Density is one characteristic evaluated when comparing bermudagrass varieties for use on a golf course turf.

Introducing New Seed-Propagated F_1 Hybrid (2-Clone Synthetic) Bermudagrass

by A. A. BALTENSPERGER, Ph.D.
Director of Turfgrass Research, FMC,
and Emeritus Professor of Agronomy, NMSU

and J. P. KLINGENBERG, Ph.D.
Research Geneticist, FMC

DURING THE past decade, interest has increased in the development of improved seed-propagated bermudagrass varieties that perform better than COMMON. GUYMON, NuMex SAHARA, SONESTA, CHEYENNE PRIMAVERA, and SUNDEVIL are among the new seeded bermudagrasses that have been commercially accepted (Table 1). GUYMON is more cold tolerant and has an attractive turf color, and NuMex SAHARA is moderately more dense, uniform, and drought tolerant compared to COMMON.

GUYMON was developed at the Oklahoma Agriculture Experiment Station by crossing two selected clones of diverse origin, and from this cross, both first (F_1) and second (F_2) generation seed is produced. NuMex SAHARA was developed at the New Mexico Agriculture Experiment Station by intercrossing eight selected clones followed by repeated intercrossing and reselection, which resulted in a multiclone synthetic variety. With the exception of

GUYMON and COMMON, the 10 named seeded varieties entered in the *National Bermudagrass Test—1992** were developed in a fashion similar to that of NuMex SAHARA (Table 1).

The recent development of F_1 hybrids or 2-clone synthetic bermudagrasses will provide users with a dense, fine-textured variety that can be grown from seed. Experimental FMC-66 and FMC-88 are examples of F_1 hybrids resulting from interpollinating two clones of *Cynodon dactylon* (L.) Pers. These are two of many F_1 hybrids that currently are in the breeding program under evaluation for turf quality and seed yield.

A Different Kind of Hybrid

Seed-propagated hybrids of the tetraploid bermudagrass, *C. dactylon* (2n = 4x = 36), have been considered for many years. G. W. Burton and co-workers and A. A. Baltensperger and co-workers have published possible methods for producing such hybrid varieties. C. M. Taliaferro and co-workers developed the variety GUYMON, where the initial seed crop was from two clones producing an *intra*specific F_1 hybrid. The F_1 seed (first generation) was planted and subsequently harvested to produce an F_2 (second generation), which is essentially a synthetic variety derived from the F_1 hybrid.

The FMC-66 and FMC-88 varieties are F_1 *intra*specific hybrids that are seed propagated. That is, both parents are of the same species, *C. dactylon*. They differ from the *inter*specific hybrids, where two different species of *Cynodon* are used as parents in each cross (Figure 1). These generally are sterile, producing little or no seed, and are vegetatively propagated. Examples of *inter*specific hybrids are TIFWAY, TIFGREEN, MIDIRON, and SANTA ANA.

FMC-66 and FMC-88 were developed in 1991 by Farmers Marketing Corp. (FMC) at the New Mexico State University (NMSU) Leyendecker Plant Science Research Center near Las Cruces, New Mexico. These F_1 *intra*specific hybrids were derived from clones of progeny plants developed by conventional plant breeding and selection using domestic and foreign plant material. Only F_1 seed will be produced and marketed. Seed was harvested from these hybrids and other similar crosses in November of 1991 and immediately evaluated in the greenhouse. These hybrids were strikingly more dense and finer textured in greenhouse and sub-

*A copy of the Progress Report 1993 for this test can be obtained by writing to: Kevin Morris, National Program Coordinator, National Turfgrass Evaluation Program, Beltsville Agricultural Research Center – West, Building 002, Room 013, Beltsville, MD 20705.

Figure 1

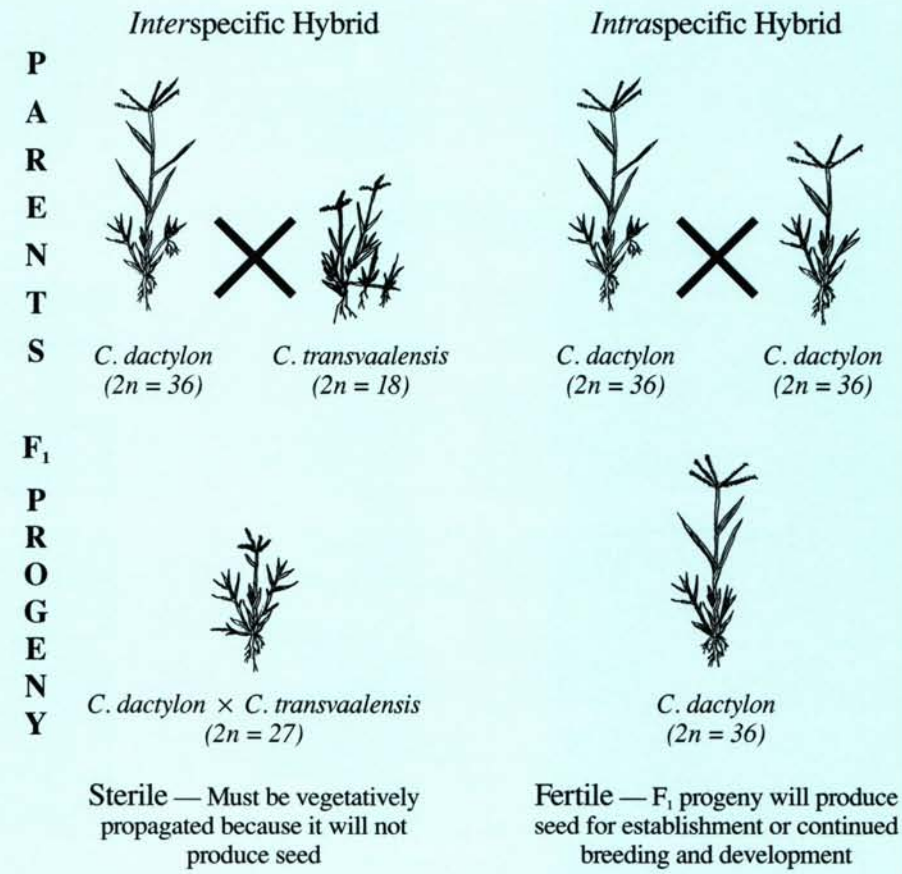


Table 1
Seed-Propagated Bermudagrasses Entered in the National Turfgrass Evaluation Program in 1986 and 1992†

1986	1992
*COMMON	*COMMON
*GUYMON	*GUYMON
*NM S-1 (NuMex SAHARA)	*NuMex SAHARA
NM S-3	*SONESTA
*NM S-2	*CHEYENNE
NM S-4	*SUNDEVIL
NM S-14	J-27
	J-912 (JACKPOT)
	FMC 1-90 (PRIMAVERA)
	FMC 2-90
	FMC 3-91
	FMC 5-91
	FMC 6-91 (SULTAN)
	90173 (MIRAGE)
	OKS 91-1
	OKS 91-11

† The 1986 test also included 21 vegetatively propagated genotypes for a total of 28 entries. The 1992 test included 10 vegetatively propagated genotypes for a total of 26 entries.

*Commercially available varieties.

sequent field experiments than other multi-clone synthetic varieties. Both of these new hybrids appear to have good specific combining ability for the selected morphological characteristics and have moderate seed yield potential.

Basis for Hybrid Designation of These *Intra*specific Varieties

Self-sterility, also referred to as self-incompatibility, is basic to producing a high percent of hybrid seed relative to self-pollinated seed. A high amount of cross-fertility is also desirable for seed set. Self-fertility studies conducted on bermudagrass indicate that this characteristic varies considerably from one clone to another. However, most clones tested have exhibited self-fertility of one or two percent expressed as seed set compared to cross-fertility 20 to 30 times greater. In a field isolation study at Las Cruces, New Mexico, the four parental clones involved in FMC-66 and FMC-88 set few seed when self-pollinated, but had moderate seed set when allowed to cross-pollinate. Seed set measured while producing the two hybrids was approximately 40 percent of the amount measured for the multi-clone synthetic variety NuMex SAHARA.

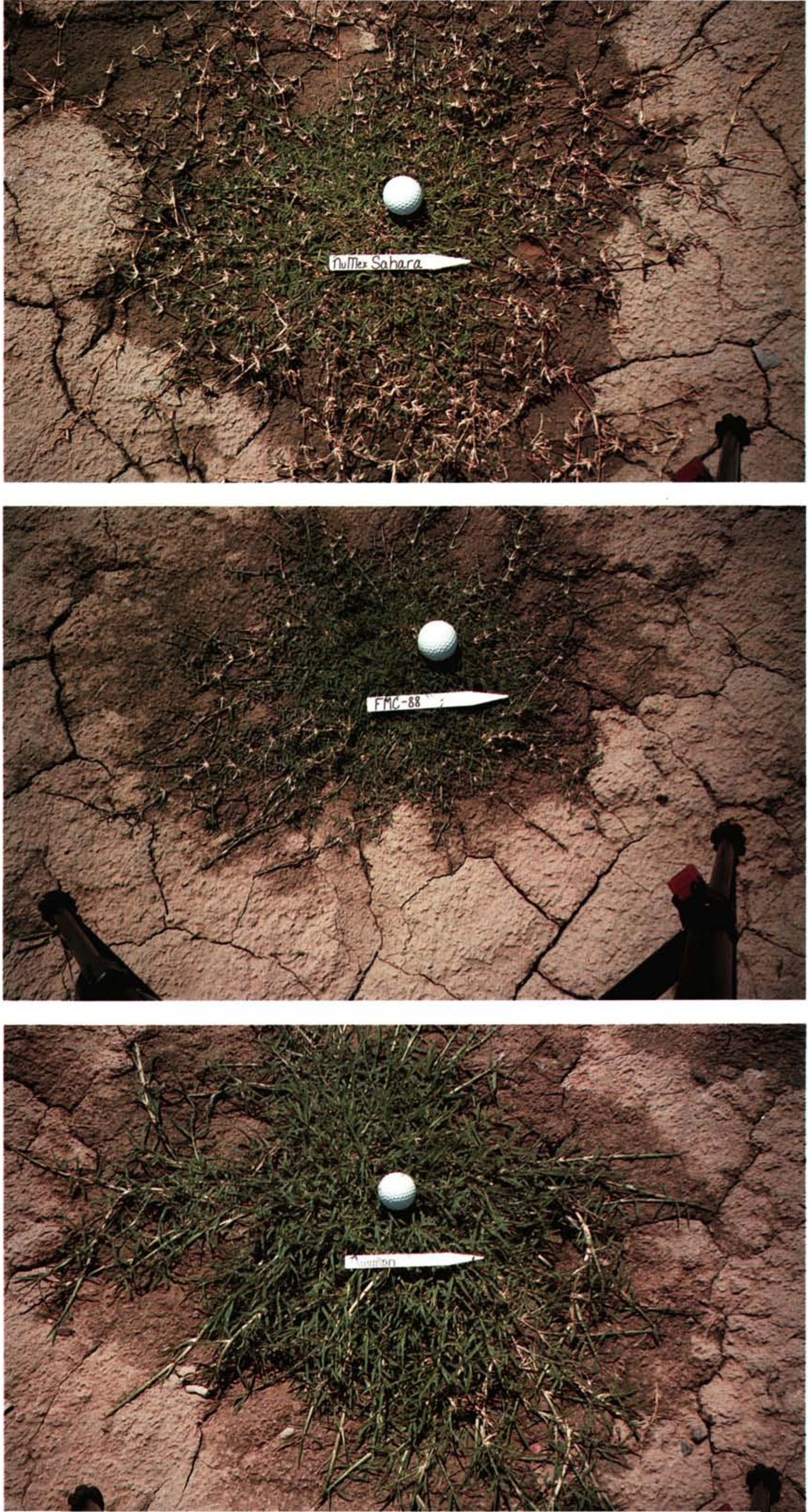
Germination and Seedling Vigor

Germination and seedling vigor are often lower for seed of selfed plants (S_1 seed) compared to F_1 hybrid seed. In this case, S_1 seed from the four clones tested had considerably lower germination and reduced seedling vigor compared to hybrids. These results suggest that the selfed seedlings would not compete well with the hybrid seedlings in solid stands. Also, the S_1 seedlings tended to be as fine or finer textured and less vigorous relative to the hybrids and presumably would not detract from turf quality.

Uniformity of Turf from These Hybrids

Uniformity of the resulting turf is important for most turfgrass uses. Since the parent clones are heterozygous, there is genetic and morphological variability among the F_1 hybrid plants. The amount of morphological variation among plants may depend primarily on the gene differences between the parent clones for such attributes as leaf length and width, shoot elongation rate, internode length, and other characteristics. Therefore, uniformity within seed lots of an *intra*specific hybrid would not be expected to be as high as an *inter*specific hybrid, such as TIFWAY, since the latter was vegetatively propagated from a single plant.

However, FMC-66 and FMC-88 have been found to be very uniform morphologically even when individual progeny are evaluated in field plots. This high uniformity likely results from the previous development



Growth differences in bermudagrass varieties is evident only 45 days after transplanting.

Table 2
Summary of Turfgrass Performance of Four Hybrids, Three Synthetic Varieties, and Common Bermudagrass in Trials Conducted at Yuma, Arizona; Gainesville, Florida; and Las Cruces, New Mexico

	Quality			Density			Texture		Color	
Entry	AZ[1]	FL[2]	NM[3]	AZ	FL	NM	FL	NM	AZ	NM
FMC-66	7.8	5.9	8.0	8.3	6.0	8.5	4.0	7.5	6.9	7.5
FMC-88	7.5	6.7	7.7	8.3	6.3	8.0	3.7	7.0	7.0	7.5
TIFWAY	—	6.5	8.2	—	6.7	8.2	4.0	7.7	—	8.1
TIFGREEN	—	6.3	7.6	—	6.9	8.3	5.0	8.7	—	8.0
SULTAN	6.5	—	7.4	6.9	—	7.3	—	6.8	6.1	7.1
NuMex SAHARA	5.9	4.3	6.9	6.3	4.9	6.7	1.0	6.7	5.5	7.3
CHEYENNE	5.3	4.1	5.0	5.6	4.2	4.5	1.0	4.5	5.8	5.3
COMMON	4.8	4.8	4.9	5.0	4.8	4.7	1.3	5.5	4.5	6.3
LSD (P-0.05)	0.5	1.3	0.7	0.5	1.8	0.7	0.6	0.9	0.4	0.9

[1] Mean performance for two years at Yuma, AZ. Means were derived from three-replicate tests and 10 observation days from fall 1992 and spring 1994.

[2] Mean performance during 1994 at Gainesville, FL. Planted: October 1993. Data supplied by Dr. A. E. Dudeck, University of Florida, Gainesville, FL. MSD used instead of LSD for test of differences.

[3] Mean performance at Las Cruces, NM, in 1993. Means derived from three-replicate test.

NOTE: All plots were rated from 1 to 9, with 9 indicating highest quality, most dense, finest texture, and darkest green color, except texture ratings at Florida were 1 to 5, with 5 being most fine. Dash (—) indicates variety was not included in the test.

Table 3
Morphological Comparison of Three Hybrids, Three Synthetic Varieties, and Common Bermudagrass at Las Cruces, NM, in 1994*

Entry	Leaf Width mm	Leaf Length mm	Leaves/ Stem number	Leaf Density** number	Stem Diameter mm
TIFWAY	1.65	19.1	25.2	4.4	0.99
FMC-66	1.84	24.3	34.7	3.9	0.99
FMC-88	2.06	17.7	20.4	3.3	1.00
SULTAN	2.58	29.2	24.4	2.8	1.12
NuMex SAHARA	2.79	34.7	19.3	2.0	1.16
COMMON	2.80	51.4	17.4	1.7	1.03
GUYMON (Syn 2)	2.91	37.6	13.2	1.8	1.31
LSD	0.09	2.2	10.6	0.3	0.06

*Data from 90 individual plants (30 plants in each of three replications) established from seed, except for TIFWAY, where 90 vegetatively propagated plants were evaluated.

**Mean number of leaves per centimeter on first five nodes of stem measured from apical leaf.

ment and selection of parent clones that resulted in similar genetic backgrounds.

Genetic control for the seed crop of *intra*-specific hybrids is enhanced over synthetic varieties with proper establishment, isolation, and maintenance of the two distinct parent clones. The F_1 seed harvested in subsequent years will be genetically identical since only F_1 seed will be produced.

Performance Results

Although these hybrids were not included in the *National Bermudagrass Test – 1992*, field evaluations have been conducted at several locations. Results indicate these hybrids produce a turf with significantly higher density and finer texture than the current generation of improved open-pollinated or multiclone synthetic seeded varieties. Both F_1 hybrids, FMC-66 and FMC-88, are more dense and have scored higher for turf quality than multiclone synthetic varieties in experiments at three locations across the United States (Table 2).

Additional performance data have been collected to better describe the two new *intra*specific hybrids and to compare them

Breeding Terminology

F_1	The first filial generation. The first generation of descent from a given cross or mating.
F_2	The second filial generation from a cross, such as the offspring from intercrossing F_1 plants.
Intraspecific hybrid	Progeny resulting from a cross of two individuals of the same species, such as *Cynodon dactylon* × *C. dactylon.*
Interspecific hybrid	Progeny resulting from a cross of two individuals of different species, such as *C. dactylon* × *C. transvaalensis.*
Clone	Identical organism descended asexually from a single ancestor, such as a vegetative stem or stolon of bermudagrass.
Progeny	Descendants or offspring from a mating or cross.
Hybrid	Offspring of genetically dissimilar parents (as members of different breeds or species).
Synthetic variety	Population of cross-pollinated plants or resulting seed from combining selected clones or lines.

with named seeded varieties and to the *inter*specific hybrid TIFWAY. Leaf and stem characteristics, including leaf density, of 90 spaced plants of each genotype indicate large morphological differences among varieties (Table 3). These quantitative data along with visual scoring should help users better choose a variety for their needs.

Possibilities — Present and Future

*Intra*specific F_1 hybrids (2-clone single-crosses) that are seed propagated, such as FMC-66 and FMC-88, provide additional varieties for specific environments and uses. Although less dense or "open" varieties, such as NuMex SAHARA, are often scored lower for turf quality, they may be the variety of choice for specific situations where drought resistance and lower density are desired. GUYMON, although coarser textured, should be considered where winter killing is a problem. An *intra*specific F_1 hybrid, such as FMC-66, with high density and fine texture may be the choice where better ball support for golf is desired.

Perhaps the most significant "bottom line" is that bermudagrass breeders are investigating new methods and providing users with more choices in seed-propagated bermudagrasses.

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