	1254	5.623
	3	90.7	3.0	11.1	51.5	15.2	11.5	1375	5.431
	4	89.6	14.0	11.2	40.7	14.9	10.7	1042	5.041
LRA 5166	1	87.4	3.5	11.1	35.0	13.2	10.0	812	5.621
	2	87.6	1.0	11.2	32.7	14.8	10.2	818	5.341
	3	88.6	2.0	12.1	43.0	13.3	10.6	1028	5.016
	4	89.4	1.0	11.0	30.2	11.6	10.7	673	5.013
AKH 84635	1	85.0	6.2	12.4	44.0	13.1	9.5	994	5.64
	2	86.0	14.5	11.5	31.2	11.7	9.7	1003	5.711
	3	86.3	10.0	11.9	36.5	11.3	9.9	774	6.051
	4	84.3	7.0	11.5	38.00	13.9	9.4	885	5.059
LRK 516	1	87.3	8.0	11.4	37.00	10.4	9.6	740	5.041
	2	86.3	16.0	11.2	56.5	13.1	9.6	1282	6.169
CD (P=0.05)		3.88	-	0.681	2.96	0.67	0.56	88.72	0.353

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