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COMPARISON OF SEED AND FIBER PROPERTIES AND YIELD OF GLANDED AND GLANDLESS COTTONS[1]

J. M. Halloin, J. H. Turner, Jr., and P. E. Hoskinson[2]

ABSTRACT

Yield, fiber, and seed properties were compared between nine pairs of glanded and glandless cottons (*Gossypium hirsutum* L.). Three replicates of paired-row plots were planted at Jackson, Tennessee, in 1975. On the average, seedcotton yield was less in glandless than in glanded cottons, possibly a result of poor adaptation of some lines to the location. Among other properties, the only important difference found between glanded and glandless cottons, as groups, was in lint percentage. The higher lint percentage of the glandless entries appeared to relate to their smaller seed size.

Additional index words: **Boll size, Lint index, Micronaire, Span length, Seed deterioration, Free fatty acids, Embryo infection, Abnormal seeds, Seedling stand.**

GLANDED cottonseed (*Gossypium hirsutum* L.) contain the toxic terpenoid aldehyde, gossypol, localized within glands, and are thus not suitable for consumption by monogastric species unless processed to remove gossypol (5). Glandless cottonseed, first described by McMichael in 1959 (6), contain neither glands nor gossypol, and need no such processing. Because of this, many cotton breeders are transferring the glandless trait into their productive cultivars. Yields of glandless cottons comparable to those obtained with glanded cultivars have been reported (4, 7). Conversely, in a study comparing recurrent backcross selections of glanded and glandless cottons, Hosfield et al. (3) found glandless cottons significantly lower in fiber yield than glanded cottons. Limited comparative data for seed and fiber properties between glanded and glandless cottons, as groups, are available. We developed such data to determine if the transference of the glandless character has had deleterious associations that influence important quality parameters.

MATERIALS AND METHODS

Breeders supplied seed of their best glandless cotton lines and the most nearly comparable glanded line. Lines of glandless and glanded cotton, respectively, and their suppliers were[3]: Lockett 22 and 'Lockett 4789A', Lockett Seed Co., Vernon, Tex.; Paymaster 464 and 'Paymaster 202', Anderson Clayton Seed Co., Plainview, Tex.; 'Gregg 35W' and 'Gregg 35', Gregg Seed Farms, Plainview, Tex.; Lambright GL5 and 'Lambright X15-5', Lambright Seed Farm, Slayton, Tex.; Coker 708 and Coker 514, Coker's Pedigreed Seed Co., Hartsville, SC; Stoneville 524 and 'Stoneville 7A', Stoneville Pedigreed Seed Co., Stoneville, Miss.; Louisiana 70-18, and 'Acala 1517C' (Originator, New Mexico Agric. Exp. Stn.) Mr. Ferd Self, Louisiana State Univ., Baton Rouge; Pope Gl and 'Hancock', Tennessee Agric. Exp. Stn., Jackson; and Acala G8160 and 'Aacala SJ-1', Cotton Res. Stn., Shafter, Calif.

A split plot design was used. Three replicates of paired-row plots were planted at Jackson, Tenn., in May 1975. First-harvest samples were hand picked in early October, and second-harvest samples were machine picked in mid November. Seedcotton was ginned on a laboratory roller gin. Seeds were delinted with conc H_2SO_4.

Yield, boll size (seedcotton per boll), lint percentage, lint index, and seed index were based on gravimetric determinations. Seeds per boll and percentage of abnormal seeds were based on counts of 10 bolls and 250 seeds per sample, respectively. Abnormal seeds were those judged to be immature, shrivelled, or damaged in ginning. The last category was predominant. Embryo infection was determined on 100 embryos per replicate as described by Halloin (2). Free fatty acids, on an oil basis, expressed as oleic acid equivalents, were measured by OACS Official Method Aa 6-83 (1).

All fiber property measurements were made at the Cotton Quality Laboratories in Knoxville. Measurements included micronaire, 2.5% span length, 50% span length, uniformity index, fiber strength, and elongation. Seeds harvested in November 1975, from plots at Jackson, were planted in three paired-row plots of 100 seeds per replicate, in mid-April, 1976, at College Station, Tex.; surviving seedlings were counted 35 days after planting to determine percentage stands. Means for agronomic characters were compared using error terms calculated from ANOVA tables.

RESULTS AND DISCUSSION

Mean fiber yield, seed and fiber properties of glanded and glandless entries are shown in Table 1. Major cultivar differences for yield and quality attributes were detected. These differences were understandable in that each breeder has his own specific objectives. Comparisons between cultivars are not presented, however, because certain cultivars were not well adapted

Table 1. Average yield, yield components, seed and fiber properties of glanded and glandless cottons.

Measurement	Glanded	Glandless
Seedcotton yield (kg/ha)	1,387	1,189 *
Lint yield (kg/ha)	541	472
Seed yield (kg/ha)	846	717 *
Boll size (g seedcotton)	6.2	6.1
Lint percentage	38.5	39.7**
Lint index (g/100 seed)	7.4	7.4
Micronaire	4.4	4.2
2.5% Span length (mm)	28.2	28.2
50% Span length (mm)	13.7	13.5
Uniformity index	48.5	48.1
Fiber strength (mN/tex)	183	189
Elongation (%)	6.9	7.6*
Seeds per boll	32.8	32.6
Seed index (g/100 seed)	11.6	11.3
Embryo infection (%)		
First harvest	4.0	2.7
Second harvest	10.6	8.8
Change	6.6	6.1
Abnormal seeds (%)		
First harvest	7.9	6.6
Second harvest	15.9	15.5
Change	8.0	8.9
Free fatty acids (%)		
First harvest	1.4	1.0*
Second harvest	2.9	3.1
Change	1.4	2.1
Stand (%, second harvest)	37.5	41.9

*,** Differences significant at the 0.05 and 0.01 levels of probability, respectively.

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[2] Research plant physiologist, SEA, USDA, National Cotton Pathology Research Laboratory, P.O. Drawer JF, College Station, TX 77840, Research Agronomist, SEA, USDA, Cotton Quality Laboratories, Univ. of Tennessee, Knoxville, TN 37915, and Associate Agronomist, West Tennessee Experiment Station, Jackson, TN 38201, respectively.

[3] Mention of a trademark, proprietary product, or vendor does not constitute a guarantee or warranty of the product by USDA and does not imply its approval to the exclusion of other products or vendors that may also be suitable.

to the test location, but may perform well in the locations for which they were developed.

Yield of seedcotton was significantly less in glandless than in glanded cottons. This difference was reflected in both seed and lint yield, although the reduction in lint yield was not significant (0.05 level) in this study. The yield reduction associated with glandless cottons may have been partly due to preferential feeding on these lines by plant bugs (*Lygus* sp.), which were observed in the plots. However, most of the difference appeared to be due to poor cultivar adaptation. Yield data were highly variable, and higher yields for glanded cottons were recorded in five of the nine pairs of lines. For one of these pairs the yield of the glanded line averaged 2.8 times that of the glandless line, whereas with some other pairs seedcotton yields were virtually equal. One glandless line averaged 1.5 times the seedcotton yield of the glanded prototype.

Among fiber properties, fiber elongation and lint percentage were significantly different between glanded and glandless cottons. Elongation is regarded as a function of fiber strength, and the lack of a significant difference between the two groups in fiber strength, plus the small magnitude of the difference in elongation, suggest that the difference in elongation is not meaningful. Increased lint percentage in association with the glandless character was found for seven of the nine pairs of cottons. This difference is probably associated with the smaller size of glandless seeds (seed index) which, although not statistically significant (0.05 level) in this study, was found in six of the nine pairs of cottons. Differences in seed size and lint percentage were of approximately the same magnitude.

No significant differences in seed index or seeds per boll were associated with glandedness. Magnitudes of all properties associated with loss of seed quality (percentage of embryo infection, abnormal seeds, and free fatty acids) increased between the first and second harvests. A significant difference (0.05 level) for percentage free fatty acids was observed between glanded and glandless cottons at the first, but not the second, harvest. Free fatty acids were highest in glanded seeds at the first harvest, but they were highest in glandless seeds at the second harvest, suggesting that this difference is not meaningful.

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A TECHNIQUE FOR ASSESSING SEEDLING EMERGENCE UNDER DROUGHT STRESS[1]

Douglas A. Johnson and Kay H. Asay[2]

ABSTRACT

A procedure involving a cellulose acetate membrane separating a polyethylene glycol-6,000 osmoticum from a germination medium of soil was modified for use as a plant-selection tool. This technique avoided direct seed and osmoticum contact, allowed maintenance of a wide range of soil water potentials, and was capable of assessing emergence of large numbers of seedlings. This procedure was used to assess seedling emergence under drought stress of 120 lines of crested wheatgrass—*Agropyron desertorum* (Fisch. ex Link) Shult., *A. cristatum* (L.) Gaertn., and *A. sibiricum* (Willd.) Beauv. Significant differences in seedling emergence at two water stress levels occurred among the crested wheatgrass lines. The genetic variance was greater under the more severe drought stress. However, relative differences among lines were not consistent under the two drought stress regimes, as indicated by the highly significant progeny × stress-level interaction and the significant, but low, correlation between drought stress levels (r=0.40, 118 d.f.). Although opportunities for genetic improvement may be greater under the more severe moisture stress level, the environment of intended use must be considered during selection.

Additional index words: **Seedling Emergence, Germination, Water Stress, Grass Breeding, Drought Resistance, Crested Wheatgrass, *Agropyron desertorum*, *Agropyron cristatum*, *Agropyron sibiricum*.**

BECAUSE germination and emergence under drought stress are of particular importance in the establishment of many crops, several techniques have been employed to assess germination and early seedling growth under drought conditions. One procedure measured germination of seeds on a blotter containing an osmotic solution of known solute potential. Solutions of mannitol, sodium chloride, and polyethylene glycol have been used widely to provide a range of water potential regimes (Uhvits, 1946; Powell and Pfeifer, 1956; Williams et al., 1967; Sharma, 1976). The different osmotica, however, had a specific effect on germination independent of water potential (Parmar and Moore, 1968; Sharma, 1973; McDonough, 1976; Bassiri et al., 1977). Consequently, this technique may confound the effects of drought stress per se with the direct effect of the osmotic solution on the seed.

Owen (1952) suspended seeds in an atmosphere maintained at specific vapor pressure to circumvent direct contact between the seed and osmoticum. This method, however, required strict temperature control to maintain desired water potential levels. Additionally, neither the vapor pressure equilibration method nor the blotter procedure provided a realistic simulation of contact between seed surfaces and soil water present under field conditions. This relationship was shown to be extremely important in controlling germination by Sedgley (1963), Monohar and Heydecker (1964), and Hadas (1975).

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[2] Plant physiologist and research geneticist, respectively, USDA, ARS, Crops Research Laboratory, Utah State Univ., UMC 63, Logan, UT 84322.