TECHNICAL NOTES

COFFEEVILLE PLANT MATERIALS CENTER

No. 2 Coffeeville, Mississippi 1987

INITIAL EVALUATION OF ILLINOIS BUNDLEFLOWER

Abstract

Illinois bundleflower, collected primarily in Oklahoma and Arkansas were initially evaluated at the Coffeeville Plant Materials Center from 1981 through 1985. The assembly of 60 accessions was narrowed to 9 on the basis of ground cover, vigor, seed production, and hardiness.

Introduction

Illinois bundleflower (Desmanthus illinoensis (Michx.) MacM.) is a herbaceous, warm-season, perennial legume. It is indigenous to prairies and alluvium from Alabama to Texas northward to Indiana and North Dakota and is most abundant in neutral or alkaline soils. It contributes to the fertility of the native grasslands by fixing nitrogen. It has been widely reputed to be an excellent source of food for wildlife, but its value as food for upland gamebirds has been discredited by Hoekstra (1963). It occurs often on dry roadsides or disturbed soils and has potential for use on surface mines, roadbanks, and similar bare or infertile areas where its nitrogen-fixing ability could enhance the establishment of additional vegetation.

Materials and Methods

Plant materials assembled at the Coffeeville Plant Materials Center (PMC) for this initial evaluation came as field collections of seeds from its primary service area and from Plant Materials Centers at Manhattan, Kansas and Knox City, Texas. Some accessions were received twice from the other Centers and were evaluated separately. Of the 55 accessions of Illinois bundleflower in the assembly, 26 were collected in Oklahoma, 13 in Arkansas, 7 in Texas, 4 in Mississippi, 3 in Louisiana, and one each from Kansas and Missouri. Five accessions of other species of Desmanthus were also received and evaluated using the same criteria. Sabine' Illinois bundleflower (PI-4340111, a 1985 release from the Plant Materials Center at Knox City, Texas, was the standard for comparison.

The seeds were planted July 20, 1983 at the Coffeeville PMC in Oaklimeter silt loam (0-2% slope) that had been plowed and fertilized with 8-24-24 at the rate of 300 lbs/acre. Each accession was seeded in rows 6 meters long and 1 meter apart. The area was cultivated as necessary to control weeds.

Evaluations were made periodically according to standard procedures described in the National Plant Materials Manual (USDA, 1984). Emphasis was placed in factors related to ground cover, seed production, and hardiness.

Except for height and width measured in centimeters, other evaluations were rated subjectively on a scale of 1 to 9 with 1 considered to have the best appearance. The visual rating (1-9) was subtracted from 10 to give the highest number to the best accession. Then a composite score was calculated by an equation that gave higher values to accessions rated best in the individual evaluations. Decimals were moved so the values would be in the 10 to 100 order of magnitude. Means were compared using the Duncan's Multiple Range test.

In computing composite scores for form or ground cover for erosion control, two forms were considered because in some cases it might be desirable to have a short or LOW form instead of a robust or BIG variety. Both were calculated to place emphasis on foliage density. The LOW form was computed by the equation:

LOW = (FOL ABN X FOL UNI) X (FOL WD X FOL HT).

The equation used for the BIG form was:

BIG = (FOL ABN X FOL UNI) X (FOL WD X FOL HT).

In the equations:

1) FOL ABN = Foliage abundance
2) FOL UNI = Foliage uniformity
3) FOL WD = Foliage or canopy width
4) FOL HT = Foliage height.

For vigor (VIG) only the first evaluation was used because VIG 2 was usually lacking.

Score for seed production (SEED) was calculated by the equation:

SEED = SD AMT X SD FIL X SD UNI where:

SD AMT = Seedpod amount
SD FIL = Seedpod fill
SD UNI = Seed Uniformity.

Results

Evaluation data for the three years the accessions were evaluated are in Table I. Letters "A" and "B" following the accession number indicates that the seeds are duplicates, being the same PI number from two Plant Materials Centers.

Data for accessions in this project were highly variable from year to year, and the best accessions were selected with the assistance of an analyses of variance using a randomized complete block design with years being the blocks. The five accessions of Desmanthus other than D. illinoensis were not included in the analysis because none appeared superior to the Illinois bundleflowers. Duplicates were treated as different accessions in the analyses.

F-values for analyses of data from the various categories are as follows:

Analysis of Variance for All Bundleflower Evaluations

	DF	LOW	BIG	VIGOR	SEED	95%	99%
Year	2	11.41**	35.85**	6.53**	14.36	3.07	4.77
Accession	67	2.41**	1.85**	1.63*	1.80**	1.40	1.61
Error	134						
Total	203						

Means were separated using the Duncan's Multiple Range test (Table II). Those that rated best in all aspects were selected for further consideration.

Accessions with the LOW growth form that showed potential were:

9017600 - Collected in Ft. Bend. County, TX by W. E. Bohmfalk.
9028959 - Collected in Lee County, MS by James Wolfe.

Those selected for the BIG growth form were:

421094 - Collectted in Caddo County, OK by Tom Wilson.
421097 - Collected in Woods County, OK by Jim Altom.
421098 - Collected in Canadian County, OK by Duane Crider.
436882 - Collected in Rogers County, OK by P. J. Boyles.
436890 - Collected in Murray County, OK by Earl G. Weisner.
436897 - Collected in Lincoln County, OK by David Legg.
9028469 - Collected in Howard County, AR by Mickey Evans.

The fifteen duplicated accessions were analyzed again using a split plot design with years being the major plot. A summary of the analyses follows.

COMPARISON OF DUPLICATE BUNDLEFLOWERS AT PMC
Analysis of Variance (Split Plot)

		F Values					
	DF	LOW	BIG	VIGOR	SEED	95%	99%
Rep	1	0.27	0.41	0.00	0.71	161	4052
Year	2	5.68	7.11	6.33	5.33	19	99
MP Error	2						
Accession	14	1.42	2.31*	2.52*	5.78**	1.95	2.96
Yr x Acc	28	0.57	1.08	1.39	2.29**	1.75	2.20
SP Error	42						
Total	89						

The analyses showed that some accessions were significantly better than the others. A mean separation using the Duncan's Multiple Range test showed the previously selected accessions to be superior in the BIG category. There were no duplicates for those selected in the LOW group. Results from the Duncan's Multiple Range test are listed below.

DUNCAN'S MULTIPLE RANGE (95% LEVEL)
Combined Averages of Duplicates

PI Number	LOW	BIG	VIGOR	SEED
420192	51.2a	62.5a	63.3	379.7a
*421094	49.9a	64.6a	66.7a	417.7a
*421097	60.2a	52.4a	68.3a	454.2a
"421098	45.8	70.8a	68.3a	498.8a
436877	34.8	25.9	61.7	336.3
436881	37.8	32.7a	65. Oa	409 .8a
*436882	74.2a	58.8a	75. Oa	504.8a
436885	46.4	40.0a	65.0a	371.3a
436886	44.2	34.7a	68.3a	351.8
436887	60.7a	37.7a	70. Oa	418.5a
436888	53. la	21.7	58.3	397.8a
436892	51.8a	18.2	53.3	379.7a
436893	43.3	23.6	61.7	200.8
436895	44.2	26.1	60.0	254.7
*436897	63.6a	63 .3a	71.7a	386 .7a

All averages followed by (a) are not significantly different.

*Accessions selected from total as having superior qualities.

Discussion

Spring recovery of Illinois bundleflower was in late March. It bloomed in June and seeds were mature by the end of July. Afterwards, it began to lose leaves and by the time of the first frost, only a few leaves remained. Because it did not provide enough foliage for good ground cover for much of the year it was not considered as a good plant for erosion control at the Coffeevile PMC where the soil is acid. However, it is a legume and could be grown with grasses to produce supplemental nitrogen. It appears to have potential for use on roadsides and surface mines. Its usefulness for wildlife food is debatable. Seeds remained on the plants late into the winter, and no birds were observed eating them at Coffeeville.

Illinois bundleflower grows naturally in alkaline or neutral soils and is abundant in parts of the PMC service area (MLRAs 131 and 135) where it would be expected to perform better. Possibly Sabine would be better adapted to calcareous areas while one of these would be better adapted to the more extensive areas of acid soils in the PMC service area. This could only be determined by additional testing in other areas.

Conclusion

Of 55 accessions of Illinois bundleflower in initial evaluation at the Coffeeville Plant Materials Center, 9 were selected as being superior to the others. Sabine, the standard for comparison, was not one of these. Two of these had the LOW growth form. Illinois bundleflower has potential for use in mixtures with grasses to fix nitrogen for them. It could be useful on roadsides and surface mines, but it would have limited use elsewhere. Some of the accessions tested at Coffeeville are superior to others but serious consideration should be given to how it might be superior to other legumes before advanced evaluations are initiated.

Several accessions have been evaluated at other Plant Materials Centers, but some are from the Coffeeville PMC service area and have not been evaluated previously. Should there! be a decision not to release a superior cultivar, a composite sample of all the germplasm could be useful for seeding in a wide range of conditions where nature could select for the best adapted. ecotypes.

References

Hoekstra, Thomas W. 1963. An Evaluation of Eight Wildlife Feedstuffs. Purdue University Department of Forestry and Conservation, Forestry 498 Special Report.

USDA. 1984. National Plant Materials Manual. Title 190.

TABLE 1. EUALUATIONS FOR BUNDLEFLOWERS AT THE COFFEEUILLE PMC
Project 2811020

PI NUMBER	YR RC	FOL HT	FOL WD	FOL ABN	FOL UNI	% STD	VIGOR 1/2	SD AMT	SD FIL	SD UNI	MATURE DATE	RESISTANCE DI	IN	HE
						Desmanthus illinoensis								
421091	83	30	8	7	3	3	5/5	0	0	0	*	8	1	1
	84	70	45	5	2	5	5/7	5	3	3	09/20	3	1	1
	85	15	15	7	1	5	7/7	0	*	*	*	*	*	*
421092-A	83	64	76	4	4	85	3/*	7	1	1	10/04	1	1	1
	84	150	200	3	4	80	4/2	1	3	2	09/01	3	3	1
	85	110	90	4	4	75	4/*	3	1	3	07/26	*	*	*
421092-B	83	71	90	3	3	90	4/3	5	1	3	10/04	1	1	1
	84	130	200	3	3	70	4/2	3	3	3	09/01	3	1	1
	85	95	80	3	3	80	3/*	4	1	2	08/09	*	*	*
421093	83	25	46	5	*	70	5/5	5	1	3	10/20	1	1	1
	84	60	60	4	5	60	5/4	4	3	5	09/01	3	2	1
	85	70	100	3	3	60	3/*	4	1	3	07/26	*	*	*
421094-A	a3	96	90	3	3	80	3/*	3	3	1	09/22	1	1	1
	84	130	200	2	2	90	4/2	2	3	2	09/01	3	2	1
	85	130	120	3	3	85	2/*	2	1	2	07/21	*	*	*
421094-B	83	61	46	5	5	a5	4/4	5	1	3	10/04	1	1	1
	84	100	100	3	3	60	4/3	4	3	3	09/01	3	3	1
	85	105	90	3	3	75	3/*	4	1	2	07/26	*	*	*
421095	83	86	51	4	3	30	4/4	7	1	3	10/04	1	1	1
	84	90	90	3	3	5	7/4	4	3	3	10/06	3	1	1
	85	120	100	3	3	10	3/*	4	1	2	07/26	*	*	*
421096	83	66	76	4	3	60	4/4	4	1	3	09/22	1	1	1
	84	110	175	3	2	75	4/2	3	3	1	09/01	3	3	1
	85	90	90	4	5	15	4/*	4	1	3	07/26	*	*	*
421097-A	83	56	61	4	1	50	3/3	4	1	1	10/04	1	1	1
	84	70	90	3	4	100	5/3	4	3	3	09/01	2	1	9
	85	115	110	2	2	100	2/*	1	1	1	08/02	*	*	*
421097-B	83	70	96	2	1	95	2/2	3	1	3	09/22	1	1	1
	84	125	160	3	1	100	3/2	3	3	3	09/01	3	2	1
	85	85	50	4	4	80	4/*	4	1	2	08/09	*	*	*
421098-A	83	90	61	3	3	95	3/*	4	1	1	10/17	1	1	1
	84	125	130	3	5	90	4/3	3	1	3	09/01	3	1	1
	85	120	80	3	3	85	3/*	1	1	1	07/19	*	*	*

PI NUMBER	YR RC	FOL HT	FOL WD	FOL ABN	FOL UNI	% STD	VIGOR 1/2	SD AMT	SD FIL	SD UNI	MATURE OATF	RESISTANCE DI	IN	HE
						Desmanthus	illinoensis							
421098-B	83	80	80	3	3	95	2/3	3	1	3	09/22	1	1	1
	84	160	200	2	2	100	4/1	3	3	2	09/01	3	3	1
	85	115	80	3	1	100	3/*	3	1	2	07/26	*	*	*
421302	83	56	61	4	3	95	3/4	4	1	3	10/17	1	1	1
	84	60	120	3	4	90	4/3	5	3	3	09/01	3	2	1
	85	90	100	4	5	85	4/*	3	1	2	07/26	*	*	*
434011	83	56	90	3	5	35	3/1	3	1	*	10/17	1	1	1
	84	75	85	4	5	60	4/3	3	3	3	09/01	3	1	1
	85	80	80	5	6	50	5/*	4	1	3	07/25	*	*	*
436877-A	83	46	30	5	*	5	5/5	9	9	1	10/04	1	1	1
	84	80	100	3	3	40	3/3	3	3	3	09/01	3	1	1
	05	115	100	2	5	30	2/*	2	1	1	07/26	*	*	*
436877-B	83	68	64	5	5	50	4/4	5	1	5	09/22	1	1	1
	84	100	100	4	5	70	5/3	3	3	3	09/01	2	1	1
	85	85	70	4	3	70	4/*	4	1	3	07/26	*	*	*
436881-A	83	90	61	4	5	30	4/*	6	1	1	09/22	1	1	1
	84	80	100	4	5	75	4/3	3	3	3	09/01	3	1	3
	85	110	70	4	5	65	3/*	2	1	3	07/30	*	*	*
436881-B	e3	71	76	3	3	80	2/2	3	1	1	10/04	1	1	1
	84	120	120	3	2	95	4/3	3	3	3	09/01	3	2	1
	85	80	65	4	3	70	4/*	4	1	3	07/26	*	*	*
436882-A	83	71	90	3	2	100	1/3	3	1	1	08/22	1	1	1
	84	90	200	2	2	100	3/2	1	3	2	09/01	3	3	1
	95	115	100	3	5	100	2/*	2	1	2	07/26	*	*	*
436882-B	83	56	76	3	2	95	3/3	4	1	1	09/01	1	1	1
	84	120	110	2	1	100	3/2	3	3	2	07/14	3	3	1
	85	85	90	3	2	100	3/*	3	1	2	07/26	*	*	*
436883	83	61	71	4	3	80	3/4	5	1	3	*	1	1	1
	84	120	120	3	5	90	4/2	3	3	3	09/01	2	2	1
	85	75	65	4	3	85	4/*	4	1	3	07/26	*	*	*
436884	83	54	51	5	5	80	3/5	5	1	3	09/22	1	1	1
	84	75	150	3	4	100	4/3	3	3	4	09/01	3	2	1
	85	105	75	4	5	65	4/*	3	1	2	07/31	*	*	*

PI NUMBER	YR RC	FOL HT	FOL WD	FOL ABN	FOL UNI	% STD	VIGOR 1/2	SD AMT	SD FIL	SD UNI	MATURE DATE	RESISTANCE DI	IN	HE
						Desmanthus illinoensis								
436885-A	83	83	80	2	3	95	3/2	3	3	3	09/22	1	1	1
	84	70	05	3	3	75	4/3	4	3	5	09/01	3	1	1
	85	110	90	3	3	90	3/*	2	1	2	07/26	*	*	*
436885-B	83	80	60	2	2	95	3/2	4	1	3	10/04	1	1	1
	84	135	100	3	3	95	4/3	3	3	3	09/01	3	2	1
	85	85	50	4	3	50	4/*	4	1	3	08/02	*	*	*
436886-A	83	53	51	5	3	60	3/4	7	3	3	09/22	1	1	1
	a4	75	70	4	3	50	4/3	3	3	3	09/01	2	1	9
	85	130	100	3	3	85	3/*	2	1	1	07/30	*	*	*
436886-8	83	56	76	3	3	95	2/3	3	1	3	09/22	1	1	1
	84	115	120	3	2	100	4/3	3	3	3	09/01	3	2	1
	85	70	50	4	3	90	3/*	3	1	3	08/09	*	*	*
436887-A	83	51	-41	4	4	85	3/4	7	1	5	10/04	1	1	1
	84	50	90	4	3	90	5/3	2	2	2	09/01	2	1	7
	85	110	120	3	3	90	2/*	2	1	2	07/26	*	*	*
436887-B	83	61	100	2	3	100	2/2	3	1	3	10/04	1	1	1
	84	100	120	3	1	100	4/3	3	3	3	09/01	3	2	1
	85	80	75	4	3	80	3/*	3	1	2	08/02	*	*	*
436888-A	83	61	122	3	2	70	3/3	3	1	1	10/04	1	1	1
	84	60	120	4	5	80	4/3	3	3	3	09/01	3	2	1
	85	75	100	5	5	60	5/*	4	1	3	08/08	*	*	*
436888-8	83	56	56	4	3	80	4/4	4	1	3	09/22	1	1	1
	84	70	100	4	5	95	4/3	3	3	3	09/01	3	2	1
	85	70	55	4	4	75	5/*	4	1	3	08/09	*	*	*
436809	83	36	36	5	3	05	3/4	5	1	3	09/22	1	1	1
	84	90	120	4	4	100	4/3	3	3	3	09/01	3	2	1
	85	75	85	4	3	90	4/*	2	1	2	08/02	*	*	*
436890	83	76	100	2	3	95	2/3	3	1	3	10/04	1	1	1
	84	140	180	3	2	100	3/2	3	3	3	09/01	3	2	1
	85	80	100	3	4	90	3/*	3	1	3	08/09	*	*	*
436891	83	31	36	5	5	10	5/7	7	1	*	10/04	1	1	1
	84	110	60	4	5	50	4/4	3	3	3	09/01	3	2	1
	85	65	85	5	3	20	3/*	6	1	5	08/02	*	*	*

PI NUMBER	YR RC	FOL HT	FOL WD	FUL ABN	FOL UNI	% STD	VIGOR 1/2	SD AMT	SD FIL	SO UNI	MATURE DATE	RESISTANCE DI	IN	HE
						Desmanthus illinoensis								
436892-A	83	20	20	7	3	40	8/*	9	3	1	10/17	1	1	1
	94	40	120	5	5	40	4/3	5	3	3	09/01	3	1	1
	85	85	100	5	3	50	4/*	3	1	3	07/26	*	*	*
436892-B	83	39	46	4	3	65	5/*	7	1	5	09/22	1	1	1
	84	55	120	4	5	60	4/4	4	3	3	09/01	3	3	1
	85	85	110	4	3	40	3/*	4	1	3	07/26	*	*	*
436893-A	83	46	46	4	3	85	3/4	5	3	5	09/22	1	1	1
	84	80	150	3	3	90	4/2	3	3	3	09/01	3	1	1
	85	85	65	4	3	75	4/*	4	1	2	07/27	*	*	*
436893-R	83	20	24	5	5	90	5/5	8	3	1	10/20	1	1	1
	84	75	90	5	5	75	4/3	4	3	3	09/01	3	2	1
	85	100	90	4	4	60	3/*	5	1	3	07/26	*	*	*
436894	83	30	30	6	3	50	5/5	8	3	5	09/22	1	1	1
	84	75	100	4	5	60	4/4	5	3	3	09/01	3	2	1
	85	75	80	4	5	40	3/*	5	1	4	08/02	*	*	*
436895-A	83	40	31	5	4	90	4/6	7	1	5	09/22	1	1	1
	84	50	70	5	3	90	5/4	6	3	5	09/01	3	2	1
	85	70	100	5	5	50	4/*	4	1	2	07/26	*	*	*
436895-B	83	41	71	6	3	80	4/5	7	1	5	09/22	1	1	1
	134	100	120	4	3	80	4/3	5	3	3	09/01	3	2	1
	85	105	110	2	3	80	3/*	3	1	3	07/26	*	*	*
436896	83	56	61	4	3	60	4/4	4	1	3	10/04	1	1	1
	84	110	160	3	2	70	3/3	3	3	3	09/01	3	1	1
	85	85	60	3	5	50	4/*	4	1	3	07/26	*	*	*
436897-A	83	56	66	4	4	95	3/4	3	1	4	09/22	1	1	1
	84	130	200	3	5	100	3/2	4	3	3	09/01	3	3	1
	85	85	125	4	4	65	4/*	4	1	2	07/26	*	*	*
436897-13	93	71	90	3	3	80	3/3	3	1	3	09/22	1	1	1
	84	120	180	2	1	100	1/2	3	3	3	09/01	3	2	1
	85	90	100	3	2	100	3/*	4	1	2	08/09	*	*	*
9006779	83	51	56	3	3	95	3/*	5	1	1	09/22	1	1	1
	84	75	140	3	3	100	3/3	4	3	3	08/06	3	3	1
	85	180	80	1	3	100	1/*	4	1	3	07/29	*	*	*

PI NUMBER	YR RC	FOL HT	FOL WD	FOL ABN	FOL UNI	% STD	UIGOR 1/2	SD AMT	SD FIL	SD UNI	MATURE DATE	RESISTANCE DI	IN	HE
							Desmanthus illinoensis							
9017600	83	41	96	1	3	90	3/3	2	1	3	10/04	1	1	1
	84	65	140	1	3	100	4/3	2	3	3	09/11	3	1	1
	85	60	75	2	1	80	3/*	2	1	2	08/14	*	*	*
9021695	83	30	50	3	5	60	4/5	3	1	1	09/22	1	1	1
	84	60	50	4	4	80	4/5	5	3	5	09/01	3	1	1
	85	80	70	5	7	60	4/*	4	1	3	07/29	*	*	*
9028297	No Germination													
9028305	83	106	155	1	1	90	2/1	1	1	1	10/17	1	1	1
	84	90	100	3	4	100	4/3	3	3	2	09/01	3	1	1
	85	85	70	4	5	70	4/*	4	1	3	08/09	*	*	*
9028326	83	71	100	2	3	85	3/2	1	3	3	10/17	1	1	1
	84	75	100	1	1	100	4/2	1	3	1	09/20	1	1	1
	85	75	90	4	5	60	4/*	4	1	3	08/14	*	*	*
9029341	83	51	61	4	3	95	3/4	3	1	3	10/17	1	1	1
	84	55	85	4	2	100	4/3	3	3	3	09/01	3	1	1
	85	55	70	4	1	95	4/*	2	1	2	08/02	*	*	*
9029374	93	41	66	4	3	95	4/*	4	1	3	10/20	1	1	1
	84	65	120	1	2	100	4/2	2	3	2	09/01	3	1	1
	85	80	90	3	3	95	3/*	2	1	1	08/09	*	*	*
9028381	83	46	61	4	3	95	3/4	4	3	3	10/20	1	1	1
	84	70	110	2	3	100	5/1	1	2	3	09/01	2	1	1
	85	100	150	1	3	90	3/*	2	1	2	08/14	*	*	*
9028413	83	25	106	2	2	80	4/3	3	1	3	09/01	1	1	1
	84	35	90	4	2	100	4/4	5	3	2	09/01	3	1	1
	85	20	65	6	6	30	6/7	7	1	3	08/14	*	*	*
9028429	83	20	58	6	3	60	4/5	7	1	5	09/22	1	1	1
	84	30	80	6	5	40	6/3	4	3	3	09/01	3	1	9
	85	65	100	3	5	50	4/*	4	1	3	07/26	*	*	*
9028430	83	61	71	5	3	40	5/4	5	1	3	09/22	1	1	1
	84	65	85	4	5	50	4/4	3	3	3	09/01	3	2	1
	85	75	90	4	6	35	4/*	4	1	4	07/18	*	*	*
9028448	83	51	36	3	2	80	4/3	6	1	3	09/22	1	1	1
	84	90	110	3	3	70	5/3	3	3	3	09/01	2	2	1
	85	75	70	3	3	35	3/*	4	1	3	07/26	*	*	*

PI NUMBER	YR RC	FOL HT	FOL WD	FOL ABN	FOL UNI	% SID	VIGOR 1/2	SD AMT	SD FIL	SD UNI	MATURE DATE	RESISTANCE DI	IN	HE
						Desmanthus illinoensis								
9028461	83	46	80	3	3	*	4/*	5	1	1	09/01	1	1	1
	85	35	25	5	3	5	4/*	7	1	5	08/14	*	*	*
9028469	83	46	61	4	3	95	3/4	5	1	3	09/22	1	1	1
	84	110	130	3	2	100	2/3	3	3	3	09/01	3	2	1
	85	100	120	2	1	100	2/*	3	1	1	07/26	*	*	*
9028485	83	36	64	4	3	60	5/5	6	1	3	10/04	1	1	1
	84	45	70	3	1	50	4/31	3	3	1	09/15	1	1	9
	85	50	70	2	1	90	3/*	2	1	1	08/14	*	*	*
9028948	83	90	69	4	2	30	3/*	4	1	1	10/17	1	1	1
	84	80	80	4	3	80	4/3	3	2	1	09/15	2	1	1
	85	90	70	3	3	85	3/*	2	1	1	07/19	*	*	*
9028949	e3	61	130	1	*	85	3/2	1	1	1	10/17	1	1	1
	84	130	150	3	3	100	3/2	2	2	3	09/01	3	3	1
	85	90	80	3	5	15	4/*	4	1	3	08/02	*	*	*
9028950	83	51	61	4	3	40	3/5	4	1	1	09/22	1	1	1
	84	130	200	4	4	50	3/3	3	3	3	09/21	3	3	1
	85	110	140	4	5	40	3/*	2	1	4	07/26	*	*	*
9028951	83	36	56	*	5	50	4/5	4	1	1	09/22	1	1	1
	84	70	90	3	3	50	4/4	4	3	5	09/01	3	1	1
	85	60	115	4	5	50	4/*	3	1	3	07/26	*	*	*
9028952	83	15	51	5	1	30	4/7	8	1	3	09/22	1	1	1
	84	70	40	5	3	20	5/6	7	3	3	09/01	5	1	1
	85	75	80	5	3	10	5/*	6	1	2	07/27	*	*	*
9028953	83	36	76	3	1	95	3/3	3	1	1	10/17	1	1	1
	84	60	150	1	1	100	4/2	2	3	1	09/01	3	1	1
	85	45	100	3	2	90	3/*	3	1	2	08/09	*	*	*
9028954	83	30	90	3	1	65	3/3	1	1	1	10/17	1	1	1
	84	40	50	3	3	60	5/4	7	3	3	09/20	2	1	9
	85	75	35	6	5	10	5/*	6	1	4	08/09	*	*	*
9028955	83	16	100	3	1	80	2/4	6	1	5	09/22	1	1	1
	84	70	100	2	3	75	4/3	2	3	3	09/01	3	1	1
	85	60	90	4	3	50	4/*	4	1	3	08/09	*	*	*

PI NUMBER	YR RC	FOL HT	FOL WD	FOL APN	FOL UNI	% STD	VIGOR 1/2	SD AMT	SD FIL	SD UNI	MATURE DATE	RESISTANCE DI	IN	HE
						Desmanthus illinoensis								
9028596	83	51	106	1	1	100	1/2	1	1	1	09/22	1	1	1
	84	70	100	3	2	100	3/3	3	3	1	09/01	3	1	1
	85	40	75	5	3	40	5/*	3	1	3	08/02	*	*	*
9028957	83	61	80	4	1	95	2/3	3	1	1	09/22	1	1	1
	84	150	120	3	2	100	3/2	3	3	1	09/01	3	3	1
	85	75	100	4	2	90	4/*	4	1	2	08/02	*	*	*
9028958	83	46	76	5	2	70	3/4	5	3	3	09/22	*	*	*
	84	110	150	3	3	80	3/3	4	3	4	09/01	3	2	1
	85	65	90	4	4	90	4/*	4	1	2	08/02	*	*	*
						Desmanthus obtusus								
9028959	83	8	152	4	1	50	4/4	6	3	1	10/20	1	1	*
	84	35	40	6	5	40	6/3	3	3	3	09/15	2	1	9
	85	65	80	4	5	60	3/*	5	1	3	08/14	a	*	*
						Desmanthus velutinus								
477961	83	10	5	5	5	75	5/9	9	3	1	a	5	5	*
	84	75	65	3	3	10	5/3	4	3	3	09/15	1	1	9
	85	115	130	2	3	10	2/*	3	1	2	08/02	*	*	a
						Desmanthus virgatus								
436898-A	83	20	12	7	5	90	5/5	7	3	*	11/08	7	5	*
	84	*	*	*	*	5	7/*	*	*	a	*	*	*	*
436898-B	83	25	25	6	1	10	7/5	8	1	*	09/22	1	1	*
	84 Winter Killed													
9028960	No Germination													
9028961	83 Germinated and Died													

Legend:

YR RC - Year of Record
FOL HT - Foliage Height (cm)
FOL WD - Foliage Width (cm)
FOL ARN - Foliage Abundance (a)
FOL UNI - Foliage Uniformity (a)
VIG-1 - Early Season Vigor
VIG-2 - Mid-season Vigor
% STD - Percent Stand
SD AMT - Seedhead Amount (a)
SD FIL - Seedhead Fill (a)
SD UNI - Seed Uniformity (a)
DI - Disease Resistance (a)
IN - Insect Resistance (a)
HE - Heat Resistance (a)

(a) Rating scale - 1 to 9 with 1 best, 5 average, 9 very poor; 0 is none or dead.

* No data available. Average for other two years used in calculations.

PI Numbers followed by A and B are duplicates.

TABLE II. MEAN SEPARATION BY DUNCAN'S MULTIPLE RANGE BY CATEGORY FOR ILLINOIS BUNDLEFLOWERS AT THE COFFEEUILLE PMC

LOW PI Number	Mean	BIG PI Number	Mean	UIGOR PI Number	Mean	SEED PI Number	Mean
9028413	151.9	**421098-B	98.1	436882-A	80.8	421098-A	552.0
*19028953	148.8	*"421094-A	95.0	436897-B	76.7	436882-A	549.0
*,9017600	140.6	**436897-B	79.1	9028469	76.7	9028948	546.0
9028955	112.3	**436890	72.'4	9006779	76.7	9028956	537.0
		421092-B	65.3	436890	73.3	9028953	525.0
		**421097-B	64.3	436887-A	73.3	9028949	518.3
		**436882-A	63.7	436886-B	70.0	421097-A	503.0
		421092-A	59.7	436882-B	70.0	9017600	490.7
		**9028469	59.4	421098-B	70.0	421094-A	480.3
				421097-B	70.0	9028305	483.3
				421094-6	70.0	9028957	480.0
				9028957	70.0	9028374	472.7
				9028956	70.0	436882-B	460.7
				9028950	70.0	9028381	458.0
				436897-A	66.7	9028341	453.3
				436887-8	66.7	9028485	447.0
				436886-A	66.7	421098-8	445.7
				436885-A	66.7	436888-A	432.3
				436881-B	66.7	436887-B	429.3
				436877-A	66.7	436881-B	429.3
				421098-A	66.7	434011	429.3
				421097-A	66.7	9028326	429.3
				9028958	66.7	9028950	420.3
				9028955	66.7	436889	411.3
				9028953	66.7	436890	408.3
				9028949	66.7	9028469	408.3
				9028948	66.7	436887-A	407.7
				9028305	66.7	436897-B	405.3
				9017600	66.7	421097-8	405.3
						421096	399.0
						421092-A	396.0
						436881-A	390.3
						436886-A	379.3
						9028951	379.0
						436885-A	376.3
						421302	375.7
						9021693	373.3
						436884	371.0
						436897-A	368.0
						436896	366.3
						436888-B	366.3
						436885-B	366.3
						9028954	364.0
						421092-8	363.3
						9006779	359.0

* LOW accessions also in UIGOR and SEED columns.
** BIG accessions also in UIGOR and SEED columns.

Means for accessions in columns are not different at the 95% confidence level.