PUBLIC BREEDING IN THE SOUTHWEST – AGRONOMIC PERFORMANCE

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Abstract

As I began putting together my ideas for this introspection of the last 50 years of public breeding efforts in the Southwest, I felt a bit intimidated. So much to remember, so much forgotten, and so much deserving of recognition that time will not allow. And, so, my review embodies a mixture of facts and subjective perceptions that may not do justice to the public sector's service to cotton improvement in the region.

It seems to me that much of the improvement effort of the past five decades has taken place against a background of two noteworthy events: (1) the westward shift of cotton production in both Oklahoma and Texas, and (2) the rapid shift from hand to machine harvesting.

Oklahoma is located at the northern limits of the Cottonbelt, and growing seasons usually are characterized by unfavorably cool temperatures in spring and fall that reduce growth and fruiting, lower production potential, limit fiber maturation, and increase problems with diseases. The importance of early maturity and storm resistance was emphasized early on, and these traits have been consistent factors in the selection and release of commercial cultivars. Early in the present century, the absence of private cotton breeding firms in Oklahoma prompted the Oklahoma Agricultural Experiment Station (OAES) to initiate formal projects to develop improved cultivars especially adapted to Oklahoma growing conditions. Prior to 1950, OAES released three cultivars of historical note: Oklahoma Triumph 44, Mebane 6801, and Stoneville 62. Since 1955, 11 additional cultivar releases have been made, which incorporated various levels of earliness and storm resistance, improved fiber quality, and resistance to bacterial blight, fusarium wilt, and verticillium wilt (Table 1).

Success of the Oklahoma cotton-breeding program is attributable to a succession of breeders, some of who are known to many of you (Table 2). I would be negligent if I did not supplement this listing with the name of E. S. Oswalt. Ed was superintendent of the Oklahoma Cotton Research Station at Chickasha at the time that I began my career in cotton breeding under the guidance of John Green. Ed was an excellent cotton agronomist and a tough taskmaster in the indoctrination of rookie breeders in the finer points of field and laboratory operations. I learned much from Ed Oswalt about the 'grunt' work involved in cotton breeding, and I believe that my 'boot camp' experiences were later shared by others who followed me, including bob Bridge. Beginning in 1986, emphasis in the Oklahoma breeding program shifter from variety development to the development and release of cotton germplasm. O the dismay of Laval Verhalen, the breeding project was terminated in 1993.

In addition to its cotton breeding program, the Oklahoma Station has maintained an active supporting cotton genetics program since 1959. Areas of study have included inheritance of agronomic and fiber traits, heterosis, breeding methodology, and genetics of pest resistance. The Station continues an active program of cotton variety evaluation and cultural studies under Laval Verhalen's leadership.

The story of public breeding in Texas is considerably different from that in Oklahoma. Not that breeding needs and objectives are very different, but rather that a greater diversity of environmental conditions and cultural situations in Texas dictate broader ranges of objectives in respect to growth and fruiting habit, earliness, fiber quality, and adaptation to mechanization. Recall that in Texas, cotton is grown over a south to north range exceeding 700 miles, stretching from the subtropical environment of the Lower Rio Grande Valley to the nearly northern limit for cotton in the Texas Panhandle.

To accommodate to variations in ecological conditions, climatic patterns, and cultural patterns, the Texas Agricultural Experiment Station (TAES) established separate breeding programs at College Station, Weslaco, Lubbock, and El Paso. Breeders in these respective programs are listed in Table 3.

The El Paso program was designed primarily to produce high fiber quality germplasm utilizing complex combination of Del Cerro, Acala, Stahman, various other Upland genotypes, and Pima. Materials from the program, sometimes known as El Paso Source Material (EPSM) are important contributors of strength in the fiber quality breeding program of the Lubbock Center. The El Paso breeding project was discontinued about 1980.

The High Plains breeding program, centered at Lubbock, was modified in the 1970's to emphasize development of high yielding germplasm adapted primarily to stripper harvest, with enhanced levels of fiber quality, especially strength. Several of the Lubbock germplasm releases have contributed to development of successful commercial varieties adapted to the High and Rolling Plains of Texas, western Oklahoma, and eastern New Mexico.

In the late 1940's, a cotton breeding project was established at Weslaco in the Lower Rio Grande Valley. The principal aim of this program was to produce full-season, high yielding cultivars suitable for both rain grown and irrigated production in South Texas, with fiber properties superior to

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those of the more commonly grown Delta-type varieties and well suited to machine harvest. The program was relatively short-lived, and was discontinued in the mid-1970's, having produced the Westcot cultivar.

During the early decades of the 1900's until the late 1930's, the cotton improvement program of the Texas Station was centered in the Department of Agronomy in College Station, with minor activities at Chillicothe and Temple. In the late 1930's, a cooperative agreement between USDA and TAES initiated an expanded cotton improvement research unit at College Station. At its peak of operation in the 1970's, the unit included scientists in cytology, cytogenetics, taxonomy, genetics, breeding, and testing. The breeding effort within the overall program concentrated on breeding methodology, modified growth and fruiting types, germplasm screening, and release of germplasm stocks adapted to machine harvesting in Central and south Texas. The team organization with genetics, cytology, and cytogenetics also supported a strong basic breeding effort in species hybridization, evaluation of exotic germplasm, and identification and isolation of new and unique traits of potential value for cultivar development. Attrition, transfers, and administrative decision over the past two decades have substantially reduced strength of the cooperative team, especially in the more basic research activities.

A second breeding program at College Station was begun about 1950, when the MAR program was initiated in the Department of pathology at College Station. That program, still in operation, centers on host plant resistance and will be discussed by Luther Bird.

As well as I've been able to determine, in the last few decades the Texas Station has released 21 cultivars for commercial production (Table 4). It would be interesting to demonstrate how much the Texas and Oklahoma public varietal releases have contributed to each state's cotton economy, in respect to yield improvement, fiber quality, or producer income, but existing documentation does not support such an appraisal. However, it appears that germplasm releases of the Oklahoma and Texas public programs have been used as parental materials for development of at least 93 commercial issues, just within these two states.

This look back at recent decades of publicly supported cotton breeding programs in the Southwest leads me to certain conclusions, most of which are equally applicable to public programs across the Cottonbelt.

1. The world of cotton improvement has changed dramatically since I left the Texas Station in 1986. Support of public programs has declined markedly from both federal and state sources. It seems reasonable to suggest that the loss of basic research programs will adversely affect future progress in cultivar development, be it in traditional or biotech programs.

2. The cotton industry, especially in respect to cultivar origination, is both a beneficiary and a victim of technology. The promises of genetic engineering are beginning to be realized with the elaboration of new genetic traits to address specific production hazards. At the same time, the shift toward transgenic approaches and consolidation of seed companies does not bode well for the survival of small independent entities whose varieties have found a competitive niche in satisfying producers' needs. This situation is especially apparent in Texas, as evidenced by data provided by USDA in its annual report on varieties planted. In 1975, an estimated 87% of the cotton acreage in Texas was planted to varieties from 12 different seed originating entities, nine of which were in-state independent companies. Similar data for 1996 indicate that about 80% of the Texas acreage was planted to varieties distributed under brand names of three major seed companies, none of which was an independent in-state organization. Only one independent seed company's varieties accounted for more than 5% of the acreage.

3. From my personal experience, I consider the 1950-1980 period to be the golden years of cotton improvement, not only in the Southwest, but also across the Cottonbelt. A combination of enthusiastic and innovative first-class scientists created an enviable fraternity of public and private researchers that made significant advances in our understanding of the cotton plant and of how it can be manipulated to best advantage for producers and consumers. I doubt that such a time will come again — I do know that I was fortunate to be a first-hand witness to it.

Table 1. Cotton cultivators released through 1986 by Oklahoma Agricultural Experiment Station.

Cultivar	Release Date	Origin
Oklahoma Triumph 44	1918	Mebane Triumph
Mebane 6801	1940's(?)	Mebane 140
Stoneville 62	1944	Stoneville 2B
Parrott	1955	Mebane 140
Kemp	1964	Stoneville 62
		Stoneville 20
Verden	1964	Northern Star
Parrott 66	1966	Parrott
		CR-4
Westburn	1967	Western Stormproof
		Auburn 56
Lankburn	1967	Lankart 57
		Auburn 56
Westburn 70	1970	Westburn
Thorpe	1973	Lankart 611
		Fox 42-5
Westburn M	1976	Im2
		22-3
		Westburn
Simwalt 82	1982	TAMCOT 24
		Im2
		OK 13-2
Cencot	1986	Westburn M

Table 2. Cotton breeders of Oklahoma Agricultural Experiment Station.

Breeder	Period of Service
Henry E. Dunlavy	1938-49 (USDA/OAES)
I. M. Parrott	1938-51 (USDA/OAES)
John M. Green	1949-58 (USDA/OAES)
Charles L. Leinweber	1955-60 (USDA/OAES)
Jay C. Murray	1959-68 (USDA/OAES)
Laval M. Verhalen	1969-present (OAES)

Table 3. Cotton breeders of Texas Agricultural Experiment Station, 1974-97.

Breeder	Location
T. R. Richmond	College Station (USDA/TAES)
E. F. McFarland	College Station (TAES)
P. J. Lyerly	El Paso (TAES)
L. L. Ray	Lubbock (TAES)
J. L. Hubbard	Weslaco (TAES)
G. A. Niles	College Station (TAES)
E. F. Young	El Paso (USDA)
J. R. Gannawy	El Paso/Lubbock (TAES)
C. W. Smith	College Station (TAES)

Table 4. Cotton cultivars released by Texas Agricultural Experiment Station, 1947-97.

Cultivar Name	Cultivar Name
Austin	TAMCOT CAMD-E
Brazos	TAMCOT CD3H
Wescot	TAMCOT GCNH
Stormmaster	TAMCOT HQ95
Blightmaster	TAMCOT SP21
Blightmaster A5	TAMCOT SP21S
Pima S-3	TAMCOT SP23
TAMCOT 2111	TAMCOT SP37
TAMCOT 788	TAMCOT SP37H
TAMCOT 788A	TAMCOT Sphinx
TAMCOT CAB-CS	