Morphological traits characterization and some yield and fiber quality components evaluation of the Argentinian cotton genetic resources

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ABSTRACT

INTA (Instituto Nacional de Tecnologia Agropecuaria) of Argentina has a national project for the collection and conservation of relevant plant and animal genetic resources. At the Experimental Station of Saenz Pena, in the northern region where the main cotton growing area is located, the cotton active germplasm collection is held as seeds samples at temperatures between 0 and 5 degrees Celsius. Cultivars and lines introduced since 1945 from many cotton growing countries of the world, plus breeder's lines outstanding for any trait/s but lacking for some agronomic trait/s, compose the collection. The following morphological, yield components and fiber quality data were collected in two different years and replicated in one of them: leaf morphology, bract morphology, boll shape, leaf hairiness, presence or absence of leaf nectaries, mean number of reproductive branches, mean internode length, height at first branch, lint peorcentage, boll weight, seed index, fiber length, fiber strength and micronaire. Plants of each accession were planted in 10 meter rows separated each other at a distance of 1 meter and final distance among plants in the row left at 20 centimeters. Fiber properties were measured through four replications for each sample with the HVI (High Volume Instrument), taken from 25 bolls from each row. Data were stored in a database and a catalogue was released for interested user in different scientific fields, particularly for breeders. They are here summarized presenting maximum, minimum, average, variance and variation coefficient values when trait continuous, and frequencies of states when discontinuous.

Introduction

INTA (Instituto Nacional de Tecnologia Agropecuaria) of Argentina has a national project for the collection and conservation of relevant plant and animal genetic resources. At the Experimental Station of Saenz Pena, in the northern region where the main cotton growing area is located, the cotton active germplasm collection is held as seeds samples at temperatures between 0 and 5 degrees Celsius. Duplicate samples are conserved at -20 °C at the base bank at IRB (Instituto de Recursos Biologicos) at INTA Castelar, Buenos Aires province. Cultivars and lines introduced since 1945 from many cotton-growing countries of the world plus breeder's lines outstanding for any trait/s but lacking for some agronomic trait/s compose the collection (Royo, 1998).

Soomro (1998) studied different morphological traits looking for insect resistance in cotton. For okra leaf type varieties developed at their institute, they found a decrease in boll rot and in thrips and white fly infestations. He also argues that variety CRIS-7, being profusely hairy, had lower jassid infestation than the control varieties.

Today, having genetic engineering techniques being developed at high pace, it is fundamental to have well characterized, evaluated and documented germplasm diversity available for use in breeding. Future improvements in environmental resistance, agronomic fitness and quality of cotton depend on diversity within the genetic resources from which new traits can be selected (Stewart, 1994). Meredith (1998) stated that unless breeders broaden their genetic base in their programs, yield stagnation will continue in the USA, and the same concept may be applied to breeding in Argentina.

The objective of this work was to estimate the variability available for each trait and provide descriptors for the characterization of the cotton genetic resources collection. Data recorded were stored in a database and a catalogue was released for interested user in different scientific fields, particularly for breeders (Royo, 1998).

Experimental procedure

The following morphological, yield components and fiber quality data were collected in two different years with one of them with two replications of the accessions and the other with no replication: leaf morphology, bract morphology, boll shape, leaf hairiness, presence or absence of leaf nectaries, mean number of reproductive branches, mean internode length, height at first branch, lint percentage, boll weight, seed index, fiber length, fiber strength and micronaire. These data were taken for almost 500 accessions of *Gossypium hirsutum* L. made up of old and new cultivars from many cotton growing countries in the world and breeder´s lines from INTA´s cotton breeding program (Royo 1998). The data analyzed and presented in this report was averaged across the two years.

Plants of each accession were planted in the field in 10 meter rows separated each other at a distance of 1 meter and final distance among plants in the row left at 20 centimeters. Fiber properties were measured through four replications for each sample with the HVI, taken from 25 bolls from each row. Maximum, minimum, average, variance and variation coefficient values were calculated for continuous traits, and frequencies of states for discontinuous traits. The coefficient of variation (CV) was created in the late 1800s as a measure of population variability (Bowman, 2001), and was estimated from data recorded in the field.

Results and Discussion

Data for discontinuous traits are presented in Table 1, and for continuous traits in Table 2. For the former traits it can be observed that there is considerable variability for leaf hairiness and boll shape, but few for okra leaf, bract morphology and nectaries presence, although within the leaf hairiness trait the no hair state has a small frequency of 2.27% and within the boll shape the rounded-oval state also has a small frequency of 2.89%.

Coefficient of variation values estimating variability for the continuous traits are listed in Table 2. Acceptable levels of variability are found for lint percent, mean height at first branch, fiber strength and mean number of reproductive branches; very little variability for seed index, boll weight, fiber micronaire and mean internode length; and not much variability for fiber length.

Although data drawn from a high number of entries should have an adequate number of replications for valid conclusions to be taken, nevertheless it is important to have these data available for use, specially for breeding purposes. It will allow for and foster germplasm resources utilization for improvement, and at the same time it will be useful for genebank managers to increase diversity in their working collections for certain traits. If these data could be available through publications from different world germplasm collections, then conservation of genetic resources could be improved targeting at rare traits or rare trait states.

References

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Table 1. *Discontinuous traits and trait states frequencies.*

Discontinuous traits	State 1 frequency	State 2 frequency	State 3 frequency	State 4 frequency	State 5 frequency
Leaf morphology	Okra	Normal			
	2.68 %	97.32 %			
Leaf hairiness	High	Intermediate	Low	No hair	
	10.72 %	50.52 %	36.49 %	2.27 %	
Bract morphology	Frego	Normal			
	1.44 %	98.56 %			
Boll shape	Rounded	Oval	Conic	Rounded-conic	Rounded-oval
	46.60 %	13.81 %	28.6 %	8.04 %	2.89 %
Nectaries presence	Present	Absent			
	96.70 %	3.30 %			

Table 2. *Continuous traits with maximum, minimum, average, variance and variation coefficient values.*

Continuous traits	Maximum	Average	Variance	Variation Coefficient %	Minimum
Lint percent	46.8	38.39	7.28	19.0	28.15
Seed index	12.5	9.61	0.73	7.6	7.25
Boll weight (gr)	6.25	4.69	0.20	4.3	3.59
Mean number of reproductive branches	20.33	13.94	4.12	29.6	9.33
Mean height at first branch (cm)	24.17	15.13	7.48	49.4	7.47
Mean internode lenght (cm)	6.27	4.56	0.26	5.7	3.09
Fiber strength T (1/8") (g/tex)	35.9	26.84	7.64	28.5	19.5
Fiber length 2.5 % span (mm)	32.9	28.44	2.52	8.9	22.95
Fiber micronaire (index)	5.35	3.94	0.14	3.6	2.95