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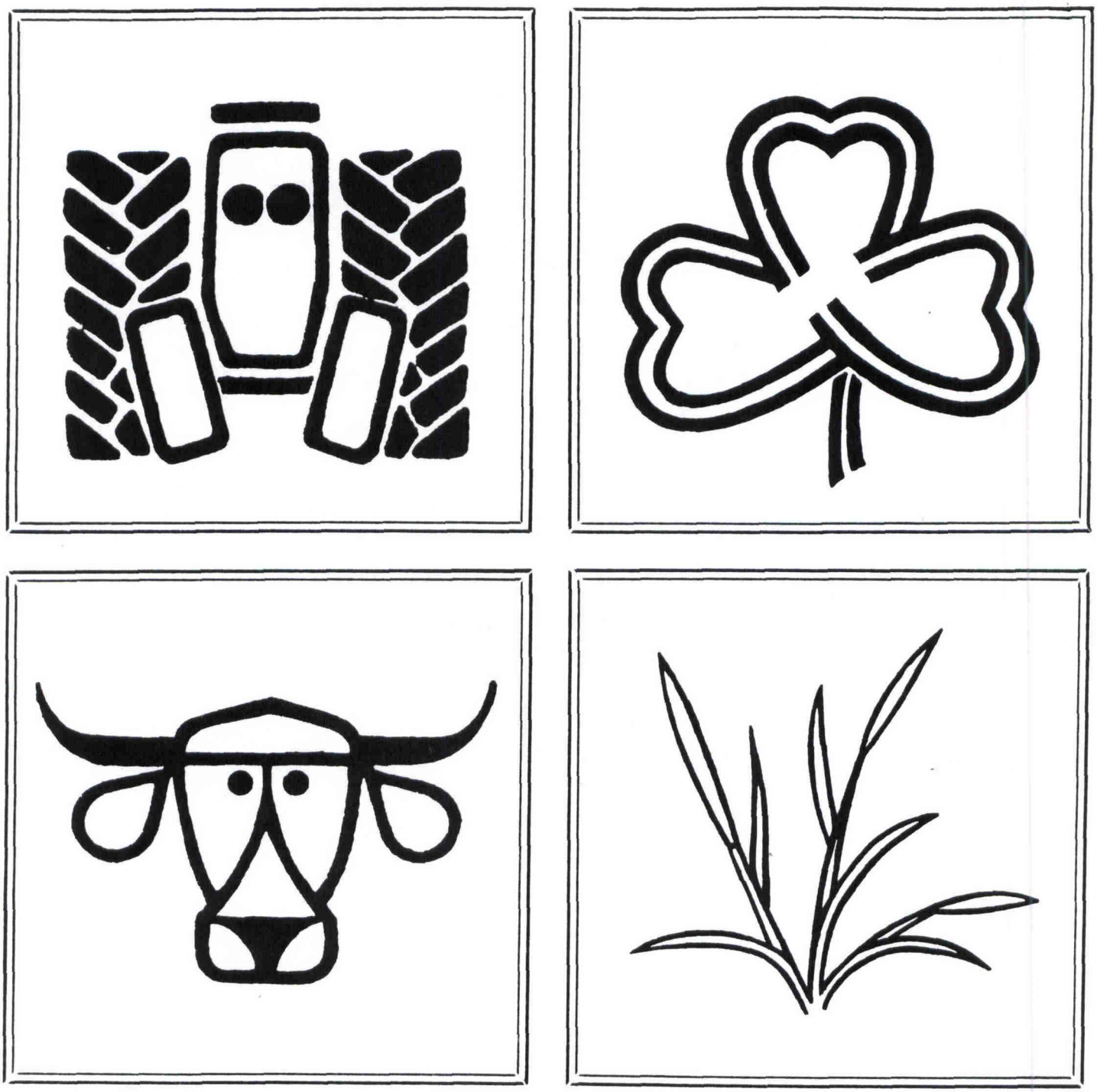

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Seed Weight and Plant Vigor in Illinois Bundleflower

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ABSTRACT

Approximately 100 seedlings were started in cones in the greenhouse from each of 38 sources of Illinois bundleflower. Based on plant height per day of age, the top 10 seedlings from each source were transplanted to the field. Mature plant weight, seed yield, weight/seed, percent of heavy seed, and heavy seed weight were determined. Weight per seed, percent of heavy seed, and weight of heavy seed (wt/seed) were related to parent weight per seed. Seed yield and mature plant weight (vigor) showed no relationship to parent seed weight. These data indicate that selection for seed weight may be effective. The interrelationship of seedling vigor and mature plant vigor require more study. Further, a pilot study of seedling vigor using 1983 seed from 24 individual plants showed a good relationship of seed weight to seedling vigor.

INTRODUCTION

Illinois bundleflower has been recognized as having dual value; forage for livestock and seed for game birds. Additionally, it has the attribute of biological nitrogen fixation. Recent observations indicate that at least under some conditions, individual plants and possibly stands may be relatively short lived. It has also been observed to have relatively low yield potential. On the positive side, volunteer stands have been observed to develop fairly readily at least under cultivated and semi-cultivated conditions.

We assume that the potential use of Illinois bundleflower will be predominantly under range conditions and that establishment, and certainly reestablishment from volunteering, will be under competition conditions. Seedling vigor and/or other characteristics that enhance the survival and competitiveness will contribute to establishment.

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KEY WORDS: Desmanthus Illinois/ warm-season legume/ mature legume/ seed weight/ seedling vigor/ establishment

Earlier evaluations of some 30 collections indicated a wide range in vegetative and seed production. Seed from collections and individual plants in that evaluation form the base for this study, which has the objective of determining the potential for improving seed weight, uniformity of seed weight, seedling vigor, and mature plant vigor in Illinois bundleflower.

PROCEDURE

Based on previous studies and seed availability of Illinois bundleflower accession, fifteen original collections and additional individual selected parents within these collections contributed 38 parental sources for this study. Average seed weight (mg/seed) was determined for each source followed by germination of approximately 100 seed in individual cones that were 1 inch in diameter at the top and 7 inches long. Date of emergence was noted and seedling height measured at 14 days post emergence. The ten tallest seedlings from each source were saved and transplanted to the field.

At seed maturity in the field, plant survival was noted, plants were cut at about 1-1/2 inches above ground, and the harvested plant material dried and weighed. The harvested seed was threshed, cleaned in an air column to remove trash and weighed. Average weight per seed was determined. Light seed were removed from each sample in an air column and the weight of the remaining (heavy) seed determined. Weight per seed of the heavy seed was then measured. The values of the 10 progeny within a source were averaged to give a source value for each of the measured characteristics.

Twenty-four individual plants representing a range in plant size, seed yield and seed size in 1983 were chosen for a pilot study to evaluate the relationship of seed size to early seedling vigor. Single seed were germinated in cones as described above. Fifteen cones in each of two replications represented each source. The seedlings were removed at the ground level 14 days post emergence, fresh weight of individual seedlings and total dry weight of the 15 seedlings in each replication was determined.

Parent and progeny relationships were evaluated by correlation and regression analyses.

RESULTS

The progeny averages for sources varied for each of the characteristics measured or calculated (Table 1). Average plant weights varied from 7 grams to 58 grams while seed yields ranged

from <1 gram to >10 grams. Average weight of clean seed varied more than average weight of the heaviest seed.

Correlation and regression analyses of these data are given in Table 2. There was a tendency for both the average weight of progeny seed and the average weight of the progeny heavy seed to be related to parent seed weight. While the relationship is not very close the data indicate some potential for improving seed size by selection which should enhance the gamebird value of the seed.

There was no relationship of progeny plant weight to parent seed size. There are at least two mitigating factors involved. The most vigorous seedlings were selected initially in each source and this could have reduced some of the potential differences in seedling vigor related to seed size. Furthermore, the plant weights are of mature plants and mature plant weight may show a poor relationship to seedling weight if conditions are suitable for seedling survival and growth.

Two relationships are shown between progeny measurements. In the relationship of seed yield/plant to percent of heavy seed and seed yield per plant to DM yield/plant, both the linear and quadratic relationships were significant. The rate of increase in seed yield declined with a high percentage of heavy seed to the point of decreasing with the highest percentage of heavy seed. If this relationship holds with further testing, it indicates some problem of producing a high yield of seed with a high percentage of heavy seed. However, the pattern may have developed through degree of determinancy. More determinate plants might be limited in the amount of large seed that could be matured at one time.

The second intraprogeny quadratic relationship is between seed yield per plant and DM yield per plant. However, the quadratic pattern is not very marked and seems to be brought about by one source which had by far the largest plants but not the highest seed yield per plant. Otherwise, within this population, seed yield increased as plant size increased. However, it may be possible for plant size to decrease with selection pressure for seed production and this relationship requires continuous monitoring.

Average 14-day post emergence seedling weight (Table 3) showed a good relationship to average weight of seed from which the seedlings were produced. Seedling size also differed within sources (Table 3). Seed from each source were selected randomly and not weighed individually. Thus, the variation within sources could not be related to seed size but likely much of the variation was probably due to seed size. Except for two sources, average seed seedling weight was less than 13 mg from seed weighing

less than 5 mg (Figure 1). These data indicate that selection for seed size should be effective in increasing early seedling vigor as indicated by top growth. Further evaluation will determine whether root development is closely associated with top development.

Table 1. Illinois bundleflower progeny averages within lines for plant and seed measurements, 1983

	Source	Parent Seed wt.	Progeny survival	DM yield/ plant	Seed yield/ plant	Heavy seed yield/ plant	Percent heavy seed	Average seed wt.	Average wt.heavy seed
		mg/seed	%	g	g	g	%	mg/seed	mg/seed
1	00000	-	100	17	2.22	.45	20	5.03	6.28
2	80-11	6.88	100	17	2.78	.34	12	5.24	6.88
3	80-14	7.59	80	10	1.80	.21	21	5.73	5.71
4	80-15-10	6.58	80	20	2.65	1.07	40	4.96	5.80
5	80-15-18	6.31	90	19	2.63	.40	15	3.96	5.19
6	80-15-6	6.04	100	17	1.29	.13	10	3.91	6.46
7	80-15-9	6.93	100	23	4.10	1.01	26	5.38	5.96
8	80-16	6.98	90	23	5.95	2.73	46	5.15	6.30
9	80-16-2	7.03	40	8	.27	.04	15	4.21	-
10	80-16-3	7.34	90	33	12.29	5.56	45	5.62	6.31
11	80-17-7	6.06	80	28	4.56	1.33	29	4.63	5.88
12	80-17-2	6.81	80	20	2.89	1.89	65	3.56	5.36
13	80-17-3	6.70	90	31	3.38	.66	19	4.21	5.51
14	80-17-5	6.82	80	18	1.81	.17	9	3.50	5.23
15	80-18	9.07	100	11	4.19	.46	11	7.36	8.32
16	80-20	7.38	80	38	4.05	.60	15	5.84	7.33
17	80-20-1	7.31	80	11	3.23	.31	10	5.94	6.18
18	80-20-10	7.23	100	36	9.58	3.39	35	5.63	6.81
19	80-20-12	6.24	100	11	2.95	.74	25	5.62	7.10
20	80-20-3	6.70	90	37	8.94	2.23	25	5.47	6.54
21	80-20-5	6.82	100	42	8.03	3.02	38	5.75	6.76
22	80-20-7	6.67	100	37	10.54	3.57	34	5.57	6.72
23	80-21	6.93	100	7	1.18	.15	13	5.30	6.23
24	80-22	6.93	30	13	3.96	.10	2	4.29	-
25	80-23	6.99	80	13	5.75	1.72	30	4.74	5.84
26	80-24	6.86	70	10	4.36	2.17	50	5.32	6.10

Table 1. Illinois bundleflower progeny averages within lines for plant and seed measurements, 1983 (Continued)

	Source	Parent Seed wt.	Progeny survival	DM yield/ plant	Seed yield/ plant	Heavy seed yield/ plant	Percent heavy seed	Average seed wt.	Average wt.heavy seed
		mg/seed	%	g	g	g	%	mg/seed	mg/seed
27	80-25-1	6.90	100	27	5.30	2.30	43	4.07	5.37
28	80-25-14	6.31	100	21	4.68	1.15	24	4.80	5.64
29	80-25-3	7.05	90	9	1.55	.37	24	3.92	5.72
30	80-35	6.55	90	58	6.08	.87	14	4.99	6.55
31	80-35-3	-	90	18	3.32	.39	12	3.92	5.21
32	80-35-4	7.10	80	12	.77	.07	9	4.31	-
33	80-4	6.94	100	24	5.57	3.25	58	4.41	5.40
34	80-4-12	5.96	60	20	2.78	.43	15	3.97	4.93
35	80-4-3	6.97	50	12	2.07	.62	30	3.84	5.31
36	80-7	7.37	80	42	6.36	1.27	20	5.21	6.22
37	80-8	6.90	100	9	1.41	.15	10	5.02	6.11
38	80-9	6.90	90	17	2.88	1.20	42	5.37	6.52

Table 2. Regression analysis and R^2 values for selected relationships

Regression	Intercept	Coefficient for X	Coefficient for X^2	R^2
Average seed wt. on Parent seed wt.	-0.134	0.907		0.34**
Average wt. of heavy seed on Parent seed wt.	0.156	0.660		0.27**
DM yield/plant on Parent seed wt.	0.0897	-0.061		0.015
Seed yield per plant on parent of heavy seed	-0.064	0.274	-0.003	0.26**
Seed yield/plant on DM yield/plant	-1.431	161.246	-708.854	0.53**

Table 3. The relationship of 14-day post emergence seedling weight to seed weight in Illinois bundleflower

Source	wt./seed	No. Seedlings	Green wt./seedling Range	Green wt./seedling average	Dry wt./seedling average
	Mg	No.	Mg		
80-4-3-4	4.1	19	11.4 - 72.5	43.0	12.3
80-15-9-1	5.4	22	19.9 - 82.2	55.4	15.4
80-16-4	6.8	29	40.9 - 119.0	69.6	21.1
80-16-5	5.8	27	8.6 - 79.5	51.6	15.2
80-16-3-3	6.2	13	34.1 - 78.2	60.3	20.3
80-17-17-8	5.3	27	36.7 - 90.0	63.2	18.8
80-18-2	7.8	28	36.8 - 96.5	61.6	22.0
80-18-10	8.1	20	36.4 - 107.5	79.1	25.1
80-20-1-1	1.9	25	15.0 - 118.7	74.8	17.8
80-20-1-3	5.8	23	41.8 - 83.8	69.5	17.5
80-20-3-3	4.3	15	49.9 - 88.8	69.1	17.9
80-20-5-4	6.3	19	52.3 - 101.4	75.3	19.0
80-20-6	7.3	28	52.2 - 110.4	75.3	19.2
80-20-7-1	5.1	22	24.7 - 86.4	56.7	15.8
80-20-7-2	6.2	18	24.0 - 92.8	62.7	18.5
80-20-10-4	4.0	13	14.6 - 63.8	42.5	11.0
80-20-10-5	-	10	42.9 - 89.3	58.4	15.6
80-22-1	4.3	17	16.1 - 58.4	35.7	10.4
80-23-6	3.3	22	11.5 - 52.2	30.8	9.9
80-24-8	5.3	20	18.5 - 59.4	41.3	12.5
80-25-1-2	3.3	13	25.8 - 65.1	37.4	10.7
80-25-3-2	3.3	27	15.5 - 54.0	33.7	10.3
80-35-1	5.9	18	37.3 - 96.4	69.2	19.7
80-35-7	3.7	7	25.5 - 53.7	40.3	11.3
80-35(ck)	-	6	47.8 - 96.5	60.8	20.9

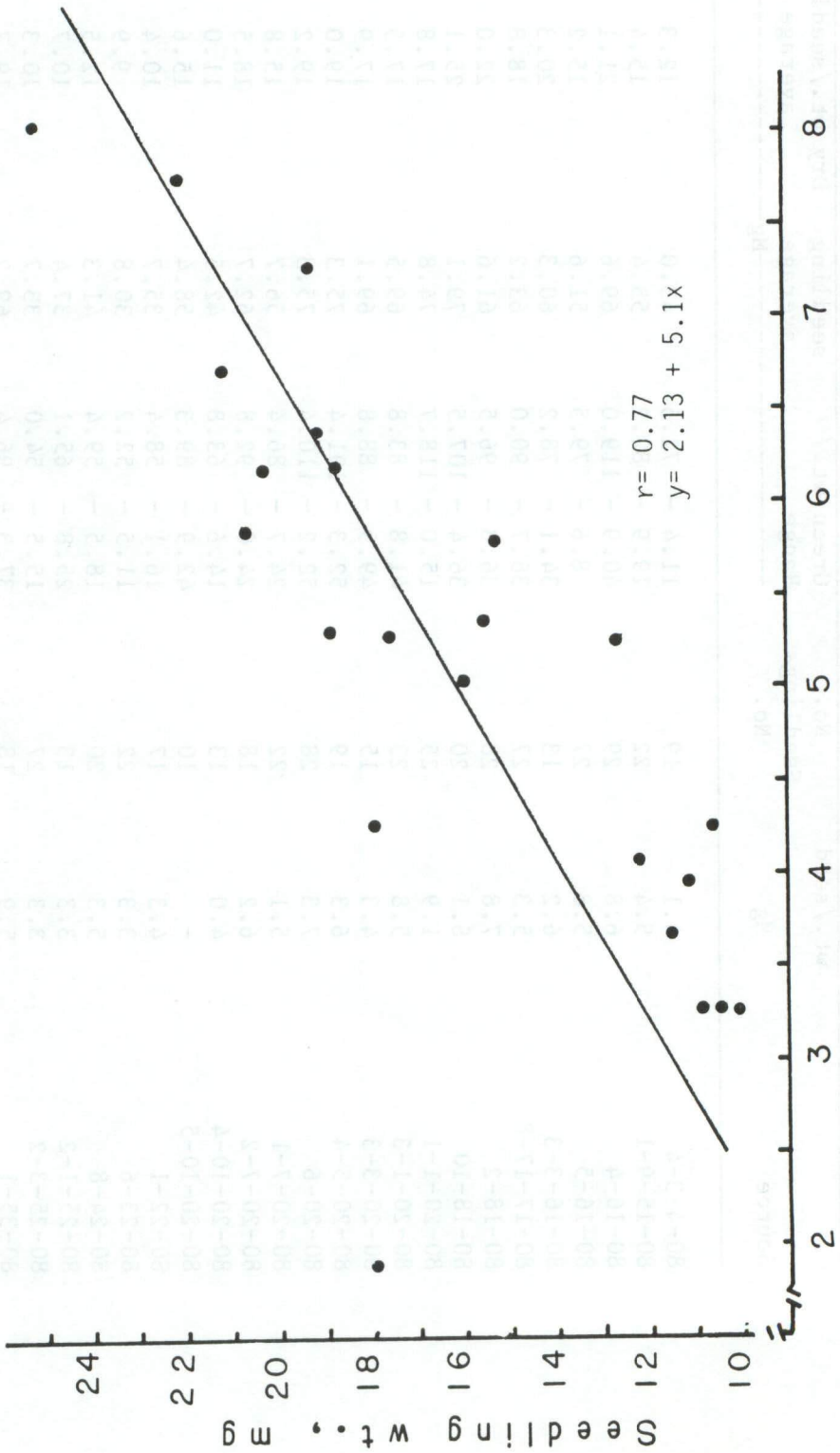

Figure 1. The relationship of Illinois bundleflower seedling weight to seed size.