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Richardson et al.

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(54) **BERMUDAGRASS HYBRID NAMED 'OZARK'**

(50) Latin Name: ***Cynodon dactylon***
Varietal Denomination: **Ozark**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/346,221**

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(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation-in-part of application No. 10/310,226, filed on Dec. 5, 2002, now abandoned.

(51) **Int. Cl.**[7] **A01H 5/00**
(52) **U.S. Cl.** **Plt./389**
(58) **Field of Search** Plt./389

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(57) **ABSTRACT**

The variety "Ozark" is a new and distinct hybrid bermudagrass variety. The plant was derived from an F1 hybrid cross of bermudagrass varieties A9959×"Coastal." "Ozark" has relatively tall, upright growth and exhibits superior cold tolerance relative to previous bermudgrass varieties, yielding well in the northern part of the bermudagrass belt.

5 Drawing Sheets

GENUS AND SPECIES NAME

The invention relates generally to the new and distinct variety of hybrid bermudagrass (*Cynodon dactylon* (L.) Pers.) described herein and designated "Ozark." As used herein, "Ozark" has the identical meaning as "Ozarka" in parent application Ser. No. 10/310,226, filed Dec. 5, 2002.

BACKGROUND OF THE INVENTION

The variety is an F1 hybrid progeny plant derived from the crossing of A9959×"Coastal" (each unpatented varieties) carried out in 1974 at the Oklahoma Agricultural Experimental Station, Oklahoma State University. "Ozark" has

been asexually reproduced and the distinctive traits of the variety have remained stable. "Ozark" was first asexually reproduced at the Agronomy Research Station, Oklahoma State University, Stillwater, Okla.

Parent line A9959 is a bermudagrass introduction from Yugoslavia. The Georgia Coastal Plain Experiment Station and Plant Science Research Division of ARS released Coastal in 1943. Coastal is the F1 hybrid of "Tift" bermudagrass and a plant introduction from South Africa.

"Ozark" was selected from other bermudagrasses and evaluated for traits and characteristics as described herein. Initial field screenings identified "Ozark" as having desirable characteristics. This led to its inclusion in advanced

multi-environmental performance tests. The results of certain of the analyses are presented herein below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**: "Ozark" bermudagrass fully established and ready for harvest. Note: complete ground cover at least 18 months after sprigging.

FIG. **2**: Individual plant of "Ozark" bermudagrass. Note: Stoloniferious reproduction from main plant.

FIG. **3**: Collar region of "Ozark" bermudagrass. Note: small pubescence where the leaf sheath and leaf blade meet.

FIG. **4**: Seedhead of "Ozark" bermudagrass at full maturity.

FIG. **5**: Cold tolerance of five bermudagrass varieties subjected to freezing temperatures ranging from −5 to −13° C. in a controlled chamber.

DETAILED DESCRIPTION OF THE VARIETY

"Ozark" is similar to "Midland," "Midland 99," and "Tifton 44" (all unpatented varieties) in morphology and growth habit. Like Midland 99 and Tifton 44, "Ozark" has relatively tall, upright growth in comparison to more decumbant cultivars such as "Greenfield." The stem diameter, shoot length, and leaf widths of Ozark, Midland, and Tifton 44 are similar. The leaves of "Ozark" tend to be longer than those of Midland and Tifton 44. "Ozark" typically produces inflorescences later and less profusely than Midland or Tifton 44. Like most hybrid bermudagrasses, "Ozark" sets only a few seeds and therefore must be propagated vegetatively.

"Ozark" has shown superior cold tolerance relative to previous bermudagrass varieties and has yielded well in the northern part of the bermudagrass belt. The superior adaptation, production and quality, for example, when grown in southern Missouri and Kansas thus make the variety unique among released bermudagrass varieties (FIG. **5**). Based on its cold tolerance and stand persistence, "Ozark" is widely adaptive north of Springfield, Mo. (37° 14' N. 93° 23' W.) extending to Elsberry, Mo. (39° 10' N. 90° 47' W.). This includes the southern one-third of Missouri and Kansas, and statewide in Oklahoma and Arkansas. Bermudagrass is generally not able to grow in the colder regions of the state, but "Ozark" is highly tolerant to the differing cold temperature changes in the above listed region. A description of the variety is presented below.

A. Additional Characteristics of the Variety

The detailed botanical description presented herein was produced from observation of greenhouse grown "Ozark" plants with 5-weeks of accumulated growth (n=25 observations per trait).

Parentage: The variety is a clonally propagated F_1 hybrid of the cross of A9959×'Coastal'. Oklahoma accession A9959 (PI 253302) is a cold tolerant clonal bermudagrass introduction from Yugoslavia. Coastal is the F_1 hybrid of 'Tift' bermudagrass and a plant introduction from South Africa.

Propagation: Vegetative (asexual) by means of propagating plant crowns, stolons and rhizomes.

Growth habit: Tall, upright, warm season perennial grass that spreads by rhizomes and stolons to form a dense sod. Rhizomes are found at a depth of greater than 4 cm, allowing rapid regrowth and recovery from sprig harvesting. Stolons and rhizomes branch from nodes.

Mature leaf blade width (measured near base of leaf) emanating from 2^{nd} visible node from shoots: mean=4 mm range=3.8–4.2 mm.

Other leaf blade characteristics: The variety has long leaves compared to some other bermudagrass varieties. Leaves are glabrous on the abaxial and adaxial surfaces and taper toward the tip. Leaves have prominent parallel veins and serrated edges. Ligules are ciliate with hairs averaging 1 mm in length. Leaf characteristics vary slightly when under unusual fertility regimes as well as when under biotic or abiotic stress.

Description of upright shoots: Mean maximum height of shoots was 460 mm. For culms the mean diameter of widest internode dimension was 3.0 mm with a range of 2.6–3.2 mm. The mean diameter of the most narrow internode dimension was 2 mm with a range of 1.5 to 2.5 mm. The mean length of the 2^{nd} internode from shoot apex was 70 mm with a range of 65–74 mm. The mean number of internodes on culms ca. 460 mm tall was 5. The culm nodes were round to oval in shape and glabrous with a mean diameter of 3.2 mm and a range of 2.5–3.5 mm. The mean number of visible nodes on culms ca. 460 mm tall was 6. Color of culms=Munsell plant color chart designation of 7.5 GY 5/6.

Sheath: Open, shorter than the internode.

Ligule: A whitish fringe of hairs 1 mm in length.

Collar: Narrow and continuous.

Auricle: Absent.

Inflorescence: Produced less densely than most commercial bermudagrass varieties. When an inflorescence is produced, 4 to 6 digitate spikelets bear few, if any, viable seeds.

Plant color: The color designation of the variety is 7.5 GY 5/6 using a Munsell color chart rating (Munsell plant color chart, Macbeth Division of Kollmorgen Instruments Corporation, New Windsor, N.Y.).

Unmowed height: 75 to 100 cm.

Disease resistance: There have been no reports or observations of any unusual and/or severe insect or disease problems with the variety. Leaf disease has been minimal when other bermudagrass varieties showed severe infections.

Rooting: Produces vegetatively propagated roots from nodes of both stolons and rhizomes (nodal or adventitious roots), which are in the ground contact. The entire root system is comprised of adventitious roots that develop laterally and tend to become rudimentary unless the stolon or rhizome is severed. Once severed, the rudimentary roots rapidly develop to support the severed portion of the plant.

B. Growth Characteristics

Forage Yield for the variety has been evaluated in clipping trials at Mt. Vernon, Mo., (Southwest Missouri Research and Education Center; 37°06' N. 93°49' W.), Haskell (Eastern Research Station, 35°13' N. 95°08' W.), Chickasha (South Central Research Station, 35°03' N. 97°56' W.), and Ardmore (Noble Foundation, 34°10' N. 97°08' W.) Okla., Batesville, Ark., (Livestock and Forestry Branch Station, 35°46' N. 91°38' W.) and Parsons, Kans. (Southeast Agricultural Research Center 37°20' N. 95°15' W.).

In almost every yield trial conducted, "Ozark" has yielded as much or more forage than other varieties. In a three-year trial at Mt. Vernon, Mo., "Ozark" had an average yield of 9,867 kg ha^{-1} (Table 1). In this trial, the three-year average yields of "Ozark" were equal to those for Midland 99, but 13% greater than Tifton 44, 31% greater than 'Hardie' and 38% greater than 'Guymon'. At Parsons, Kans., "Ozark" had outstanding yields, producing an average 14,986 kg ha^{-1} of forage per year (Table 2). Although the yields were less during the first year of this trial, by the third (and final) year it produced significantly (18 to 40%) more forage than other varieties tested.

At Batesville, Ark., "Ozark" had a four-year average yield of 15,702 kg ha^{-1}. This yield from "Ozark" was similar to Tifton 44 and 'Greenfield', but 14% greater than Midland, 24% greater than 'World Feeder' and 37% greater than Guymon (Table 3). In trials conducted at Haskell and Chickasha, Okla., the variety yielded similarly to Tifton 44, Hardie and Midland 99, but produced significantly more forage than Midland, 'Quickstand', World Feeder and Greenfield (Tables 4 and 5). Yield tests conducted at the Noble Foundation, near Ardmore, Okla. showed that the variety produced four-year average yields that were similar to Coastal, Hardie, and Midland 99, but yielded 19% more forage than Tifton 44, 22% more than Midland, and 47% more than Quickstand (Table 6).

The excellent production of "Ozark" in Missouri, Kansas, Arkansas and Oklahoma is due in large part to its cold hardiness. In laboratory cold tolerance tests, "Ozark" had a T_{mid} value of –9.0° C. (FIG. **5**). This T_{mid} value was significantly lower (i.e. indicating more cold tolerance) than any other variety tested including Midland 99, Greenfield, Midland, and Tifton 44. T_{mid} values indicate the coldest temperature at which 50% of the plants survive.

The variety has survived well in a number of environments. Stands of the variety have not shown signs of winterkill at any location where yield testing has been conducted. Further, observation plots as far north as Elsberry, Mo. (39°10' N. 90°46' W.) have persisted more than six years where all other bermudagrass varieties showed signs of winterkill.

Overall the forage quality of "Ozark" has been similar or better than other high-yielding bermudagrass varieties. At Mt. Vernon, "Ozark" had acid detergent fiber (ADF), neutral detergent fiber (NDF) and crude protein (CP) values that were similar to Midland 99 and Tifton 44 (Table 7).

Forage quality of "Ozark" was also tested during 1995 at both Chickasha and Haskell, Okla. At Chickasha, "Ozark" had ADF, NDF and CP values that were equal to the highest yielding varieties in the trial (Tifton 44, Hardie and Midland 99) except that it had 10 g kg^{-1} less ADF than Tifton 44 (Table 8). At Haskell, "Ozark" has less ADF and NDF than the other high-yielding varieties (Midland 99, Hardie, and Tifton 44) (Table 9). The crude protein concentration of "Ozark" was similar to all the other varieties tested at Haskell.

TABLE 1

Annual and three-year average forage yield of five bermudagrass varieties grown at the Southwest Missouri Research and Education Center, near Mt. Vernon, Missouri

Variety	1996	1997	1998	Average
		kg ha^{-1}		
Ozark	6,707	11,189	11,704	9,867
Midland 99	5,980	11,005	11,119	9,368
Tifton 44	5,615	10,219	9,931	8,588
Hardie	4,580	7,622	8,366	6,856
Guymon	4,116	7,233	7,048	6,132
Average	5,400	9,454	9,634	8,162
LSD (0.05)	1,244	1,059	1,532	992

TABLE 2

Annual and 3-year average yield of 6 bermudagrass varieties grown at the Mound Valley Unit, Southeast Agricultural Research Center, near Parsons, Kansas

Variety	1993	1994	1995	Average
		kg ha^{-1}		
Ozark	10,304	18,144	16,509	14,986
Hardie	13,373	17,584	13,530	14,829
Tifton 44	11,715	15,792	12,970	13,492
Midland	9,856	13,171	10,886	11,305
Greenfield	10,170	9,587	10,774	10,177
World Feeder	9,206	9,632	9,946	9,595
Average	10,771	13,985	12,436	12,397
LSD (0.05)	1,322	1,770	1,837	

TABLE 3

Annual and 4-year forage yield of 6 bermudagrass varieties grown at the Livestock and Forestry

Variety	1995	1996	1997	1998	Average
			kg ha^{-1}		
Tifton 44	18,637	13,530	1,837	18,122	16,442
Ozark	18,144	13,104	13,709	17,853	15,702
Greenfield	18,637	11,962	14,224	14,448	14,818
Midland	16,755	9,050	13,619	14,470	13,474
World Feeder	15,501	7,706	12,768	11,917	11,973
Guymon	13,574	7,146	8,355	10,192	9,817
Average	16,875	10,416	13,026	14,500	13,704
LSD (0.05)	3,203	2,733	2,016	2,262	1,792

TABLE 4

Annual and 4-year average forage yield of 8 bermudagrass varieties grown at the South Central Research Station, near Chickasha, Oklahoma

Variety	1995	1996	1997	1998	Average
			kg ha^{-1}		
Tifton 44	26,006	25,446	21,213	20,093	23,190
Hardie	28,829	26,006	18,525	16,083	22,361
Ozark	27,059	22,624	18,502	16,710	21,224
Midland 99	25,693	22,736	19,286	17,002	21,179
Midland	23,834	20,362	16,867	12,275	18,335
Quickstand	20,586	19,869	11,738	6,115	14,577
World Feeder	18,256	16,016	9,968	5,802	12,511
Greenfield	16,621	16,934	11,088	5,533	12,544
Average	23,360	21,249	15,898	12,452	18,240
LSD (0.05)	3,539	3,002	2,509	2,778	2,106

TABLE 5

Annual and 3-year average forage yield of 8 bermudagrass grown at the Eastern Research Station, near Haskell, Oklahoma

Variety	1995	1996	1997	Average
		kg ha^{-1}		
Midland 99	24,901	21,146	20,675	22,241
Hardie	23,811	18,973	21,347	21,377
Tifton 44	22,938	19,914	20,807	21,220
Ozark	22,557	20,115	20,899	21,290
Midland	21,011	17,584	17,181	18,592
Quickstand	20,070	17,069	14,314	17,151
Greenfield	18,928	13,709	15,501	16,046
World Feeder	17,046	15,165	15,322	15,844
Average	21,408	17,959	18,256	19,208
LSD (0.05)	1,008	1,949	2,419	1,613

TABLE 6

Annual and 4-year average forage yield of 7 bermudagrass varieties grown at the Noble Foundation, near Ardmore, Oklahoma

Variety	1996	1997	1998	1999	Average
			kg ha^{-1}		
Coastal	5,750	7,056	13,526	10,619	9,238
Ozark	7,195	5,812	12,491	10,927	9,106
Hardie	7,499	6,193	10,917	10,759	8,842
Midland 99	6,056	5,994	11,877	9,801	8,432
Tifton 44	5,811	5,363	9,826	8,652	7,413
Midland	6,154	4,239	9,178	8,679	7,062
Quickstand	4,416	1,960	6,642	6,324	4,835
Average	6,126	5,231	10,637	9,394	7,847
LSD (0.05)	1,570	1,698	2,272	1,430	1,578

TABLE 7

Three-year average (1996–1998) of acid detergent fiber (ADF), neutral detergent fiber (NDF), and crude protein of 5 bermudagrass varieties grown at the Southwest Missouri Research and Education Center, near Mt. Vernon, Missouri

Variety	Acid Detergent Fiber	Neutral Detergent Fiber	Crude Protein
	g kg^{-1}		
Guyman	262	553	192
Hardie	282	537	188
Tifton 44	271	589	178
Midland 99	270	573	177
Ozark	271	575	177
Average	271	565	182
LSD (0.05)	6.1	19.0	7.3

TABLE 8

Acid detergent fiber (ADF), neutral detergent fiber (NDF), and crude protein during 1995 of eight bermudagrass varieties grown at the South Central Research Station, near Chickasha, Oklahoma

Variety	Acid Detergent Fiber	Neutral Detergent Fiber	Crude Protein
	g kg^{-1}		
Tifton 44	383	724	130
Hardie	376	711	129
Ozark	373	703	128
Midland 99	369	714	126
Midland	374	713	130
Quickstand	366	704	119
World Feeder	359	714	121
Greenfield	360	683	128
Average	370	710	126
LSD (0.05)	9	20	NS

TABLE 9

Acid detergent fiber (ADF), neutral detergent fiber (NDF), and crude protein during 1995 of eight bermudagrass varieties grown at the Eastern Research Station, near Haskell, Oklahoma

Variety	Acid Detergent Fiber	Neutral Detergent Fiber	Crude Protein
	g kg^{-1}		
Midland 99	389	722	122
Hardie	395	731	112
Tifton 44	401	755	115
Ozark	376	712	125
Midland	384	726	124
Quickstand	397	740	113
Greenfield	380	713	132
World Feeder	375	734	121
Average	389	730	120
LSD (0.05)	12	13	NS

What is claimed is:

1. A new and distinct hybrid bermudagrass plant as illustrated and described herein.

* * * * *

FIG. 1

FIG. 2

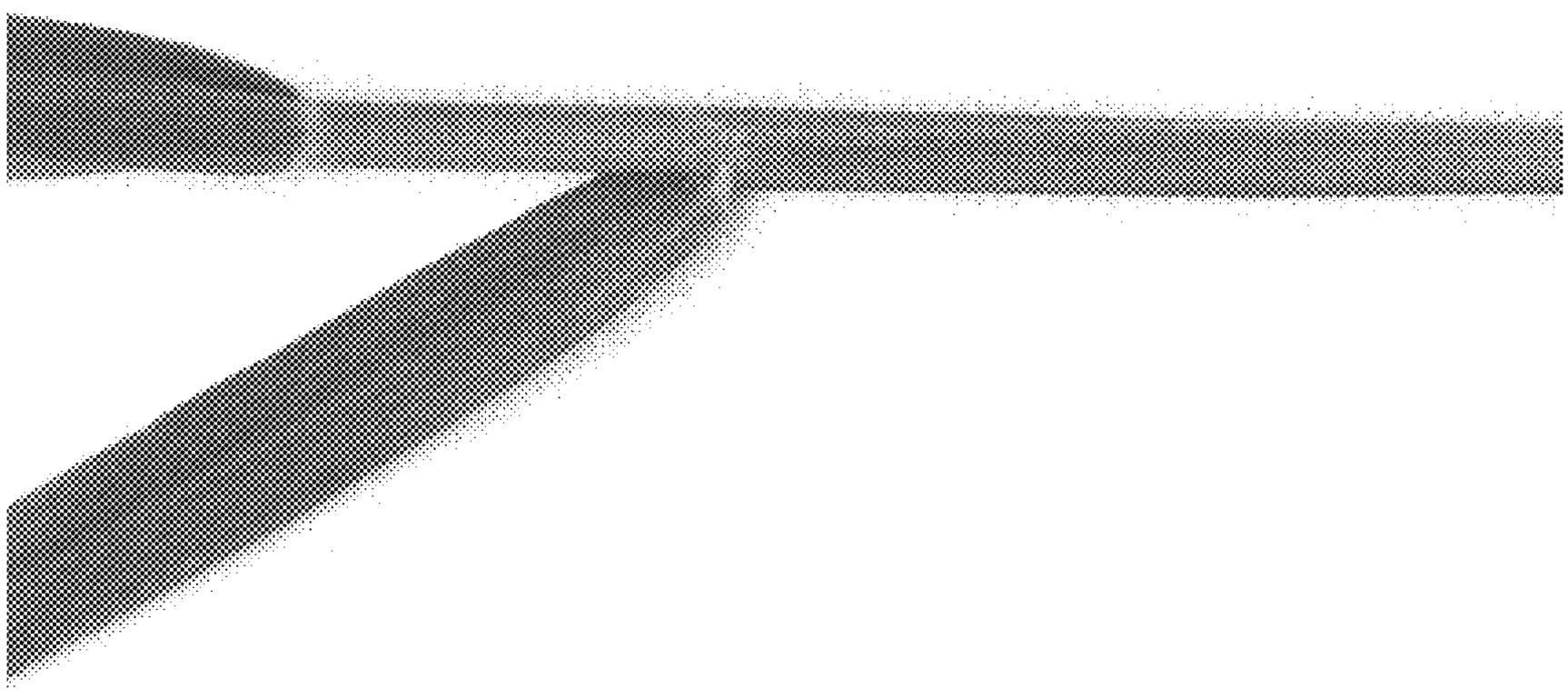

FIG. 3

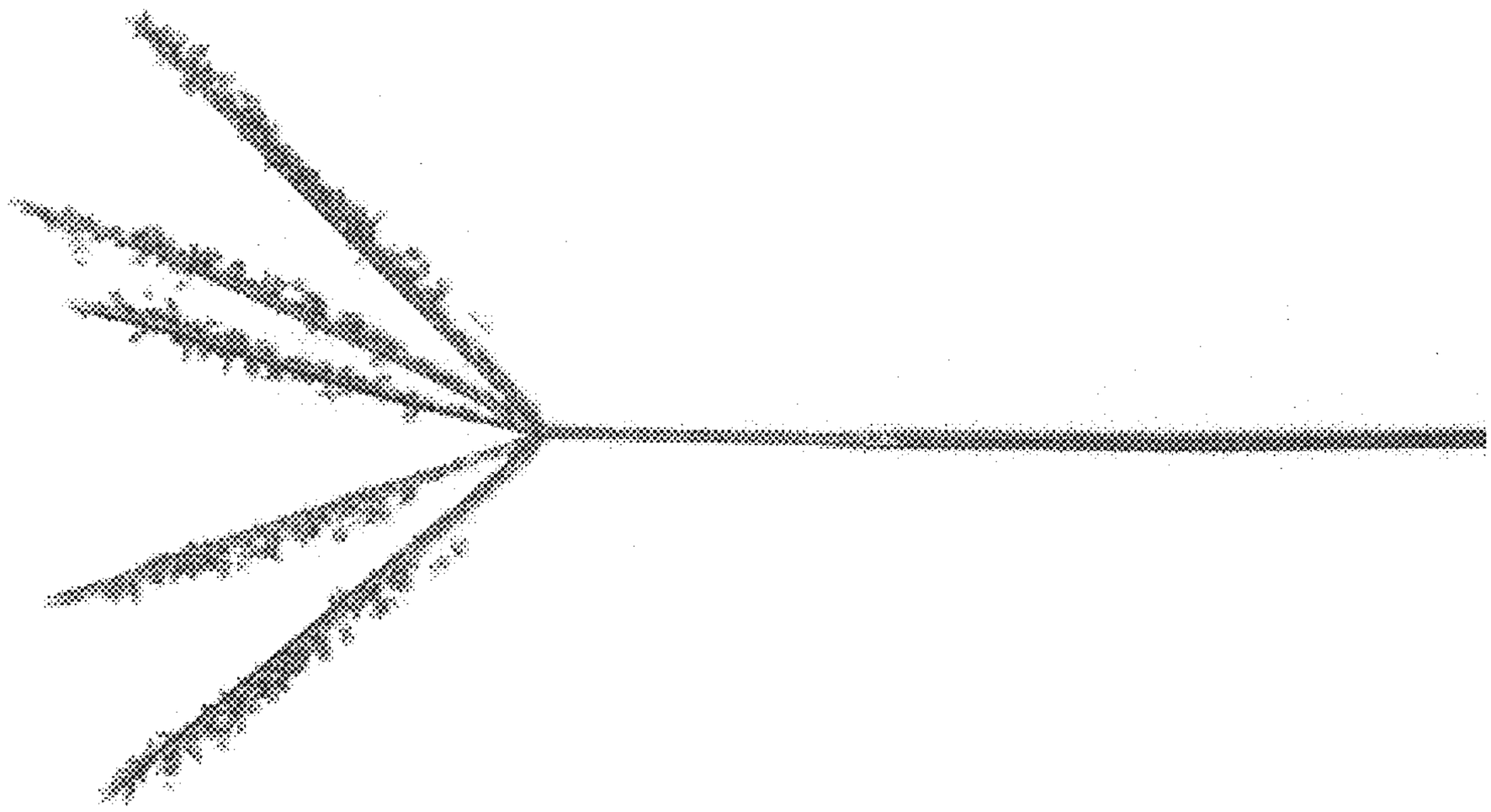

FIG. 4

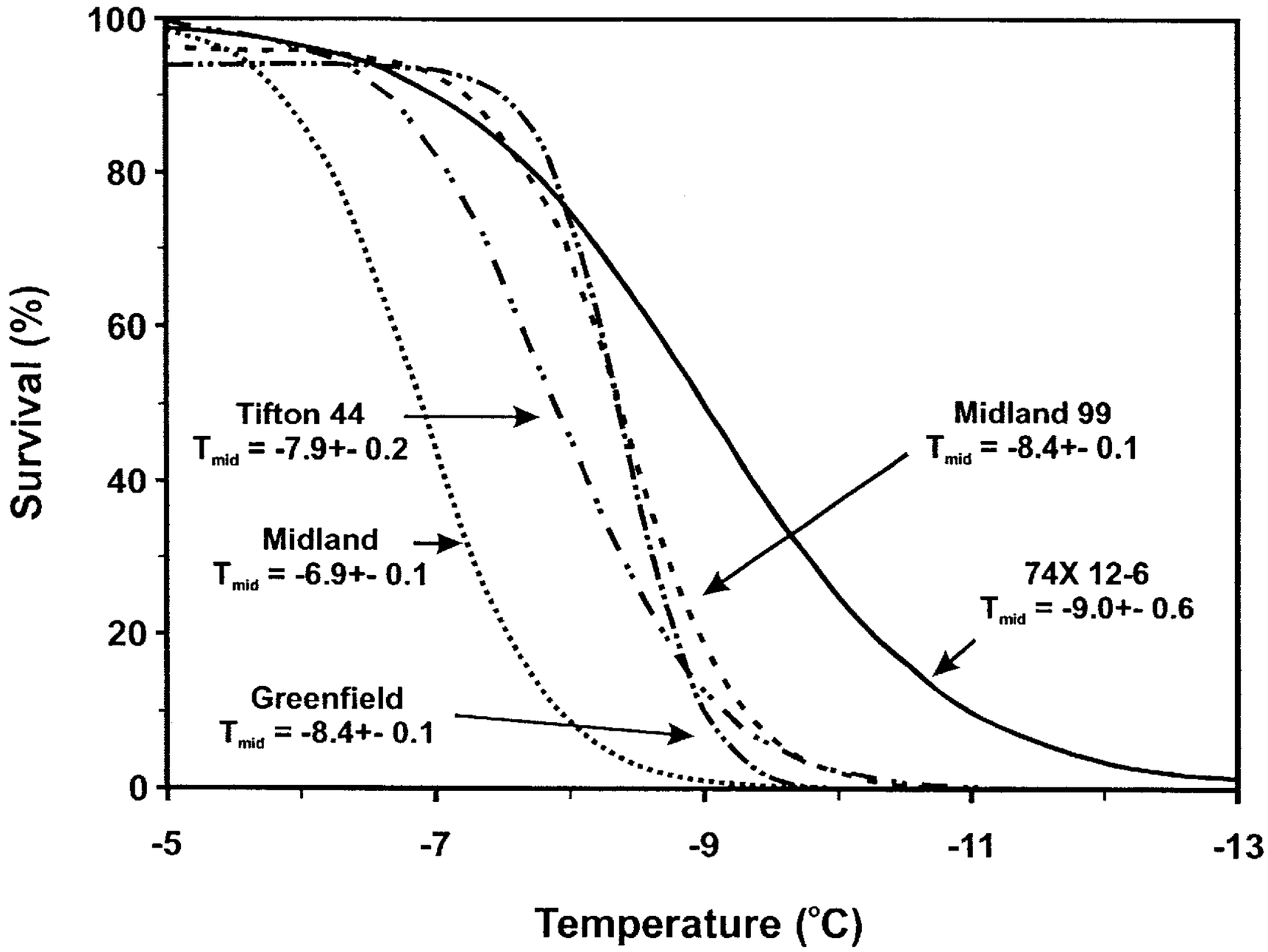
100
80
60
40
20
0
Survival (%)
Tifton 44
T_{mid} = -7.9+- 0.2
Midland
T_{mid} = -6.9+- 0.1
Greenfield
T_{mid} = -8.4+- 0.1
Midland 99
T_{mid} = -8.4+- 0.1
74X 12-6
T_{mid} = -9.0+- 0.6
-5
-7
-9
-11
-13
Temperature (°C)

FIG. 5