Seeded Bermudagrasses

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Bermudagrass is the most widely grown warm-season perennial grass in the southeastern US. Its popularity is due to adaptability to a wide range of soil types, drought tolerance, and persistence under intensive grazing (Burton and Hanna, 1995). The most productive varieties have been hybrids that produce little viable seed and must be established vegetatively by sprigs (portions of shoot, crown, roots, rhizomes, and stolons) or with some varieties, tops (6 to 8 week old topgrowth). Recommended planting rate is from 20 to 40 bu./acre. A bushel equals 1.25 cu ft and contains about 100 sprigs. Establishment costs including land preparation, sprigs or tops, planting, fertilizer, and weed control range from $125 to $225 per acre depending on variety. Tifton 85 is considered the best variety because of its high productivity and nutritive value (Hill et al., 2001).

Seeded bermudagrasses

There has been a great deal of interest in using bermudagrasses that can be established from seed as opposed to sprigs. In addition to being less expensive and not as burdensome as sprigging, seeded bermudagrasses can be used on small acreages that are not economical to sprig and on steep slopes and cut-over timberland where good seedbed preparation necessary for sprigging is not feasible. Most seeded bermudagrasses on the market are blends that contain 2 to 4 lines that frequently contain Giant and common. Components of some of the blends on the market are reported in Table 1. The percentage of each line in the blend may vary from year to year depending on seed availability and cost.

Common bermudagrass is well adapted to all soils. Because it is a good seed producer, common bermudagrass seed is less expensive (about $2.50-3.00/lb) than other seeded bermudagrasses. Giant is used in blends because it has rapid establishment and good early growth. However, it will not persist for more than 2 or 3 years in the eastern half of Texas. As giant bermudagrass goes out, the other bermudagrasses lines in the mixture fill in. Giant has persisted in drier climates in the western half of Texas under irrigation (Marsalis et al., 2003). Seed of Giant bermudagrass is more expensive ($7/lb) because it is a poor seed producer.

1997-2002 Study

A 5-year study at the TAMU Agricultural Research and Extension Center at Overton compared sprigged bermudagrasses (Tifton 85 and Coastal), some seeded bermudagrass lines and blends, and bahiagrasses. The first 2 years were very dry resulting in low yields (Table 2). Some of the seeded blends were as productive as Coastal but not as productive as Tifton 85 bermudagrass (Evers and Parsons, 2002). The same results have been reported in Georgia (Hoveland, 1996) and Virginia (Teutsch and Tilson, 2003). Pensacola and Tifton 9 bahiagrass were the least productive. Under drought conditions in 1998, Tifton 85 had superior drought tolerance to Coastal and the seeded bermudagrasses. In the third year common, giant, and Wrangler bermudagrass and kikuyugrass were added to the study. The first year (1999) production of Giant was twice that of common, but by the third year (2001) the Giant stand had thinned and common twice as productive as Giant. Because these last four entries were only grown for the last 3 years, their long term averages were not included in the statistical analysis of 5 year averages.

One explanation for the lack of difference between Coastal and common bermudagrass today vs. 50 to 60 years ago is a genetic shift in Coastal. After Coastal bermudagrass was released

in 1943, early studies showed Coastal out yielded common bermudagrass from 15 to 40%. The more nitrogen applied, the greater the difference. Coastal bermudagrass will produce about 3 to 5% viable seed. Because bermudagrass is cross pollinated, it will cross with common or other bermudagrasses growing near by. When Coastal was released, only certified sprigs were sold but over the years sprigs were dug from "Coastal" pastures that were contaminated with common or Coastal x common cross plants. To day there are probably no Costal bermudagrass pastures remaining that are genetically identically to the original Coastal that was released in 1943.

2002-2004 Study

Because of strong producer interest in seeded bermudagrasses, a joint project between the Texas Agricultural Experiment Station at Overton and Seeds West, Inc. at Maricopa, Arizona was initiated in 2002 to evaluate 166 half-sib families of seeded bermudagrasses and compare them to Coastal and Tifton 85 bermudagrass. Tifton 85 was the most productive variety (Table 3). Coastal produced about 1 ton/acre less forage than Tifton 85, which is typical. Seeded entries of common, Giant, and Cheyenne produced yields similar to Coastal as in the previous study. The range in production of the 166 half-sib families ranged from 6900 to 13,400 lb dry matter/acre. Each year there were from 25 to 35 entries that were as productive as Tifton 85. There were 14 entries with forage production similar to Tifton 85 each of the 3 years. These 14 entries were taken back to southern Arizona to develop potential varieties (SWI-810 [Cheyenne II], SWI-812, and SWI-814) that might be more productive than other available seeded bermudagrass varieties and blends.

2006-2008 Study

The most recent comparison of vegetative and seeded types was conducted at Overton Texas, Starkville Mississippi, and Tifton Georgia for 3 years. Drought and weeds were major problems in Texas and Mississippi in 2006. Weeds were a major problem since there are no labeled herbicides for establishing bermudagrass from seed. At the Georgia location the test site was fumigated with methyl bromide (not labeled for use by producers) before planting to kill existing weed seed in the soil. This resulted in excellent bermudagrass stands. Irrigation was available in Mississippi and Georgia with limited irrigation (lawn sprinkler) in Texas. Because of poor stands due to weed competition and drought, some of the seeded entries were replanted in spring 2007 in Texas and Mississippi. Management practices for the 3 years are reported in Table 4.

At Overton the highest yielding entry was Tifton 85 at 11,000 lb/acre (Table 5). With adequate moisture and fertility, Tifton 85 establishes rapidly as shown by the first year yields of 5000 lb/acre. Coastal, Coastcross II, and SWI-810 (Cheyenne II) were the next most productive with average yields of 6200 to 6900 lb/acre. The low Coastal yields in the establish year is typical for Coastal in East Texas because it is slow to form a solid stand. There was no statistical difference among the seeded entries except for Giant. The 3 year average yield for Giant was the lowest because of no yield the first year. In this area Giant stands deteriorate with time.

At Starkville Tifton 85 was the highest yielding bermudagrass entry at slightly more than 14,000 lb/acre (Table 6). It was the only entry to establish vigorously during drought from May to July, 2006. All other entries had a 3 year average of less than 8,000 lb/acre. All seeded entries except common had a 3 year average yield that was similar to Coastal. SWI-1807, as at Overton, had poor establishment and low yields over 3 years (< 2000 lb/acre). Results are similar statistically if only the 2 year average of 2007 to 2008 is considered (data not shown). Over the last two years, seeded types (except common) and Coastal had similar yields of 9,336 to 11,046 lb/acre (Coastal = 10,376 lb/acre). Tifton 85 had a two year average of 17,454 lb/acre. The two year average of common was 5,797 lb/acre and for SWI-1807 it was 3,503 lb/acre.

At Tifton yields of entries over 2007 and 2008 were very consistent and resulted in similar rankings in the 3 year average yields (Table 7). SWI-812 was not significantly different

from Giant over three years. The three seeded entries from Seeds West had very similar yields within years and averaged over three years. All seeded entries except Common had lower yields in 2007 versus 2008, though overall rainfall was slightly greater.

Location had a major influence on forage yields and ranking of entries. Average first year yields were 1,633, 1,644, and 14,943 lb/acre for Overton, Starkville, and Tifton respectively. Tifton is the most southern location and therefore has milder winters and a longer warm-season growing period. Overton and Starkville were in a severe drought in 2006 which drastically affected establishment and yield. The Tifton test site was fumigated with methyl bromide (not cleared for pasture use and no longer available) for weed control resulting in rapid establishment and excellent stands.

Considering the 3 year averages, the only common rankings across locations were Tifton 85 as the most productive, along with Coastcross II at Tifton, and SWI-1807 as the least productive (Table 8). At Overton and Starkville there was no statistical difference among seeded entries except Giant was lower at Overton and common was lower at Starkville. At Overton SWI-810 (released as Cheyenne II) was the only seeded entry not statistically different from Coastal. At Starkville all seeded entries except common were equal to Coastal. At Tifton, Cheyenne and Giant were the most productive seeded entries but all seeded entries were more productive than Coastal.

The 3 year results support the belief that Tifton 85 is the most productive bermudagrass across the southeastern United States. They also show that the seeded bermudagrasses for the most part are equal to, or better than, Coastal. These studies were carried out at moderate nitrogen fertilizer levels (Table 4). One would expect differences among entries to be less at lower nitrogen rates (75-100 lb/acre) and greater at higher nitrogen rates (> 300 lb/acre).

Establishing seeded bermudagrass

Although there is no published data available, recommended seeding rate for bermudagrass is from 5 to 10 lb/acre. Both hulled and unhulled seed of common and giant are available. Hulled bermudagrass has the outer seed brackets removed and germinates quicker, especially at cooler temperatures, than unhulled seed. Hulled bermudagrass seed are shiny dark brown and very small (1/64 in. long). Unhulled bermudagrass seed is about 1/16 in. long with a dull straw color. Mixtures of hulled and unhulled common bermudagrass are available.

A pound of hulled bermudagrass seed contains about 2 million seed and a pound of unhulled bermudagrass seed contains 1.5 million seed (Wheeler and Hill, 1961). Some of the bermudagrass seed is coated and some is not. A clay material that may contain some plant nutrients is coated on the seed increasing seed size and doubling the weight. Because the clay coating doubles the seed weight, a pound of coated seed contains only about half the seed that a pound of uncoated seed does. The price per pound of coated and uncoated seed may be similar.

Germination of hulled and unhulled common bermudagrass seed was determined in an incubator at night/day temperatures of 41/59, 50/68, 59/77, 68/86, 77/95, and 86/104^{0}F with 12 hour days. Four replications of 100 seed were treated with a fungicide and placed onto moistened blotter pads in glass Petri dishes. The dishes were covered with lids, enclosed in plastic food storage bags to retain moisture, and placed in the incubator set to one of the six temperature treatments. Seeds were kept moist with distilled water. Seeds were checked daily for 28 days to record germination. A seed was counted as having germinated when both a green leaf and the root were visible to the naked eye. For the hulled seed, germination was most rapid at the three

warmest temperatures (Fig. 1). However maximum germination was only was only 48% at 86/104, 72% at 77/95, but 93% at 68/86^{0}F. The rate of germination was slower at 59/77^{0}F but maximum germination was 82%. Germination was slower and only reached 28% at the cool temperature of 50/68^{0}F. Hulled bermudagrass seed failed to germinate at the lowest temperature. The rate of germination was slower with unhulled seed than hulled seed (Fig. 2). The germination of unhulled seed was the most rapid and reacted the highest level at 77/95^{0}F. Maximum germination of unhulled seed at the two middle temperatures was about 20 percentage points lower than the hulled seed.

Optimum temperatures for bermudagrass seed germination is when daily low temperatures reach 60^{o}F which is about May 1 for the Overton area. Planting after mid-June is discouraged because of normally hot and dry weather conditions Because bermudagrass seed is so small, it is best to broadcast the seed on a prepared seedbed and roll it with a packer to press the seed in to the soil surface. If the seed bed is not firm (boot heal imprint is deeper than ½ in.) also roll before broadcasting seed.

Weeds, especially crabgrass, are a major problem in getting good stands of seeded bermudagrass. There are no preemergent herbicides that selectively control seeds without harming emerging bermudagrass seedlings. One option is to prepare a seedbed and roll it with a packer. Weeds will emerge with the first rain. Before the weeds exceed 2 to 3 in. tall, spray Gramoxone Max (1.5 pt/acre) or Roundup Ultra (1 pt/acre). The weeds will turn brown in about 1 day for Gramoxone Max, 5 to 7 days for Roundup Ultra. One to 2 days after spraying, broadcast the bermudagrass seed and roll to press the seed in the soil surface. Additional weeds will emerge with the next rain, but the initial big flush of weeds will be eliminated.

Yields of most available seeded bermudagrass lines and blends are similar to Coastal but less than Tifton 85 bermudagrass. Tifton 85 has superior drought tolerance and higher nutritive value than Coastal and seeded bermudagrasses. Tifton 85 has fewer ether bonds (ether bonds in the lignin can not be broken by rumen bacteria) than Coastal (Hill et al., 2001).

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Table 1. Blends of seeded bermudagrasses.

Trade name	Components
Pasto Rico	Common, Giant
Pasture Supreme	Common, Giant
Primero	CD 90160, Mirage, Giant, Panama
Ranchero Frio	Cheyenne, Cheyenne 2, Mohawk, Giant
Sungrazer 777	KF 194, Jackpot, CD 90160
Sungrazer Plus	KF 194, CD 90160, Giant
Texas Tough Plus	Common, Giant, Majestic
Tierra Verde	Common, Giant
Vaquero	CD 90160, Mirage

Table 2. Warm-season perennial grass yields from 1997 through 2001.

	1997	1998	1999	2000	2001	Average
Entry	----------lb dry matter/acre----------					
Tifton 85 bermuda[1]	5044 a[2]	8064 a	12915 a	12032 a	15680 a	10747 a
CD 90160 bermuda	2737 b	3550 d	9696 bc	10347 b	13395 a-c	7945 b
Texas Tough bermuda	2480 bc	5262 b	11749 ab	7956 e-g	10993 cd	7688 b
Ranchero Frio bermuda	1943 cd	2912 de	8984 c	9991 bc	12428 b-d	7251 bc
Terra Verde bermuda	2085 cd	4885 bc	9054 c	8318 d-f	11748 b-d	7218 bc
Coastal bermuda[1]	1611 d	3739 cd	8507 cd	9440 b-d	11549 b-d	6969 bc
Cheyenne bermuda	2408 bc	3430 de	6640 d-f	8928 c-e	13431 ab	6967 bc
KF CD 194 bermuda	1914 cd	3664 cd	7407 c-e	7525 fg	10075 de	6117 c
Pensacola bahia	583 e	2167 e	4771 f	6809 gh	7682 ef	4402 d
Tifton 9 bahia	767 e	2203 e	5470 ef	5967 h	7398 f	4361 d
Common bermuda[3]			383	7445 fg	11352 b-d	6393
Giant bermuda[3]			836	7356 fg	6643 f	4945
Wrangler bermuda[3]			188	6744 gh	7550 f	4827
Kikuyugrass[3]			0	7620 e-g	5539 f	4386

[1]Bermudagrass varieties established from sprigs.
[2]Yields within a column followed by the same letter are not significantly different at the 0.05 level, Fisher's Protected LSD Test.
[3]Entries planted in 1999. All other entries planted in 1997.

Table 3. Three-year yields of several varieties and 164 seeded bermudagrass lines at Overton, Texas.

	2002	2003	2004	Average
Variety	Yield (lb dry matter/acre)			
Coastal	6383	11,618	14,966	10,989
Tifton 85	8878	13,810	13,716	12,135
Common†	7557	10,624	12,908	10,363
Giant†	5675	9,062	10,230	8,322
Cheyenne†	6370	10,438	13,183	9,997
Wrangler†	4966	10,123	9,713	8,267
Seed lines	3532-9691	5119-15,619	7962-16,121	6879-13,402

†Seeded.

Table 4. Rainfall and management practices for bermudagrass trials in Texas, Mississippi, and Georgia in 2006, 2007, and 2008.

	Texas	Mississippi	Georgia
	2006		
Planting date	May 2	June	May 2[†]
Rainfall (in.) (Mar-Oct)	18.9	30.9	15.5
Irrigation	lawn sprinkler	1	2
Fertilization (lb/ac)	180-55-55	240-80-160	128-32-64
Harvests	2	2	4
	2007		
Rainfall (in.) (Mar-Oct)	36.7	24.9	19.6
Irrigation	0	0	1
Fertilization (lb/ac)	220-0-120	240-80-160	160-40-80
Harvest	4	3	5
	2008		
Rainfall (in.) (Mar-Oct)	38.2	38.8	?
Irrigation	0	0	0
Fertilization (lb/ac)	220-85-205-1B	300-100-200	160-40-80
Harvest	5	5	5

[†]Methyl bromide applied before planting for weed control.

Table 5. Bermudagrass yields for 3 years and average annual yield at Overton, Texas (Gerald Evers).

Entry	2006	2007	2008	Average
	----------lb dry matter/acre----------			
Tifton 85	5423 a[†]	13933 a	11716 a	11066 a
Coastal	1323 e	8725 bc	9236 bc	6909 b
Coastcross II	3719 b	7006 c-e	8978 bc	6786 b
SWI-810	2178 cd	8051 b-e	7146 de	6262 b-d
Common	0	7374 c-e	5343 fg	5556 cd
SWI-814	1559 de	6820 e	7024 d-f	5492 d
SWI-812	1234 e	6847 de	7014 d-f	5434 d
Cheyenne	897 e	6657 e	5902 e-g	5253 d
Giant	0	5743 f	5285 g	4126 e
SWI-1807	0	0	0	0 f
LSD (0.05)	761	1407	1699	1068

[†] Values in a column followed by the same letter are not significantly different at the 0.05 level, Fisher's Protected LSD.

Table 6. Bermudagrass yields for 3 years and annual average at Starkville, Mississippi (David Lang).

Variety	2006[†]	2007	2008	Mean
	----------lbs acre^{-1}----------			
Tifton 85	7398 a[‡]	18950 a	15956 a	14102 a
Giant	2861 b	10611 b	9749 c	7740 b
Cheyenne	534 c	9519 b	12574 b	7542 b
Coastal	1666 bc	9419 b	11334 bc	7473 b
SWI-812	497 c	9428 b	10966 bc	6964 b
SWI-814	242 c	9603 b	10991 bc	6946 b
SWI-810	368 c	8447 b	10224 c	6347 b
Common	225 c	5546 c	6049 d	3940 c
SWI-1807	1019 c	5193 c	1814 e	2675 c
LSD (0.05)	1447	2576	2342	1551

[†] Additional plants were started from the seed in the greenhouse over the winter of 2006-07 and replanted in May, 2007.

[‡] Values in a column followed by the same letter are not significantly different at the 0.05 level, Fisher's Protected LSD.

Table 7. Annual and three year average bermudagrass yields at Tifton, Georgia (Bill Anderson).

Entry	2006	2007	2008	Average
Tifton 85	16619 ab[†]	27506 a	25406 a	23177 a
Coastcross II	18086 a	26067 a	22193 b	22115 a
Cheyenne	17970 a	21394 bc	17822 cd	19062 b
Giant	16426 abc	20489 bcd	17442 d	18119 bc
SWI-812	16118 bc	19717 cde	14832 e	16889 cd
SWI-810	16159 bc	18783 de	14860 e	16600 d
SWI-814	16422 abc	18169 e	14793 e	16461 d
Common	16428 abc	15436 f	15184 e	15682 d
Coastal	9714 d	14382 f	11401 f	11832 e
SWI-1807	5483 e	7669 g	6043 g	6398 f
LSD (0.05)	1687	2281	2212	1509

[†] Yields in a column followed by the same letter are not significantly different at the 0.05 level of significance, Fisher's Protected LSD.

Table 8. Average 3 year (2006-2008) yields of bermudagrass varieties at Overton, Texas; Starkville, Mississippi; and Tifton, Georgia.

Variety	Overton	Starkville	Tifton	Average
	----------lb DM/acre----------			
Tifton 85	11066 a[†]	14102 a	23177 a	16115
Coastcross II	6786 b		22115 a	14450
Cheyenne	5253 d	7542 b	19062 b	10619
Giant	4126 e	7740 b	18119 bc	9995
SWI-812	5434 d	6964 b	16889 cd	9762
SWI-810	6262 b-d	6347 b	16600 d	9736
SWI-814	5492 d	6946 b	16461 d	9633
Coastal	6909 b	7473 b	11832 e	8738
Common	5556 cd	3940 c	15682 d	8392
SWI-1807	0 f	2675 c	6398 f	3024
LSD (0.05)	1068	1551	1509	1376

[†] Yields in a column followed by the same letter are not significantly different at the 0.05 level of significance, Fisher's Protected LSD.

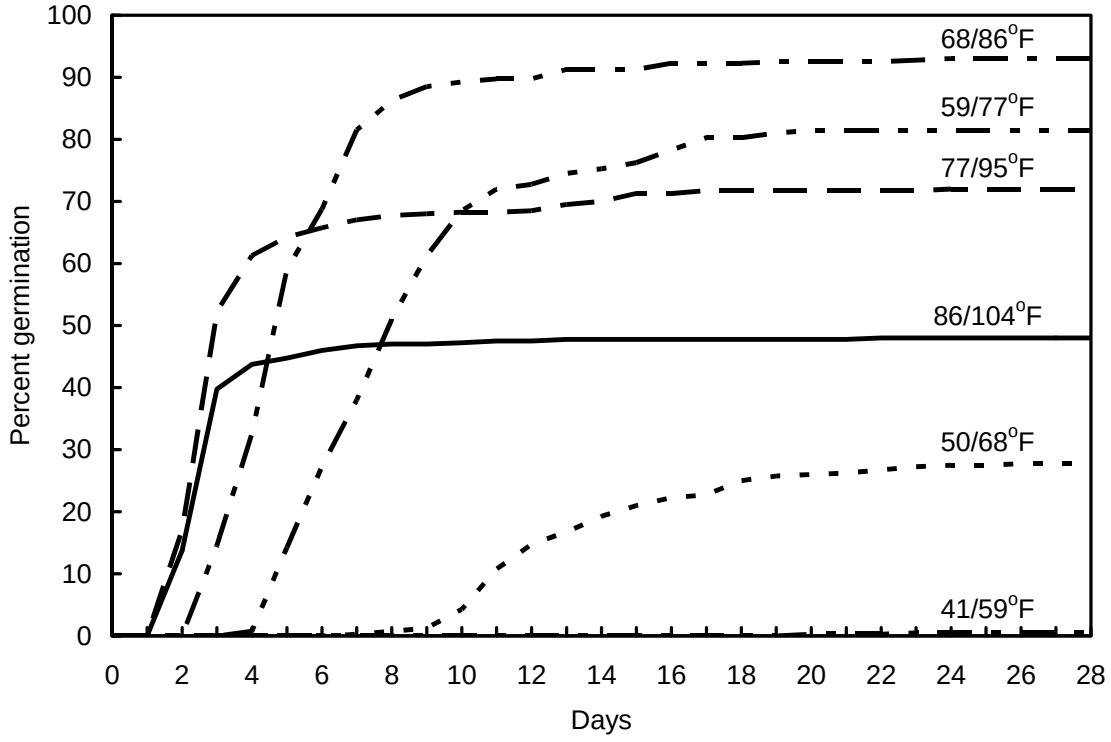

Fig. 1. Germination of hulled bermudagrass seed over 4 weeks at six night/day temperatures.

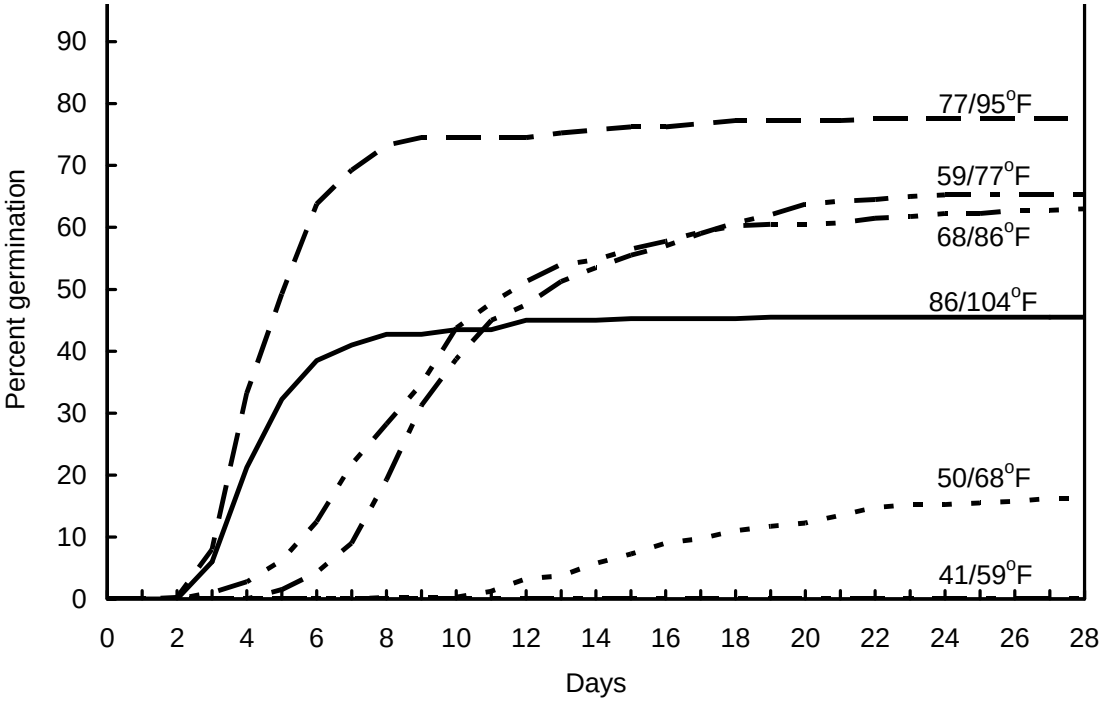

Fig. 2. Germination of unhulled bermudagrass seed over 4 weeks at six night/day temperatures.