NAME OF TEST: Evaluation of Guar Varieties, Introductions and Selections, 1959-62.

OBJECTIVES: To evaluate the agronomic and seed quality characteristics of Guar, Cyamopsis tetragonoloba, strains in the world collection. To determine the forage and seed production capabilities of existing varieties and advanced breeding lines. To develop a varietial improvement program in Texas in cooperation with M. L. Kinman and G. W. Rivers of the Oilseed Section.

EXPERIMENTAL PROCEDURE:

Location: College Station, Beeville, Iowa Park and Chillicothe. Yield tests were conducted at all locations and the evaluation nursery was conducted at Iowa Park.

RESULTS: See tables.

DISCUSSION: Demand for guar gum (manogalactan) has increased in recent years, but present domestic production accounts for only about 10% of domestic consumption. Approximately 100,000 acres of guar have been grown each year in North Texas and Southern Oklahoma and this acreage has been relatively stable for the past several years. In 1958-59, personnel of the USDA, Northern Utilization Research and Development Division, Peoria, Illinois, became interested in evaluating the potentials of guar as a source of industrial raw material, which in turn stimulated an expansion of the guar research program in Texas.

In 1959, a collection of 89 introductions, 39 single plant selections and 6 named varieties of guar were grown at Iowa Park, Texas, to evaluate their potential as commercial varieties or as a source of germplasm for varietial improvement and to maintain viable seed of all entries, if possible. Thirty-five introductions either failed to germinate or to produce seed. Seed was harvested in bulk and desirable individual plants were selected from certain heterogeneous strains. All material was evaluated for a number of plant and seed characteristics, and a description of each entry (based on these notes) was recorded for future reference. A summary of the observed range in variability of the various plant and seed characteristics is presented in Table 1. Growth habit was recorded as non-branching (NB), basal branching (BB), branching(B) and fine branching (FB). Plant height varied from 32 to 56 inches; leaves were either pubescent (P) or glabrous (G); and disease ratings ranged from 1-5 with 1 representing resistance and 5 susceptibility.

Considerable variation was observed in a number of the characteristics checked. Most of the components of seed yield that were included in the study (pods per node, pod length and seed size) appeared to be controlled largely by genetic factors since the variation within the check varieties was considerably less than the total range of variation observed in the nursery. Variation in the supposedly related character (seeds per pod), however, appeared to be largely environmental since variation within the check varieties was as great as total variation. Definite differences in Alternaria leaf spot reactions were apparent, ranging from no infection to severe infection. All check varieties were moderately to highly susceptible. The prevalence of black seed appears to be largely environmental, being associated with occurrence of rainfall after seeds mature. The assumption that seed quality might be improved by developing early maturing varieties does not seem warranted, since the lower pods mature first, and early fruiting varieties may have a longer period in which to sustain seed damage. Much of the wide variations noted in seed yields were due to poor

stands because some seed lots were old. Considerable variation in seed yield occurred between plots with good stands, however, which can be attributed to either disease reaction, response to environment or inherent yielding ability.

Usable variation in most of the important plant and seed characteristics of guar were found in the collection of material grown in 1959. It may be feasible to isolate guar types with both high forage yields and high seed yields since some introductions with branching growth habit and resistance to Alternaria leaf spot produced seed yields comparable to the better non-branching types.

A summary of the forage and seed production data obtained in the guar yield test at Iowa Park, 1960-62, is presented in Table 2. Both seed and forage yields were high in 1960 and 1961 with PI 253186, PI 179930 and Groehler producing the best combination of both seed and forage. PI 253186, a Texsel type, showed up well at Iowa Park but was severely damaged by Alternaria leaf spot at Beeville, thus, further testing of this strain was not considered necessary. In 1962, yields of both seed and forage were low due to severe damage due to Alternaria as well as bacterial blight disease. The highest yielding strains were those with the greatest resistance to these two diseases. Groehler 1-3 selection appeared to be very promising at this location.

Seed and forage yield data from the Beeville test is presented in Table 3. Yields, in general, were low and seed quality was poor in both 1961 and 1962. Much of the poor performance in this test can be traced to severe Alternaria leaf spot damage which caused almost complete early defoliation in the early fruiting strains and partial defoliation of the later fruiting strains as they approached maturity. In some cases, almost complete defoliation had occurred before forage yields were taken. PI 179930 and Groehler selection show the most promise of improving on the performance of the check varieties of Texsel and Groehler.

Table 4, summarizes the disease score in 1962 at College Station, Beeville and Iowa Park. Damage due to disease varied in intensity at various locations. Alternaria leaf spot and bacterial blight were the most common diseases. The yield test at Beeville has been severely damaged by Alternaria with susceptible varieties being almost completely defoliated by July 5. At other locations and in commercial fields, Alternaria leaf spot varied from present but causing no damage to nearly as severe as at Beeville. At College Station and Iowa Park the most serious disease appeared to be bacterial blight but Alternaria was also present. Blight completely destroyed some plots at both College Station and Iowa Park, but the varietial resistance pattern seemed to be more clear cut at College Station. The Groehler 1 selections have a high degree of resistance to this disease.

PROJECT: Hatch 460
WORKER: R. D. Staten
DATE SUBMITTED: November, 1962

Table 1. A summary of the range of agronomic characteristics evaluated in guar plant introductions and selections, compared with check varieties, Iowa Park, Texas, 1959.

Characteristic measured	Range of character expression	Character Expression by Checks					
		Texsel		Groehler		Mesa	
		Range	Mean	Range	Mean	Range	Mean
Growth habit	NB-FB	NB	--	BB	--	B	--
Height (inches)	32-56	35-42	38	32-42	35	36-41	39
Leaf type	P-G	P	--	P	--	P	--
Pods/node	2-12	5-8	7	5-8	7	3-6	4
Seed/pod	5-12	5-10	--	6-10	--	6-11	--
Pod length (inches)	1.5-5.0	1.9-2.8	--	2.0-2.8	--	2.0-3.0	--
Alternaria leaf spot	1-5	4-5	--	3-5	--	3-4	--
Lodging (%)	7-100	15-33	25	7-30	13	18-44	35
Seed size (gms. per 100 seed)	2.3-5.0	2.8-3.0	2.9	2.8-3.5	3.2	3.1-3.6	3.3
Black seed (%)	3-70	28-45	37	29-52	37	28-52	36
Seed yield (gms.)	8-833	418-757	613	545-803	658	152-401	273

Table 2. Evaluation of guar varieties and selections for forage and seed production, Iowa Park, Texas, 1960-62. (Replicated, uniform test. Irrigated as needed.)

Variety or strain	Seed Yield (lbs./acre) 1960	1961	1962[2]	Comparable average	Forage Yield (lbs./acre-air dry) 1960	1961	1962	Comparable average
Texsel	----[1]	1740	340	(1130)	----[1]	3850	1200	(3240)
Groehler	1350	1940	320	1200	5845	4570	1260	3890
PI 164801	1330	1740	130	1070	5740	4940	950	3880
PI 179930	1410	1980	455	1280	5900	5270	3070	4750
PI 183400	1190	1330	420	980	5540	5280	3670	4830
S-47-2	1340	----	610[3]	(1150)	5720	----	3780[3]	(4300)
S-44-1	1330	1640	600[3]	(1080)	5680	4820	4420[3]	(4200)
(Na 444 x Tex)-7	---	1820	230	(1120)	----	4910	1370	(3850)
PI 158118	----	1410	435	(1020)	----	5840	3920	(5590)
PI 253186	2110	1660	---	(1480)	5620	4140	----	(3830)
Groehler 1-3	----	----	690	(1490)	----	----	3090	(5190)
PI 163104	----	----	360	(1160)	----	----	3390	(5490)
PI 179930-2	----	----	320	(1120)	----	----	2020	(4120)
PI 179930-3	----	----	225	(1025)	----	----	950	(3050)
PI 263406	----	----	120	(920)	----	----	1000	(3100)
LSD (.05)	410	320	220		N.S.	940	380	
C.V. (%)	20.8	13.6	44.8		9.2	14.5	38.9	

1/ Poor stand, not harvested.

2/ Severe disease (bacterial blight) plus drought caused low yields.

3/ Preliminary test yields, not included in analysis or comparable average.

Table 3. Evaluation of guar varieties and selections for forage and seed production, Beeville, Texas, 1961 and 1962.

Variety or strain	Seed Yields (lbs/acre) 1961	1962	Comparable average	Forage Yields (lbs/acre-air dry) 1961	1962	Comparable average
Texsel	710	300	505	3405	460	1930
Groehler	840	190	515	5860	670	3265
PI 179930	460	505	480	7330	1580	4455
PI 183400	150	400	275	8310	1950	4630
(Na 444 x Tex.)-7	940	220	580	7490	560	4025
PI 158118	130	250	190	6810	1990	4400
PI 253186	740	---	(670)	5250	----	(2590)
S-44-1	300	650	475	5830	600	3215
S-47-2	---	210	(280)	----	570	(3230)
Groehler 1-3	---	640	(710)	----	1880	(4540)
PI 179930-3	---	460	(530)	----	1360	(4020)
PI 179930-2	---	430	(500)	----	1290	(3950)
PI 163104	---	320	(390)	----	1680	(4340)
PI 263406	---	120	(190)	----	970	(3630)
PI 164801	---	70	(140)	----	630	(3290)
LSD (.05)	190	135		1600	460	
C.V.(%)	21.6	28.9		19.3	25.5	

Table 4. Disease ratings on uniform guar nurseries at College Station, Beeville and Iowa Park, Texas, 1962.

Variety or strain	Alternaria Leaf Spot Ratings & Damage							Bacterial Blight Ratings			
	College Station	Beeville		Iowa Park	Defoliation-Beeville			Dead-College Sta.		Iowa Park	
		6/14	7/9		6/14	7/9	Dead-7/9	8/27	9/15	9/4	9/4
	(0-5)	(0-5)	(0-5)	(0-5)	(%)	(%)	(%)	(%)	(%)	(0-5)	(%)
Texsel	3.0	1.8	4.5	5.0	10	84	40	25	100	3.5	10
Groehler-2	3.0	3.5	5.0	4.2	28	94	92	30	100	3.0	26
PI 179930	1.0	1.0	1.2	3.0	10	15	2	1	25	3.0	3
PI 179930-2	0.5	1.5	2.0	2.5	8	24	8	4	60	2.5	25
PI 179930-3	1.0	0.8	2.5	3.0	5	33	10	0	55	4.5	52
PI 183400	1.5	0.5	1.5	3.0	0	13	0	0	20	2.0	0
PI 158118	1.5	2.0	1.0	2.8	10	5	0	0	28	2.0	0
PI 164801	3.0	4.5	5.0	4.5	35	89	85	60	100	5.0	36
(Na 444 x Tex.)-7	3.0	3.0	4.5	4.5	30	86	75	40	100	4.5	33
Groehler 1-3	0.5	0.8	2.0	2.0	0	21	8	0	0	0.5	0
PI 163104	1.5	2.5	1.5	3.5	13	9	2	4	75	2.0	1
PI 263406	1.5	1.5	3.8	3.2	18	44	22	35	100	4.5	38
Groehler 1-1	0.5	---	---	2.0	--	--	--	0	0	0.5	0
Groehler 1-2	0.5	---	---	1.0	--	--	--	0	0	0.0	0
S-47-2	1.0	---	---	2.0	--	--	--	0	20	0.5	0
S-44-1-3	1.0	---	---	1.5	--	--	--	0	15	0.0	0
PI 179930-1	1.5	---	---	3.0	--	--	--	30	100	4.0	25
PI 179930-4	1.5	---	---	2.5	--	--	--	3	30	2.5	5
K-2194	1.5	---	---	3.0	--	--	--	5	65	3.0	5
Okla. 55-3	3.0	---	---	5.0	--	--	--	65	100	3.0	15
PI 169801	3.5	---	---	4.0	--	--	--	86	100	4.5	37