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gen escaping into the groundwater supply. Also, very little irrigation would be needed as well as little mowing.

"It also affords a different color and texture than the fairways."

For the fairways, Hurdzan used a bluegrass blend of about 15 percent Mystic, 15 percent Bensun, 15 percent Touchdown, 25 percent Ram I, 15 percent Jamestown chewings fescue and 15 percent Prelude ryegrass. This blend, too, is high in nitrogen and conserves water. The far rough areas are planted with wildflowers and sheep fescue.

Other water conserving areas were driveways being drained into a central pond and ornamental grass windbreaks such as Chinese silver grass, fountain grass and love grass.

"The time a golf course uses the most water is when it's being established," says Hurdzan. "New plants need a lot of water to grow. It's not uncommon to irrigate eight to 10 times a day. To conserve in this area, we use a straw mulch. It's expensive, as much as $500 an acre, but again, the benefits can be felt down the road—less erosion and water conservation benefits.

"Water conserving elements add initially more cost to a project, but the money is recouped later," concludes Hurdzan. "It's important to find clients who feel a certain stewardship to the earth."

Dr. Michael Hurdzan, *president of the American Society of Golf Course Architects, and partner in Kidwell & Hurdzan Inc., Columbus, OH.*

Golf Course Superintendents Association of America

The 5,000-member Golf Course Superintendents Association of America has been "aware of an impending crisis" for quite some time, according to President Jim Timmerman of Orchard Lake Country Club, Orchard Lake, MI.

"With the rate of new courses being built in the South and Sunbelt states, the water situation can only get worse," says Timmerman.

That crisis could come as quickly as within the next 10 to 15 years.

"When a water crisis does occur, one of the first industries to go will be recreational," predicts Timmerman. "We (golf courses) don't want a bad guy image. Golf courses are beneficial to the environment even in as much as they provide oxygen in the air."

The GCSAA has always supported turf research, ranging from $25,000 to $35,000 a year to various programs and researchers. They finally decided to put their resources into one, three year program under Dr. William Torello of the University of Massachusetts. He is doing tissue culture and genetic work leading to genetic manipulation of turfgrass cultures.

"We (irrigation industry) will probably be targeted first for any type of restrictions."

—Baron

Regional golf course superintendents' associations are also lending a hand.

The membership of Baltusrol Golf Club in Springfield, NJ, felt so strongly about the need for research that each member will donate $2 annually to the USGA Turfgrass Research Program.

"Hopefully, other clubs will see the same need," said Timmerman.

Members of the USGA Research Committee *are from left, Dr. Paul Rieke, of Michigan State University; James G. Prusa, GCSAA associate executive director; George M. Bard, USGA Executive Committee; Alexander M. Radko, USGA (retired); Monty Moncrief, Athens, GA; Dr. James R. Watson, vice president, Toro; Charles W. Smith, Club Managers Association; Dr. Marvin Ferguson, Texas A&M University; and William Bengeyfield, national director, USGA Green Section and chairman of the Research Committee.*

Irrigation Association

The Irrigation Association, headquartered in Washington, D.C. represents more than 1,000 irrigation equipment manufacturers, distributors, contractors and technical personnel involved in specialized irrigation.

They have put their effort into lobbying before Congress for tax incentives for those who convert to more efficient-type irrigation systems, thus conserving water.

Tom Schiltz of the Irrigation Association doesn't hold out much hope, though, at least with the Reagan administration.

"Basically this isn't going to happen with the current administration's stance on tax reform. It would never even entertain the idea of the kind of incentives we're talking about," Schiltz said. "There is a big problem ahead and if we (this industry) don't take care of it ourselves, the government will." **WT&T**

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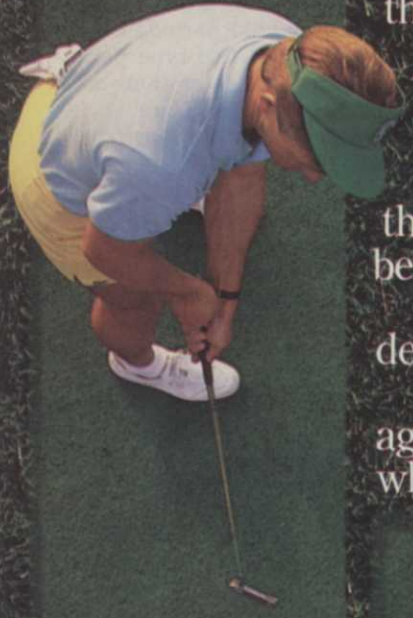

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Landscape Managers' Guide to:
Tall Fescues

by William A. Meyer, Turf Seed, Inc., Hubbard, OR

Tall fescue (*Festuca arundinacea* Schreb.) is becoming increasingly popular as a turfgrass in many areas of the United States. This species has been a very important grass for forage, roadside stabilization and erosion control for many years.

The increased demand for tall fescue for turf has resulted from escalating energy costs to produce fertilizers and pesticides, and water shortages in many areas, especially in the southwestern U.S. Compared to other cool-season grass species, tall fescue is unique due to its deep root system for drought tolerance or avoidance, the ability to persist at reduced soil fertility, and reasonably good tolerance to many pests.

The release of new lower-growing tall fescues starting in the late 1970's has increased the interest in tall fescues for turf.

Origin and history

Tall fescue is a native of Europe and is found throughout Europe, in Asia, eastern and southern Africa, Madagascar, southern Australia, New Zealand, and in large areas throughout the United States. It tolerates a variety of geographic and climatic conditions, which explains its wide range of adaptation.

This species, now found in most of the 50 states, was introduced in the early 1800's. Because of its morphological resemblance to meadow fescue, it was not classified as a distinct species until 1950, even though it was already being widely used for forage, conservation and roadsides.

The utilization of tall fescue increased a great deal with the development of the first improved cultivars from naturalized American tall fescues. Harry Schoth of Oregon State University developed and released Alta in 1941. Kentucky 31 (KY-31) was developed and released by the University of Kentucky in 1943. Both KY-31 and Alta were developed primarily as forage grasses, but have been used as turfgrasses.

By the 1960's, tall fescue was being recommended for turf by the state of Tennessee because of its wide adaptation to variable soil pH, rainfall and sunlight.

Until recently, KY-31 has been the most widely used and recommended cultivar for turf, especially in the transition zone of the United States, where other cool-season grasses are not well-adapted and the warm-season grasses are sometimes killed by the cold. This transition zone includes an area south of central Illinois, east of Topeka, KS, north of Macon, GA, and west of the Atlantic coastal plain of the Carolinas. Both Alta and K-31 have been used in the southwestern U.S., especially in California and at higher elevations in Arizona and Nevada.

KY-31 has produced a better turf quality than Alta in most turf trials. In the transition zone the common practice for turf managers is to reseed KY-31 lawns each year to maintain denser stands.

Growth characteristics

The tall fescues live up to their name when they are allowed to produce seedheads, growing as tall as 4-5 feet.

Tall fescue is basically a bunchgrass, but limited rhizomes can be seen on certain plants, especially when they are grown in light, sandy soils. Breeding work is in progress to develop varieties with increased rhizome production. Thick stands of the present varieties can produce a tough sod if sufficient time is given for a mature turf.

In many northern lawns of Kentucky bluegrass, tall fescue can be a severe weed problem when single, coarse clumps are scattered in a turf area. The leaf blades of KY-31 and other common-type cultivars are generally a light-green color and coarse, with a harsh feel to the hand. Individual plants can be found in old turf stands that are finer-bladed with a softer texture and a reduced vertical growth rate when compared to KY-31.

Most breeding programs to develop improved turf-type varieties have been based on selections from old turf areas that have the ability to develop a denser, finer-bladed turf with improved persistence. The tall fescues usually slow up their growth and go dormant during cold periods earlier than the improved turf-type perennial ryegrasses and later than most Kentucky bluegrasses. Their spring green-up rate is also intermediate to these other two species.

Breeding turf-types

The main disadvantage of KY-31 and other older tall fescue varieties is they produce a coarse open turf with a light green color. Dr. C. Reed Funk initiated a breeding project at the New Jersey Agricultural Experiment Station to develop tall fescue cultivars for turf purposes. Other breeding programs were started in the 1970's with some programs as cooperative breeding projects with Funk.

Rebel was the first turf-type released from the above programs, followed by Falcon and Olympic. The varieties have leaves approximately 30-40 percent finer than KY-31 and densities of tillers almost twice KY-31. They all have a darker blue-green color than KY-31 with improved persistence in turf. They also have improved disease resistance compared to KY-31.

In most turf trials at both high and low maintenance these new varieties have shown superior turf performance. Other turf-type varieties that have shown improved turf performance over KY-31 are Bonanza, Adventure, Jaguar, Apache, Arid, Mustang, Houndog and Finelawn I. It is interesting to note that some of the later maturing varieties (in seed production) such as Jaguar, Adventure, Bonanza and Apache have generally given superior turf performance than earlier maturing varieties. The varieties Bonanza and Apache possess the darkest genetic blue-green color of the present varieties, followed by Mustang and Olympic.

Disease resistance

The most common and serious disease of tall fescues are Rhizoctonia brown patch and net blotch (*Hel-*

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minthosporium leaf spot). Other diseases occur, but not as widespread as these two.

Net Blotch Under cool cloudy and wet conditions net blotch caused by *H. dictyoides* Drechs. can be found on tall fescues whereever they grow. In western Oregon this disease is especially severe on seedlings when mowing and traffic occurs during the establishment period. The symptoms are net like patterns of streaks of dark brown tissue on the leaves. When the disease is severe the leaves turn yellowish-brown and die back from the tips. The varieties Bonanza, Mustang, Jaguar and Olympic have shown the best resistance to this disease to date. Breeding programs in New Jersey and Oregon have shown that field selection in space plants can be used effectively to develop more resistant varieties.

Brown Patch Brown patch caused by *Rhizoctonia solani* Kuhn is a very serious disease of tall fescue. This disease is most severe under hot and humid conditions when the turf is subjected to long wet periods. High fertility, close mowing and poor air circulation increases the severity of this disease. Breeding programs to develop cultivars with increased brown patch resistance have been promising to date. Among the new turf-type varieties, Adventure, Jaguar and Bonanza have shown the best resistance to date. Many of the cultivars from Europe and the varieties Alta, Goar and Fawn have been damaged more severely than KY-31 or the new improved turf-type cultivars.

Brown patch can also become more severe when drought stress precedes humid conditions favoring disease development. Varieties that have improved resistance to drought stress generally show less damage from this disease.

Some varieties are able to recover from brown patch injury better than others. Most varieties recover very rapidly as soon as cool, favorable growing conditions occur. Breeding programs are in progress to develop higher levels of brown patch resistance in new varieties of tall fescue.

Adding five percent by weight of Kentucky bluegrass to a tall fescue turf has shown promise to reduce the development of brown patch. Care must be taken to select bluegrass varieties with only moderate aggressiveness to prevent crowding out of the tall fescue by bluegrass.

It is interesting to note brown patch is not as serious a problem in arid areas of the Southwest as in the transition zone.

Pythium Blight Various species of pythium can destroy seedlings or mature turf of tall fescue when weather conditions are similar to those favoring brown patch. This disease, called Pythium blight, is usually most severe in poorly drained areas and can rapidly deteriorate turf quality if conditions for disease activity persist for more than a short period.

Koban or Apron fungicides are effective to control Pythium blight as seed treatments. A change in weather conditions to cooler temperatures and reduced humidity will usually halt the development of this disease.

The level of resistance in the present cultivars is questionable considering the number of pythium species involved. Adventure and Falcon had somewhat less disease in a New Jersey trial in 1983.

Crown Rust During cool spring and fall periods crown rust caused by *Puccinia coronata* cda. can occur on tall fescues in many areas of the U.S. The yellow orange pustules are urediospores of this fungus and in the late fall the crown-like teliospores (hence the name) can occur. Tall fescue is generally more resistant than meadow fescues. Progress has been made in selecting varieties with improved resistance in Western Oregon. Alta and Fawn are quite susceptible while KY-31 and most of the new turf-types are quite resistant.

Powdery Mildew Some of the new turf-type varieties which develop very dense leaf canopies in seed production fields have been found to be susceptible to powdery mildew. This disease is usually restricted to the dense center parts of each plant that is severely shaded. It appears that most of the present varieties can be affected when excessive foliage is produced in the springtime. From space plant observations it appears that breeding for improved resistance to this disease is possible. Powdery mildew has not been noted in shade trials to date.

Heat, drought tolerance

Tall fescue is a very deep rooted species which helps to tap water resources deeper in the soil profile than the other cool-season species. In Nebraska studies by Kopec and others, in two-inch mowed turf they found roots of the new turf-type varieties 48-inches deep and roots of KY-31 54-inches deep. It is encouraging to see that the roots of these denser and fine textured varieties are maintaining rooting depth comparable to the more open and coarser KY-31.

In 1981 studies in western Oregon, the varieties Olympic and Falcon were still maintaining 80 percent or more green color after 70 days of drought compared to 67 percent for hard fescue, 32 percent for chewings fescue, 44 percent for creeping fescue, 40 percent for perennial ryegrass and 16 percent for Kentucky bluegrass.

In water use studies the tall fescues have been found to have a higher water loss rate that most other warm season grasses and some of the cool season species. This high water loss rate has a beneficial cooling effect during heat stress periods as long as the roots can reach available water reserves.

Most of the present varieties of turf-type tall fescues have shown similar response to drought and heat stress to KY-31. Attempts to develop an extremely dwarf and fine variety (similar in texture to turf-type perennial ryegrass or Kentucky bluegrass) have resulted in problems with reduced drought and heat stress and increased disease problems. These very fine and dwarf clones are being crossed with well-adapted varieties with higher levels of summer disease resistance.

Extreme soil conditions

Tall fescues are able to grow on a wider range of soil conditions than other cool season species. The new turf-type varieties are able to maintain much better density at low fertility than KY-31 at low fertility. The darker colored varieties are more striking at low fertility levels.

Tall fescues have above average tolerance for acidic, alkaline, saline and poorly drained soils. In California trials the varieties Olympic and Jaguar showed improved resistance to iron chlorosis than other varieties.

Shade tolerance

Many of the new turf-type varieties, especially those with improved net blotch resistance, have shown improved shade tolerance over KY-31. All of the varieties become finer and softer in shade, which makes tall fescue more compatible in mixtures with other species.

In shade situations, the tall fescues can be found very far south because of the cooling effects from the shade.

Cold tolerance

In trials on the high desert of eastern Oregon the tall fescues have shown very good cold tolerance in space plantings when compared to all of the perennial ryegrasses over four winters. In New Jersey, Pennsylvania and Rhode Island the well-adapted varieties have suffered winter damage under severe ice sheet conditions. The cold hardiness of tall fescues is reduced when they are heavily fertil-

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Tall Fescue Varieties

A brief description of the tall fescues presently available or becoming available in the near future.

Adventure tall fescue was developed by Pure-Seed Testing, Inc. of Hubbard, Oregon. It will be distributed by Warren's Turf Nursery. Adventure is an advanced generation synthetic variety derived from selections from old turf areas in the northeastern U.S. It has performed very well in turf trials throughout the U.S. both in full sun and partial shade. Adventure is an attractive, vigorous, leafy, turf-type variety with a medium dark green color, medium-fine leaf texture and good density. It has shown greater vigor and better color at low fertility levels than other tall fescues currently available. Adventure has good resistance to Rhizoctonia brown patch and moderate resistance to net blotch disease. Seed became available in 1983.

Alta tall fescue was developed by the Oregon Agricultural Experiment Station with the cooperation of the Agricultural Research Service of the United States Department of Agriculture. It was released in 1940. Plants were selected out of two introductions from Germany and one commercial seed lot on the basis of improved winter survival, ability to remain green during dry summers in western Oregon, high forage yields, and ability to persist. Alta has heen used extensively for turf in California. It produces a rather coarse, upright turf of moderately low density and rapid leaf elongation. Alta has shown above average susceptibility to net blotch and Rhizoctonia brown patch in turf trials and crown rust in western Oregon. Alta is a commercially available variety.

Apache tall fescue is a new, moderately low growing turf-type variety with a dark blue-green color when compared to most other varieties. This variety was developed by Pure-Seed Testing, Inc. and will be marketed by Turf-Seed, Inc. It is an advanced generation synthetic variety derived from selections from old turf areas in New Jersey, Georgia and Illinois. Apache has shown moderately good resistance to net blotch, brown patch and very good resistance to crown rust. It has shown good density and a medium-fine texture with a reduced rate of leaf elongation. It has shown good traffic, heat and drought tolerance in trials to date and good color retention at low fertility. Commercial seed will become available following the 1984 harvest.

Astro tall fescue is a new, moderately low growing variety developed by Pure-Seed Testing and marketed by Green Seed Co. It is an advanced generation synthetic variety developed from parental clones selected from old turf in North Carolina, Illinois and New Jersey. This variety has a medium dark green color with medium texture and density. Astro has shown moderately good resistance to net blotch, crown rust and brown patch and good heat, cold and drought tolerance and good persistence in turf. Commercial quantities of seed will be available after the 1984 harvest.

Bonanza tall fescue is a new, low growing turf-type developed by Pure-Seed Testing, Inc. and marketed by Cenex, Inc. This variety is a 3-clone synthetic derived from germplasm from New Jersey and Georgia. This variety has a very dark blue-green color when compared to other tall fescues and has a dwarfer, slow leaf elongation rate compared to other varieties. Bonanza has very good resistance to brown patch, net blotch and crown rust. The wear, drought, heat and cold tolerance of this dense variety has been very good in trials to date. It has shown good color retention at low fertility and will be available in very limited quantities after the 1984 harvest

Brookston was developed by North American Plant Breeders and International Seeds, Inc. It is produced and marketed by Stanford Seed of Buffalo, New York. Brookston is a leafy, moderately low growing turf-type tall fescue with a medium dark green color, medium texture and medium density. It is reported to have improved low temperature hardiness. Brookston has very good resistance to net blotch and crown rust. It has shown reduced summer stress tolerance. Limited amounts of seed became available following the 1983 harvest.

Clemfine was developed and released by the South Carolina Agricultural Experiment Station and Loft's Seed, Inc. It originated from germplasm selected from old turfs located in the southeastern United States. Clemfine has a medium green color, coarse texture, and a medium-low density. It has moderatley good resistance to Rhizoctonia brown patch, but only fair resistance to net blotch. Clemfine closely resembles Kentucky 31 tall fescue in many characteristics, but has generally shown improved performance and increased persistence in turf trials. Seed of Clemfine became available after the 1982 harvest.

Falcon tall fescue was developed cooperatively by Pure-Seed Testing, Inc. and E. F. Burlingham & Sons from germplasm obtained from the New Jersey Agricultural Experiment Station. The first certified seed was produced in 1980. Falcon is a leafy, moderately low growing, turf-type variety. It has the ability to produce an attractive, more persistent turf with finer texture and higher density than most of the currently available varieties of tall fescue. It has improved resistance to brown patch, crown rust and net blotch.

Fawn was developed at the Oregon Agricultural Experiment Station and released in 1964. It produces high seed and forage yields in the Willamette Valley where it shows greater height and vigor in early spring and earlier maturity than Alta or Kentucky 31. Fawn produces a coarse, open turf with a rapid rate of leaf elongation. It is susceptible to net blotch and Rhizoctonia brown patch diseases in New Jersey turf trials and to crown rust in western Oregon. Fawn also appears to be less winter hardy and less tolerant of adverse summer conditions than Kentucky 31.

Finelawn I is a new moderately low growing turf-type variety developed by Pure-Seed Testing, Inc. and marketed by Finelawn Lawn Research, Inc. of Madison, Georgia. This is an advanced generation synthetic variety developed from clones derived from old turf areas in Alabama, Georgia, Pennsylvania and New Jersey. This variety has shown moderately good resistance to net blotch, brown patch and crown rust. It has shown good drought, heat and cold tolerance. It became commercially available following the 1983 harvest.

Galway was developed by Northrup-King. It is a medium dark green turf-type variety with medium density and a medium coarse texture. The variety has good heat and drought tolerance and improved cold hardiness. It does well in light to moderate shade as well as in full sun. Galway has shown moderate resistance to Rhizoctonia brown patch and net blotch. Galway is a moderately low growing variety intermediate in growth habit between the turf-type varieties and Kentucky-31. Commercial seed production has been initiated.

Goar tall fescue was selected at the Imperial Valley Field Station at El Centro, California and developed in cooperation with the Plant Materials Center, Soil Conservation Service, Pleasanton, California and the California Agriculture Experiment Station. The parental germplasm was obtained from Hungary. It was released in 1946. Goar

continued on page 54

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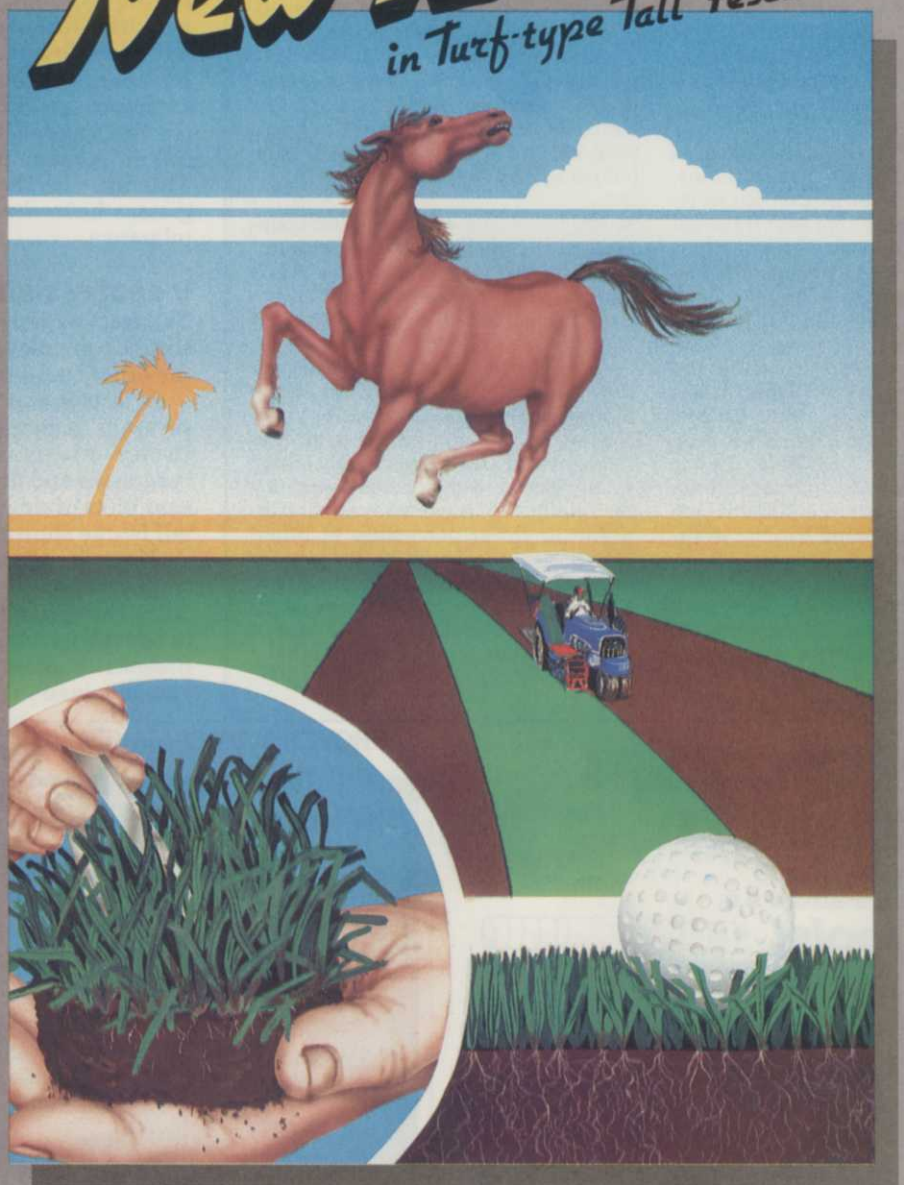

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is an early maturing, vigorous, rather coarse bunchgrass adapted to heavy textured alkaline soils. It is reported to show improved growth during high summer temperatures in California. Goar has performed poorly in turf trials with high susceptibility to Helminthosporium blight and Rhizoctonia brown patch. Goar is reported to be susceptible to crown rust.

Houndog was developed and released by International Seeds, Inc. of Halsey, Oregon. Its parental germplasm originated from plants selected from old turfs in Kentucky and Tennessee plus plants selected from Rutgers and Missouri. Houndog is a leafy, persistent, moderately low growing, turf-type variety with a medium dark green color, medium texture, medium density, and a semi-prostrate growth habit. It has good heat and drought tolerance, performs well in shade and shows good color retention in late fall. Houndog has moderate resistance to Rhizoctonia brown patch and net blotch and crown rust. Seed of Houndog became available following the 1983 harvest.

Jaguar was developed by Pure-Seed Testing, Inc. of Hubbard, Oregon. It will be distributed by Garfield Williamson, Inc. of Jersey City, New Jersey. Jaguar is an attractive, leafy turf-type tall fescue with medium density and texture, a medium dark green color and a moderately low growth habit. It has good heat and drought tolerance, good shade adaptation, and very good color retention with low temperatures in late fall. Jaguar has very good resistance to crown rust, Rhizoctonia brown patch and net blotch. It has done very well in trials Seed became available commercially following the 1983 harvest.

Kenhy tall fescue was developed cooperatively by the Kentucky Agricultural Experiment Station and the Agricultural Research Service of the United States Department of Agriculture. It was released in 1976. Kenhy is a synthetic of eleven 42 chromosome derivatives of annual ryegrass X tall fescue hybrids which were selected for vigor, soft lax leaves, and forage with high moisture content during drought stress. Kenhy has a lower stomatal frequency than Kentucky-31, which may contribute to its lower percentage of rolled leaves, greater palatibility, and greener foliage during summer drought stress. Kenhy produces a rather coarse, moderately open turf with a rapid rate of leaf elongation. It has shown improved

ized and mowed closely.

Traffic tolerance

In our wear trials in western Oregon and the Sports Turf Research Institute in Bingley, England, the new improved varieties such as Falcon, Adventure, Mustang, Olympic and Rebel have been found to have superior traffic tolerance than KY-31 and other common type varieties. The crowns of tall fescue are slightly deeper in the soil profile than perennial ryegrasses. This may be the reason why these grasses have shown improved traffic tolerance.

Insect resistance

Tall fescues generally have better resistance or tolerance to insects than the other cool-season turf species.

In tests in western Oregon billbugs severely damaged many of the Kentucky bluegrasses, perennial ryegrasses and fine fescues. The adjacent plots of new and old varieties of tall fescue showed no damage.

There is a possibility that the endophyte, commonly referred to as *Epichloe typhina*, which has been found to convey insect resistance when it is present in perennial ryegrasses, is also involved in conveying insect re-