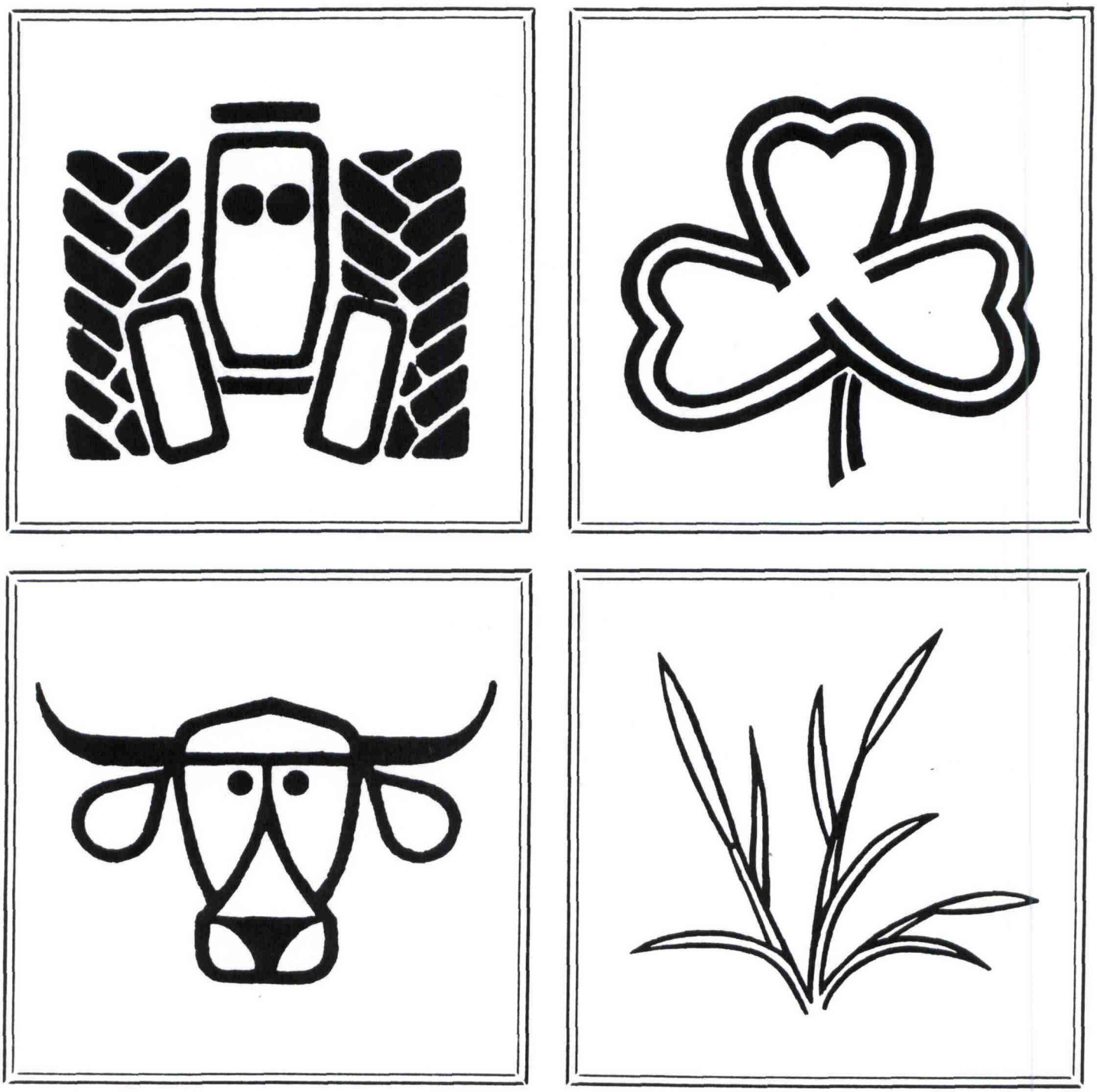
PUBLICATIONS

1984

CPR—4253
October 1984



Forage Research in Texas

1984

The Texas Agricultural Experiment Station, Neville P. Clarke, Director, The Texas A&M University System, College Station, Texas

Germination of Four Warm-Season Legumes

Randy L. Dovel[1]

SUMMARY

The germination of four warm-season forage legumes was characterized at 20° and 30°C. The percent germination and time to reach 50 percent germination were determined for each temperature. Alysicarpus rugosus has a germination temperature requirement above 20°C. Desmanthus illinoenis, Leucaena leucocephala, and Rhynchosia minima had 59, 57, and 56 percent germination respectively. All species except R. minima declined in percent germination with decreasing temperature. The time required to reach 50 percent germination increased with decreasing temperatures for all species.

INTRODUCTION

The quality of warm-season grasses often drops below optimal production levels for most classes of animals and may drop below their minimal maintenance requirements in mid and late summer (Ellis and Lippke, 1976). The inclusion of legumes in warm-season forage production systems can increase animal performance (Whiteman, 1980). Legumes raise the protein content of the sward due to their ability to symbiotically fix nitrogen. The dry matter digestibility (DMD) of grasses and legumes may be similar in the early spring; however, grasses decline in DMD at a much faster rate than do legumes (Holt, 1977). Forage legumes are more highly digestible than warm-season grasses in mid and late summer and provide more energy per pound of forage for animal production.

From the above, the inclusion of legumes in forage production systems seems desirable. However, the establishment of several promising warm-season legumes has been difficult. Stylosanthes guianensis and Stylosanthes hamata emerge late in the growing season due to a high germination temperature requirement (Dovel, 1983). This requirement has also been observed in Alysicarpus vaginalis. Emergence at such a late date is detrimental to stand establishment because of competition with warm-season gasses, which begin active growth much earlier. Therefore, the ability of warm-season legumes to germinate and emerge at temperatures corresponding to those of early spring

---

[1] Graduate assistant, Soil and Crop Sciences Department, College Station, Texas 77843. This study was partially supported by the R. M. Kleberg Research Foundation.

KEY WORDS: Warm-season legumes/ Seed germination/ Temperature requirements

would be a good criterion for the screening of warm-season legumes. In this study the rates of germination and percent germination of four legume species were examined at various temperatures.

MATERIALS AND METHODS

The legume species included in this study were Alysicarpus rugosus, Desmanthus illinoensis, Leucaena leucocephala, and Rhynchosia minima. Twenty six assessions of D. illinoensis were included, four of these assessions were divided into heavy, medium, and light seed lots. Eleven assessions of L. leucocephala were observed. Five assessions of L. leucocephala were divided into seed lots of different seed weights. Only one assession each of A. rugosus and R. minima was used in this study.

The seed of A. rugosus were mechanically scarified for twenty seconds. L. leucocephala seed were scarified in water heated to 80°C for three minutes. D. illinoensis and R. minima received no scarification treatment.

The seed lots were placed on moistened filter paper in petri dishes. They were treated with a two percent solution of Captan and placed in a growth chamber. The rates of germination were noted at constant temperatures of 30° and 20°C. Further observations will be made at 40°, 35°, 25°, 15°, and 10°. The seeds were allowed 14 days to germinate. Seeds were considered germinated when the radicle protruded 1 mm or more past the seed coat. Percent germination in 14 days and time required to reach 50 percent of that germination were determined. Fifty percent germination was defined as 50 percent of the total germination in each 14-day week period.

RESULTS AND DISCUSSION

All species except R. minima showed a decline in percent germination with decreasing temperature. A. rugosus declined sharply in percent germination, dropping from 98 percent germination at 30°C to only 4 percent, germination at 20°. D. illinoensis and L. leucocephala decreased in percent germination by 20 and 30 percent respectively. D. illinoensis and L. leucaeana exhibited variation within species in the decline of percent germination with decreasing temperature.

Decreasing temperature increased the time required to reach 50 percent germination in all species. The effects of decreasing temperature were most pronounced on A. rugosus, which took only 18 hours to reach 50 percent germination at 30°C but 240 hours

at 20°C. The time required to reach 50 percent germination in L. leucocephala was increased from 61 to 240 hours; D. illinoensis showed an increase from 12 hours to 75 hours. R. minima was the least affected, increasing from 18 hours to only 42 hours. Both D. illinoensis and L. leucocephala showed variability within species in the change in time required to reach 50% germination with decreasing temperature.

Although these results are limited in scope, several conclusions can be tentatively drawn from these findings. A. rugosus has a germination temperature requirement that is above 20°C. This would preclude its use as a warm-season forage legume in many situations due to late emergence after warm-season grasses are actively growing. All three of the remaining species studied germinated well at 20°C. Further testing at lower temperatures will be needed to better characterize their abilities to germinate under early spring conditions. Observations of the various assessions within D. illinoensis and L. leucocephala indicate that there is sufficient variability within each species to select for early spring germination. It must be reiterated that these results are incomplete and further testing and analysis of the data will be required before these conclusions can be substantiated.

LITERATURE CITED

Dovel, R. L. 1983. A phenological study of five warm-season legumes. Masters thesis. Texas A&M University. p. 96.

Ellis, W. C. and H. Lippke. 1976. Nutritional values of forages. In Grasses and Legumes in Texas. Texas Agricultural Experiment Station RM6. pp. 27-66.

Holt, E. C. 1977. Meeting the nutrient requirement of beef cattle with forage. In Forage-fed Beef: Production and Marketing Alternatives in the South. Bulletin 220. Southern Cooperative Series. pp. 261-285.

Whiteman, P. C. 1980. Tropical Pasture Science. Oxford University Press, New York. p. 392.

Table 1. Germination Characteristics of Warm-season Legumes

Assession	Percent Germination		Hours to 50% Germination	
	30°C	20°C	30°C	20°C
A. rugosus	98	4	18	240
R. minima	56	56	18	42
L. leucocephala				
81-1.2	74	77	60	216
81-1.3	82	73	45	216
81-1.0	98	82	72	216
81-11.1	80	63	60	240
81-11.2	92	84	60	240
81-13.3	66	63	60	216
81-17.1	84	39	60	264
81-17.2	88	69	60	264
81-17.3	94	61	60	264
81-19.1	46	1	72	240
81-19.2	52	1	72	288
81-19.3	46	3	84	288
81-20.2	90	37	72	288
81-20.3	96	51	60	264
81-22.2	90	47	48	264
81-26.0	94	59	36	264
81-35	70	21	72	288
81-100	100	91	36	192
Average	82	57	61	240
D. illinoensis				
80-1	90	68	12	96
80-2	58	46	12	90
80-3	86	78	12	84
80-4	68	64	12	90
80-5	36	24	12	120
80-6.1	80	60	12	120
80-6.2	70	76	12	96
80-6.3	80	60	12	72
80-7	86	74	12	48
80-8	66	68	12	84

Table 1. Germination Characteristics of Warm-season Legumes (Continued)

Assession	Percent Germination		Hours to 50% Germination	
	30°C	20°C	30°C	20°C
D. illinoensis (cont)				
80-9	90	80	12	48
80-10	62	56	12	90
80-11	78	80	12	48
80-12	82	56	12	96
80-13	70	70	12	84
80-14.1	88	86	12	120
80-14.2	86	82	12	96
80-14.3	94	76	12	90
80-16.1	80	56	12	60
80-16.2	90	64	12	60
80-17	68	48	12	66
80-19	60	42	12	66
80-20	70	66	12	48
80-21.1	76	76	12	84
80-21.2	84	80	12	60
80-21.3	88	70	12	66
80-22	78	68	12	60
80-23	82	68	12	60
80-24	68	66	12	60
80-25	86	30	12	60
80-27.1	36	20	12	84
80-27.2	38	38	12	96
80-27.3	52	28	12	60
Average	74	59	12	75