

TECHNICAL NOTES

COFFEEVILLE PLANT MATERIALS CENTER

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SEED PRODUCTION AND VARIATION AMONG SELECTED PARTRIDGEPEA ACCESSIONS

Abstract

Seed production and other characteristics for 14 accessions of partridgepea (*Cassia* spp.) were measured, and the number of candidates for release at the Coffeeville Plant Materials Center (PMC) was reduced to three, primarily on the basis of seed production. The three accessions, 9021655 from Crawford County, AR, 9021660 from Columbia County, AR, and 9028396 from Dallas County, AR, were each distinct in their growth habit, but each was so variable that more selection is necessary before a unique and stable cultivar may be released.

Introduction

An assembly of partridgepeas, mostly showy partridgepea (*Cassia fasciculata* Michx.), was evaluated at the Coffeeville PMC from 1981 through 1985. Of the 116 accessions evaluated at the PMC, 16 were selected for advanced testing because they consistently performed better on the basis of ground cover, vigor, seed production, and hardiness (Coffeeville PMC, 1987). The accessions were:

- 421728 *C. mimosoides* - From Puerto Rico through Americus PMC.
- 436819 *C. fasciculata* - Collected in Falls Co., TX, by Richard Oliver.
- 9021655 *C. fasciculata* - Collected in Crawford Co., AR, by Wayne L. Weese.
- 9021660 *C. fasciculata* - Collected in Columbia Co., AR, by Bobby J. Cook.
- 9021666 *C. fasciculata* - Collected in Crittenden Co., AR, by J. L. Reid.
- 9028367 *C. fasciculata* - Collected in Ashley Co., AR, by Louis Jacks.
- 9028375 *C. fasciculata* - Collected in Lee Co., AR, by Hardy Cloutier.
- 9028380 *C. fasciculata* - Collected in Sharkey Co., MS, by Ike C. Presley.
- 9028390 *C. nictitans* - Collected in Lincoln Co., AR, by B. Whitehurst.
- 9028396 *C. fasciculata* - Collected in Dallas Co., AR, by Earl D. Chapman.
- 9028414 *C. fasciculata* - Collected in Miller Co., AR, by Dee M. Vanderburg.
- 9028449 *C. fasciculata* - Collected in Mississippi Co., AR, by Levell Foote, Jr.
- 9028475 *C. fasciculata* - Collected in Rapides Par., LA, by Andrew C. Irwin.
- 9028480 *C. fasciculata* - Collected in West Carroll Par., LA, by Mike May.
- 9028482 *C. fasciculata* - Collected in West Baton Rouge Par., LA, by S. Anderson.
- 9028920 *C. nictitans* - Collected in Faulkner Co., AR, by Kenneth A. Croft.

Because more information concerning seed production and classification was needed to reduce this number of accessions for advanced evaluations, some seeds of these accessions were provided to Wood Glen Experimental Gardens in Jackson, MS, for more detailed studies.

Methods and Materials

Seeds of only 14 of the 16 selections were available for planting. These were sown in greenhouse trays into a commercial potting mixture with fertilizer added on March 11, 1989. When seedlings were large enough, individual plants were transferred to multi-pot containers (2" x 2" x 2.5") containing the potting mixture. As well as could be done, seven plants of nearly equal size were selected from each accession and transplanted to garden rows on May 20. Plants were evenly spaced in rows 1.5 meters long. Weeds were controlled by hoeing and no fertilizer was added.

Plants were observed frequently and each row was evaluated for maturity, attractiveness, and undesirable features every two weeks from June 29 to September 26. The number of plants surviving was noted, and the average height and width of plants were recorded in inches. The abundance of foliage, flowers, and fruits, and the resistance to lodging and disease were visually determined using the standard rating system given in the National Plant Materials Manual where 1 = excellent, 3 = good, 5 = fair, and 7 = poor (USDA, 1984).

Since some question had arisen regarding the nomenclature of some accessions in the assembly (Brooksville PMC, 1986), taxonomic characteristics were also studied (Fernald, 1950), and accession 9028390, which had originally been called C. nictitans, was determined to be C. fasciculata.

Of the seven plants of each accession, three entire plants (numbers 2, 4, and 6) were harvested when seeds began to mature to determine potential production and variability within and between accessions. The number of flowers and pods was recorded for each plant to determine potential seed production. Where seeds were mature, they were collected and pods and seeds counted and weighed. The entire aerial portion of each plant was then air dried and weighed to determine plant biomass. Pods of the remaining plants (numbers 1,3,5, and 7) were hand harvested as they matured. At the end of each ten-day period, pods and seeds for each accession were counted and weighed.

Results and Discussion

The basis for selection of the better accessions (9021655, 9021660, and 9028375) was primarily seed production (Table 1) since most accessions except 9028396, which had poor survival, also performed well in the visual evaluations (Table 2). Some of the other accessions showed signs of disease early in the season or disease or lodging late in the season; however, these undesirable factors did not appear to substantially affect seed production. Except for 421728 which was a different species, many accessions of C. fasciculata had characteristics that distinguished them from the others although the differences were not readily apparent in the evaluations. Accessions from the more southern collections tended to flower and mature seeds later. Accessions 9021660, 9028475, and 9028462, also more southern, had a more slender and taller growth form. Accessions 9021666 and 9028449 from northeastern Arkansas had dark red or maroon anthers, whereas, anthers of most of the others were predominantly yellow with blotches of maroon at their bases. Some accessions, 9028375, 9028390,

and 9028414, had intermediate anther color, being mottled with yellow and maroon in almost equal amounts. This difference in anther color has been recognized by Isely (1975), in a taxonomic study of the genus Cassia, who described C. fasciculata as having "usually yellowish anthers tending toward red in the western portion of the range." An examination of herbarium specimens of flowers of all the accessions collected during the initial evaluation of Cassia at the PMC (Coffeeville PMC, 1987) tended to substantiate the same geographic pattern.

Although accessions showed some distinct properties, differences among individuals within an accession were often as great (Table 3). Certain plants were more robust, branching, and produced flowers and fruit earlier and longer (Table 1). Some plants died very soon after seeds matured while others continued to produce flowers until killed by freezing around December 1. A few individuals produced an early and a late crop of seeds.

Because individuals within each accession varied so widely, an analysis of variance of the data in Table 3 showed no significant differences between accessions except for height. If the sample number had been increased from 3, a better mean separation could be obtained; however, large individual differences would still be present. Considerable variation is recognized in C. fasciculata, such as phenology, size, pubescence, growth habit, and gland shape and color; and distinct varieties, variants, and intermediates have been recognized. Within a specific region, pure and mixed populations of different phenotypic expressions may be distinguished (Isely, 1974). Differences may also be controlled by exposure and edaphic conditions, and the species has an excellent potential for additional taxonomic and ecological studies as well as having enough genetic diversity to allow for selection of improved cultivars for erosion control, green manure, and beautification.

Conclusions

The three accessions (9021655, 9021660, and 9028375) were selected for additional testing because they had the highest seed production. They also showed good form and vigor. Although plants in each accession showed similarities, they were not uniform. The variation within these three productive accessions, should provide sufficient germplasm diversity for selection of plants with outstanding characteristics.

References

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- Isely, Duane. 1975. Leguminosae of the United States: II. Subfamily Caesalpinioideae. Mem. N. York Bot. Garden. 25(2): 52-98.
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TABLE 1. HARVEST DATA FOR ROW WITH 4 PARTRIDGEPEA PLANTS
AT JACKSON, MISSISSIPPI (1989)

ACCESSION NUMBER	HARVEST DATE	PODS		SEEDS		SEED PER POD	SEED PER GRAM
		NUMBER	WT (g)	NUMBER	WT (g)		
421728	09/26	26	1.9	119	0.4	4.6	298
421728	10/06	228	17.1	1040	3.4	4.6	306
421728	10/16	240	17.6	1623	5.2	6.8	312
421728	10/26	249	18.8	1795	7.0	7.2	256
421728	11/06	234	19.5	1786	7.6	7.6	235
421728	11/16	90	6.1	507	1.8	5.6	282
421728	11/26	103	3.2	332	0.9	3.2	369
421728	12/06	107	3.8	192	0.4	1.8	480
	ALL	1277	88.0	7394	26.7	5.8	277
9021655	09/26	146	29.0	1434	12.6	9.8	114
9021655	10/06	330	65.7	3242	28.4	9.8	114
9021655	10/16	457	67.2	3277	28.3	7.2	116
9021655	10/26	248	32.2	1699	13.9	6.9	122
9021655	11/06	80	6.2	337	2.2	4.2	153
9021655	11/16	241	12.8	940	3.8	3.9	247
9021655	11/26	66	2.0	171	1.6	2.6	104
	ALL	1568	215.1	11100	90.8	7.1	122
9021660	10/06	120	26.3	1574	11.1	13.1	142
9021660	10/16	173	36.4	2023	15.1	11.7	134
9021660	10/26	656	108.7	5840	49.1	8.9	119
9021660	11/06	337	62.6	3471	28.0	10.3	124
9021660	11/16	122	9.8	724	3.1	5.9	234
9021660	11/26	92	8.5	570	4.0	6.2	143
9021660	12/06	11	0.8	68	0.3	6.2	227
	ALL	1511	253.1	14270	110.7	9.4	129
9021666	09/26	360	44.1	1975	14.8	5.5	133
9021666	10/06	392	48.0	2151	16.2	5.5	133
9021666	10/16	183	24.4	1257	10.5	6.9	120
9021666	10/26	223	23.0	1151	6.0	5.2	192
9021666	11/06	88	5.7	345	2.3	3.9	150
9021666	11/16	35	1.6	86	0.4	2.5	215
9021666	11/26	3		6	0.1	2.0	120
	ALL	1284	146.8	6971	50.3	5.4	139
9028367	09/26	439	65.5	3192	22.7	7.3	141
9028367	10/06	440	65.6	3200	22.7	7.3	141
9028367	10/16	61	7.5	364	2.7	6.0	135
9028367	10/26	396	46.4	2265	18.7	5.7	121
9028367	11/06	255	21.9	973	8.2	3.8	119
9028367	11/16	132	8.9	410	3.3	3.1	124
9028367	11/26	156	8.5	461	2.8	3.0	165
9028367	12/06	113	4.1	255	1.1	2.3	232
	ALL	1992	228.4	11120	82.2	5.6	135
9028375	09/26	16	2.2	119	0.7	7.4	170
9028375	10/06	286	38.6	2125	12.7	7.4	167
9028375	10/16	880	87.2	5495	31.6	6.2	174
9028375	10/26	1361	109.5	5915	42.2	4.3	140
9028375	11/06	794	42.3	2436	19.7	3.1	124
9028375	11/16	217	9.5	601	2.8	2.8	215
9028375	11/26	158	6.4	387	1.6	2.4	242
9028375	12/06	103	3.0	213	0.7	2.1	304
	ALL	3815	298.7	17291	112.0	4.5	154

ACCESSION NUMBER	HARVEST DATE	PODS		SEEDS		SEED PER POD	SEED PER GRAM
		NUMBER	WT (g)	NUMBER	WT (g)		
9028380	09/26	122	18.1	968	8.3	7.9	117
9028380	10/06	546	81.1	4330	37.1	7.9	117
9028380	10/16	262	23.6	1387	10.0	5.3	139
9028380	10/26	163	12.8	749	5.4	4.6	139
9028380	11/06	83	4.9	322	2.1	3.9	153
9028380	11/16	150	6.8	325	2.3	2.2	141
9028380	11/26	14	0.7	57	0.3	4.1	190
9028380	12/06	9	0.4	42	0.1	4.7	420
	ALL	1349	148.4	8180	65.6	6.1	125
9028390	09/26	245	40.0	2207	15.1	9.0	146
9028390	10/06	386	63.0	3477	23.7	9.0	147
9028390	10/16	169	19.8	813	6.0	4.8	136
9028390	10/26	234	23.4	964	7.9	4.1	122
9028390	11/06	352	26.0	1342	8.4	3.8	160
9028390	11/16	162	9.2	532	2.4	3.3	222
9028390	11/26	58	2.6	169	0.8	2.9	211
9028390	12/06	19	0.5	19	0.1	1.0	190
	ALL	1625	184.5	9523	64.4	5.9	148
9028396	09/26	24	3.5	188	1.5	7.8	125
9028396	10/06	435	63.5	3412	26.8	7.8	127
9028396	10/16	391	31.7	1745	13.1	4.5	133
9028396	10/26	350	24.7	1301	9.9	3.7	131
9028396	11/06	128	6.6	327	2.3	2.6	142
9028396	11/16	66	3.2	123	1.0	1.9	123
9028396	11/26	60	2.9	206	1.0	3.4	206
9028396	12/06	34	4.1	255	1.1	7.5	232
	ALL	1488	140.2	7557	56.7	5.1	133
9028414	09/26	117	14.8	820	3.5	7.0	234
9028414	10/06	418	53.0	2929	12.6	7.0	232
9028414	10/16	145	16.1	930	3.4	6.4	274
9028414	10/26	83	8.0	541	2.4	6.5	225
9028414	11/06	26	1.9	122	0.5	4.7	244
9028414	11/16	15	0.6	42	0.1	2.8	600
9028414	11/26	1		3	0.0	3.0	300
	ALL	805	94.4	5387	22.5	6.7	240
9028449	09/26	20	3.0	142	1.0	7.1	142
9028449	10/06	83	12.5	590	4.0	7.1	148
9028449	10/16	56	6.6	254	1.8	4.5	141
9028449	10/26	46	5.5	272	2.1	5.9	130
9028449	11/06	28	2.4	107	0.6	3.8	178
9028449	11/16	6	0.4	8	0.0	1.3	267
9028449	11/26	2		5	0.0	2.5	500
	ALL	241	30.4	1378	9.5	5.7	144
9028475	10/26	166	28.0	1657	12.9	10.0	128
9028475	11/06	419	54.2	2627	24.5	6.3	107
9028475	11/16	241	24.9	1669	11.7	6.9	143
9028475	11/26	96	6.2	511	3.5	5.3	146
9028475	12/06	72	2.9	245	1.0	3.4	258
	ALL	1237	146.5	8092	63.1	6.5	128

TABLE 1. HARVEST DATA (Continued)

ACCESSION NUMBER	HARVEST DATE	PODS		SEEDS		SEED PER POD	SEED PER GRAM
		NUMBER	WT (g)	NUMBER	WT (g)		
9028480	09/26	602	65.7	4328	27.9	7.2	155
9028480	10/06	126	21.8	906	5.8	7.2	156
9028480	10/16	142	16.7	931	6.2	6.6	150
9028480	10/26	169	17.2	880	6.7	5.2	131
9028480	11/06	85	6.4	302	2.3	3.6	131
9028480	11/16	42	2.0	114	0.6	2.7	190
9028480	11/26	19	0.4	35	0.2	1.8	175
	ALL	1185	130.2	7496	49.7	6.3	151
9028482	10/16	4	0.8	47	0.3	11.8	157
9028482	10/26	111	20.1	1114	7.9	10.0	141
9028482	11/06	182	27.4	1381	12.0	7.6	115
9028482	11/16	78	7.3	527	2.8	6.8	188
9028482	11/26	46	3.4	276	2.5	6.0	110
9028482	12/06	42	1.5	123	0.4	2.9	308
	ALL	463	60.51	3468	25.9	7.5	134

TABLE 2. PERFORMANCE OF PARTRIDGEPEAS AT JACKSON, MISSISSIPPI (1989)

ACCESSION NUMBER	PCT SURV	MAXIMUM SIZE			MOST SEED HARVEST		MOST FLOWERS		AVERAGE		
		HT	WD	DATE	GRAMS	DATE	RATE	DATE	FOL	DIS	LODGE
421728	100	47.4	33.3	08/26	7.6	11/06	1	08/26	1.9	1.7	1.1
9021655	100	37.1	35.3	09/09	28.4	10/06	3	08/11	2.9	1.7	1.9
9021660	100	67.4	48.4	09/09	49.1	10/26	1	09/09	3.0	3.3	1.6
9021666	100	39.4	41.0	09/09	16.2	10/06	2	08/11	3.3	2.6	2.0
9028367	100	52.8	49.8	08/26	22.7	10/06	2	08/11	3.4	2.0	2.7
9028375	100	41.3	43.9	09/09	42.2	10/26	1	08/26	2.0	1.9	2.1
9028380	100	45.7	34.4	09/09	37.1	10/06	3	08/26	2.4	2.1	2.0
9028390	100	48.2	42.1	09/09	23.7	10/06	1	08/26	1.7	1.7	1.7
9028396	78	34.5	41.5	09/09	26.8	10/06	3	08/11	4.1	3.1	1.1
9028414	100	44.7	33.4	09/09	12.6	10/06	3	08/11	4.4	3.0	1.6
9028449	92	43.5	34.8	09/09	4.0	10/06	1	07/28	3.0	3.3	1.7
9028475	100	47.4	37.0	09/09	24.5	11/06	2	09/09	4.0	3.6	1.7
9028480	100	39.0	35.6	08/26	27.9	09/26	4	08/11	3.7	3.1	2.1
9028482	100	53.0	36.4	09/26	12.0	11/06	2	09/09	4.7	2.6	1.6

TABLE 3. GROWTH AND PRODUCTION OF INDIVIDUAL PARTRIDGEPEA PLANTS AT JACKSON, MISSISSIPPI (1989)

ACCESSION NUMBER	PLANT NUMBER	HEIGHT (in.)	WIDTH (in.)	BRANCHES (number)	FLOWERS PRODUCED	BIOMASS GRAMS
421728	1	45	25	25	923	158
421728	2	51	25	19	1466	291
421728	3	57	18	6	285	42
	AVE.	51	23	17	891	164
9021655	1	53	26	19	744	231
9021655	2	28	12	8	39	9
9021655	3	38	31	16	265	96
	AVE.	40	23	14	349	112
9021660	1	60	29	23	561	217
9021660	2	67	57	14	1149	450
9021660	3	58	15	10	160	70
	AVE.	62	34	16	623	246
9021666	1	37	32	8	462	113
9021666	2	47	24	13	505	145
9021666	3	42	27	14	680	144
	AVE.	42	28	12	549	134
9028367	1	56	46	26	613	164
9028367	2	57	43	17	393	109
9028367	3	52	36	11	913	175
	AVE.	55	42	18	640	149
9028375	1	24	6	4	32	6
9028375	2	28	24	9	132	26
9028375	3	58	38	17	1801	628
	AVE.	37	23	10	655	220
9028380	1	45	31	25	990	381
9028380	2	33	11	3	94	25
9028380	3	53	40	18	1000	256
	AVE.	44	27	15	695	221
9028390	1	55	34	12	596	181
9028390	2	42	14	14	480	94
9028390	3	58	47	21	1167	390
	AVE.	52	32	16	748	221
9028396	1	27	27	17	252	64
9028396	2	21	19	12	1	8
9028396	3	26	20	15	68	15
	AVE.	25	22	15	107	29
9028414	1	42	20	11	658	121
9028414	2	46	24	5	215	45
9028414	3	47	38	10	262	123
	AVE.	45	27	9	378	96

ACCESSION NUMBER	PLANT NUMBER	HEIGHT (in.)	WIDTH (in.)	BRANCHES (number)	FLOWERS PRODUCED	BIOMASS GRAMS
9028449	1	50	24	21	1100	356
9028449	2	45	24	9	420	111
9028449	3	40	28	14	581	126
	AVE.	45	25	15	700	198
9028475	1	57	29	13	368	114
9028475	2	47	14	9	111	43
9028475	3	65	40	18	1250	430
	AVE.	56	28	13	576	196
9028480	1	46	36	7	422	87
9028480	2	47	33	5	149	59
9028480	3	41	21	11	374	99
	AVE.	45	30	8	315	81
9028482	1	77	33	12	770	362
9028482	2	49	14	2	41	29
9028482	3	52	33	8	749	320
	AVE.	59	27	7	520	237