

WEEDS TREES & TURF
TURF MANAGEMENT SERIES/PART 1



Fred J. Grant

The Turfgrass Seed Market

The Turfgrass Seed Market

What was once a relatively simple task of selecting turfgrasses for a particular site is now a skill requiring a degree of expertise by turf managers.

As recently as the 1960s, the choices were limited to a few improved public varieties for each type (genus) of turfgrass. Merion Kentucky bluegrass, released in 1950, proved there was an interest in improved (and more expensive) turfgrasses.

Today this interest has developed into an industry valued in excess of \$400 million and a multitude of improved turfgrasses. The monostand is gone. Quite often a fairway, lawn, or athletic field will be seeded with a mixture of three bluegrasses, two or three fine fescues, and two or three perennial ryegrasses. Turf managers consequently need an expanded basic knowledge of turf seed.

This knowledge should include a history of turfgrass improvement, the advantages of certain turfgrasses, the technology of seed production, and trends in variety development. Such information can provide the logic required to make a wise selection for a particular site.

The total of this information would stress anyone's memory, but portions of it can be memorized if the desire is present. To create the desire, one needs only to realize the historical richness of the story. The remainder of the information can be as close as this magazine for reference.

For these reasons, we offer this profile of the turf seed market. We hope it results in a new perspective of improved varieties and the recognition of the effort, dedication, and cooperation of those who developed them.

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Bruce F. Shank

Bruce F. Shank, Editor



THE EARLY YEARS

Although cultivation of grasses for grazing, gardens, and sports dates back thousands of years, nearly all advancement in the turf seed industry has taken place in the last century. Advances in plant genetics, seed production technology, and the commercial attractiveness of the turf seed market have provided the impetus for growth, especially in the last 30 years.

Prior to 1886, when J. R. Olcott created an experimental turfgrass garden at the Connecticut Agricultural Experiment Station at Storrs, most discovery had been in the areas of taxonomy, genetics, and use.

One of Aristotle's students, Theophrastus, is credited with classifying plants into annuals, biennials, and perennials in approximately 300 B.C. The Romans made the first clear distinction between agriculture and ornamental horticulture in their language.

The Renaissance revived interest in formal gardens. Sports such as bowls, golf and soccer were developing from the 1300s (A.D.) to the 19th Century.

In 1694, the Dutch botanist Camerarius proved the sexual nature of plants. In the next century, Carl von Linne' (Linnaeus) improved upon previous methods of classifying living creatures and plants and developed the standard method of classification used today.

During this time, explorers from European countries were establishing the first settlements in the Western Hemisphere. Whether accidental or intentional, seed from European grasses found the North American soil suitable for growth. Settlers, afraid of attacks, preferred to surround themselves with open fields rather than closely spaced buildings and trees. The town green therefore became a characteristic of



Fred V. Grau

The first extension turf specialist in the country at Pennsylvania State University working with Burt Musser. Grau also served as director of the USGA Green Section from 1945 to 1953.

early settlements. Livestock grazed in the green to keep it under control.

During the 1800s, Gregor Mendel, an Austrian monk, created the base for the science of genetics by describing inheritance factors called genes and Dane Wilhelm Johannsen identified the difference between the genetic makeup of an organism and its physical appearance under varied conditions (genotype and phenotype).

At the end of the 19th Century, the turf market was beginning to organize for growth. In addition to Olcott's work in Connecticut, Rhode Island started evaluation plots at its Agricultural Experiment Station. In 1894, the United States Golf Association was formed to encourage the growth and improvement of all phases of golf. In 1883, the American Seed Trade Association was created and the industry of supplying seed to end users was clearly recognized.

As the 20th Century began, interest in turf was present but technology

was not. Little was known about management practices, turf diseases, hybridization of turfgrasses, or even equipment needed to mow. Agriculture was not much further ahead in a technological sense. The engine-driven tractor was still on the drawing boards.

The next 30 years were critical for both agriculture and turf industries. Unfortunately, when many improved agricultural products received protection from the original Plant Patent Act of 1930, no protection was afforded improved turfgrasses. Not for another 40 years did turf seed breeders get commercial protection so that they could recoup their development costs for improved turfgrasses.

By 1930, 13 states had turfgrass research of some type underway. Many of these state programs were established by the recommendation and cooperation of the United States Department of Agriculture and later the USGA Green Section who jointly managed the center of turf research, The Arlington Turf Gardens, located on the present site of the Pentagon. The Green Section was established in 1920, four years after the creation of the Arlington Turf Gardens. The Gardens, later moved to Beltsville, MD, was the central point for collecting and testing turfgrasses from natural stands as well as a testing site for management practices.

The Green Section worked closely with the Arlington Gardens and published much of the research in "The Bulletin", which was published from 1921 to 1933. During that period Dr. John Montieth Jr. served as Green Section pathologist. From 1925 to 1940, Montieth made major contributions to the development of turf fungicides and other management practices.

In 1940, Dr. Fanny Fern Davis became acting director of the Green Section. She helped develop the early use of the new herbicide 2,4-D for turf. Dr. Fred Grau assumed the directorship in 1945 and served until 1953 when USGA changed the scope of the Green Section.

Another major organizational factor in the development of turfgrasses and turf management was the National Association of Greenskeepers of America, formed in 1926. Today known as the Golf Course Superintendents Association of America, the group was formed largely by the organizational efforts of John Morley, superintendent of Youngstown Country Club, Youngstown, OH; Robert E. Power, green chairman at Westwood Country Club, Cleveland, OH.; and Fred Burkhardt, greenskeeper at Westwood. They helped organize a meeting of representatives of greenskeeper associations from New



Joseph Valentine
Superintendent of Merion Golf Club near Philadelphia who discovered Merion bluegrass on his course in 1936.

determine the cost of production as compared to the price of the seed on the market.

Merion was considered a poor seed producer, but it offered the special advantage of resistance to leaf spot, powdery mildew and stripe smut. A high price was set to cover production costs and the market was willing to bear it. Poor seed production is considered less than 400 lbs. per acre.

Hundreds of candidates for new grasses are under evaluation by universities and seed companies. Few of these will pass the seed production test. Compromising certain qualities for seed production ability is sometimes necessary.

While turf research began in the United States in 1885, the actual release dates of some of the earlier selected turfgrasses were: Merion Kentucky bluegrass - 1950; Illahee creeping red fescue - 1950; Meyer zoysiagrass - 1951; Tiflawn ber-



Jesse A. DeFrance
Director of the turf program at Rhode Island during the 40's and 50's. His work involved bentgrasses and tall fescues.

England, Michigan, Philadelphia and western Pennsylvania which led to the formation of NAGA. GCSAA has proceeded to make major contributions to turf management during its 54 years of service.

The method used to find improved turfgrasses into the 1940s was the search of golf courses, parks, and any other turf area for stands of

grass which exhibited superior appearance, disease resistance, shade tolerance, etc. They were natural selections to common turfgrasses. The most famous turfgrass discovered this way, and the grass that made the market boom, was Merion, found on Merion Golf Club near Philadelphia by golf superintendent Joe Valentine in 1936.

The USGA Green Section and GCSAA encouraged golf course superintendents to search their course for stands of naturally selected turfgrasses. These grasses were those which persisted and developed under conditions of low mowing, periodic fertilization, shade, irrigation, and other conditions found on golf courses. Ben Warren, founder of Warren's Turf Nursery in Chicago, and university turf specialists such as Fred Grau, Jesse de France, and Glenn Burton travelled extensively looking for naturally selected turfgrasses in golf courses, parks and cemeteries. From these searches the original genetic base was established.

These collections were evaluated for characteristics desired of turfgrasses; color, leaf coarseness, disease resistance, drought tolerance, low mowing, and fertilizer requirements. Once a grass was identified as promising, its seed producing ability had to be judged to



John Morley
The first president of the National Association of Greenskeepers of America in 1926. Today the group is known as the Golf Course Superintendents Association of America.

mudagrass - 1952; Penncross bentgrass - 1954; and NK100 perennial ryegrass - 1962.

Although important advances in breeding turfgrasses took place in the 1930s, few if any hybridized turfgrasses reached the market by 1960.

History of State Turfgrass Research Programs

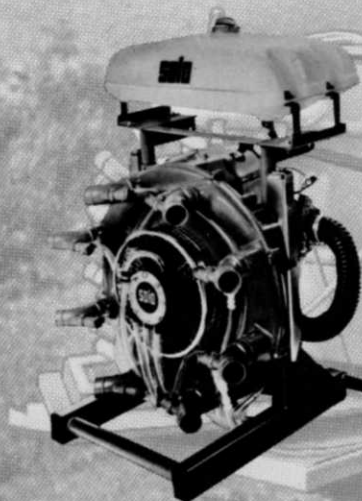
State	Turf research initiated	First turf grass conf.	Location	Early investigators
Alabama	1927	1960	Auburn Univ.	D. G. Sturkie
Alaska	1950	None	Univ. of Alaska	H. Hodgson, A. Kallio, A. Wilton, R. Taylor, L. J. Klebesadel
Arizona	1949	1953	Univ. of Arizona	S. Fazio, J. Folkner A. Baltensperger
Arkansas	1959	None	Univ. of Arkansas	A. M. Davis
California	1951	1951	Univ. Cal., Davis	L. Currier, R. Hagan
	1948	1949	Univ. Cal., Riverside	V. Stoutemeyer, P. Miller, R. E. Endo
Colorado	Early 1940's	1954	Colo. State Univ.	G. Beach, J. FuIts
Connecticut	1885	None	Univ. of Connecticut	J. B. Olcott
Delaware	1965	1968	Univ. of Delaware	W. Mitchell, C. Phillips
Florida	1945	1953	Univ. of Florida	R. Bair, G. Nutter
Georgia	1946	1946	Tifton, Georgia	G. W. Burton
Hawaii	1963	1965	Univ. of Hawaii	R. Voss, D. Watson, W. McCall
Idaho	None	None	Univ. of Idaho	None
Illinois	1934	1960	Univ. of Illinois	A. Lang, J. Pieper, F. Weinard
Indiana	1942	1937	Purdue Univ.	M. Clevitt, G. Hoffer, G. Mott
Iowa	1931	1932	Iowa State Univ.	V. Stoutemeyer, H. Lantz, S. Edgecomb, E. Roberts
Kansas	Late 1920's	1950	Kansas State Univ.	J. Zahnley, L. Quinlan
Kentucky	1948	None	Univ. of Kentucky	E. Fergus, J. Spencer
Louisiana	1960	1963	Louisiana State Univ.	T. E. Pope
Maine	1958	1962	Univ. of Maine	R. Struchtemeyer
Maryland	1931	1928	Univ. of Maryland	R. Thomas, E. Cory, E. Deal
Massachusetts	1927	1931	Univ. of Massachusetts	L. Dickinson
Michigan	1929	1930	Michigan State Univ.	R. Cook, J. Tyson, M. McCool
Minnesota	1936	1964	Univ. of Minnesota	H. Hayes, H. Schultz
Mississippi	1956	1960	Mississippi State Univ.	C. Johnson, L. Wise
Missouri	1910	1960	Univ. of Missouri	J. Whitten, E. Brown
Montana	1920's	None	Montana State Univ.	None
Nebraska	1927	1963	Univ. of Nebraska	F. Keim, F. Grau
New Hampshire	1961	1965	Univ. of New Hampshire	L. J. Higgins
New Mexico	1954	1955	New Mexico State Univ.	C. E. Watson
Nevada	1965	None	Univ. of Nevada	R. Ruf, R. Post
New Jersey	1924	1929	Rutgers Univ.	H. Sprague, E. Evalul, G. W. Musgrave
New York	1947	1947	Cornell Univ.	J. F. Cornman
North Carolina	1961	1963	N. Carolina State Univ.	J. Harris, W. Gilbert
North Dakota	1962	None	N. Dakota State Univ.	J. Carter, K. Larson, I. Dietrich
Ohio	Early 1920's	1938	Ohio State Univ.	F. Welton, G. McClure, R. Davis, K. Bader
Oklahoma	1948	1946	Oklahoma State Univ.	W. Elder, R. Chessmore
Oregon	1930	1948	Oregon State Univ.	H. A. Schoth
Pennsylvania	1929	1929	Penna. State Univ.	H. Musser, F. Grau
Rhode Island	1890	None	Univ. of Rhode Island	L. Kinney, H. Wheeler J. A. DeFrance
South Carolina	1959	None	Clemson Univ.	P. M. Alexander
South Dakota	1955	None	S. Dakota State Univ.	William Macksam
Tennessee	1938	1947	Univ. of Tennessee	J. K. Underwood
Texas	1940	1946	Texas A & M Univ.	G. Warner, R. Potts, A. Crain, J. Watson, E. Holt
Utah	1958	1964	Utah State Univ.	H. Peterson, K. Allred
Vermont	1959	1965	Univ. of Vermont	G. M. Wood
Virginia	1910-1915	1957	Va. Polytechnic Institute	L. Carrier, A. Smith
Washington	1942	1948	Washington State Univ.	A. G. Law
West Virginia	1930	1967	W. Virginia Univ.	Collins Veatch
Wisconsin	1920	1959	Univ. of Wisconsin	F. Burcalow, E. Nielsen, D. C. Smith, J. Sund
Wyoming	1962	None	Univ. of Wyoming	Loyd Ayres
USDA cooperating with USGA	1920 1941	None None	Arlington, Va. Beltsville, Md.	John Monteith, Jr. John Monteith, Jr.

Reprinted from Turfgrass Science, American Society of Agronomy, 1969.

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H. B. Musser

Leader in turfgrass development at Pennsylvania State University. Had a part in the development of many improved turfgrasses such as Pennfine and Penncross.

Following the war, the prewar work had to be reorganized. Strong pressure from universities and the Green Section resulted in the release of American improved varieties in the 50's. In the late 40's, the American Society of Agronomy, encouraged by Fred Grau and others, created a Turf Committee. A minor setback was the repositioning of the Green Section in 1953 to serve USGA member clubs only. Although its work still benefitted everyone indirectly, USGA concentrated its support on golf turf work.

The postwar years brought new consumer interest in housing and home landscapes. The value of a nice lawn was growing. Gradually, the dollars shifted to the homeowner market. Along with the seed industry, the sod industry grew rapidly to meet the new demand for quality lawns.

This growth in home lawn care, added to turf needs generated by golf, sod production, and road construction permitted states to increase their support of turf programs at state universities. This resurgence of support of university research resulted in most of the improved hybrids during the 60's and 70's. In 1961, Rutgers created a fulltime turfgrass breeder position and filled it with a graduate student from its corn breeding program, C. Reed Funk. His contributions, combined with breeding work of Penn State, Rhode Island, Oregon State and others, is the foundation of today's breeding effort.



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THE FORMATIVE YEARS

During 1930-1960, seed producers were highly involved with production of common grasses. They had a reliable demand for a product which they had developed an acceptable technology to handle. Basically, they collected seed from natural stands of common grasses by a practice called stripping. Seed companies would

arrange with farmers in the midwest to have certain pastures ungrazed during late spring and early summer.

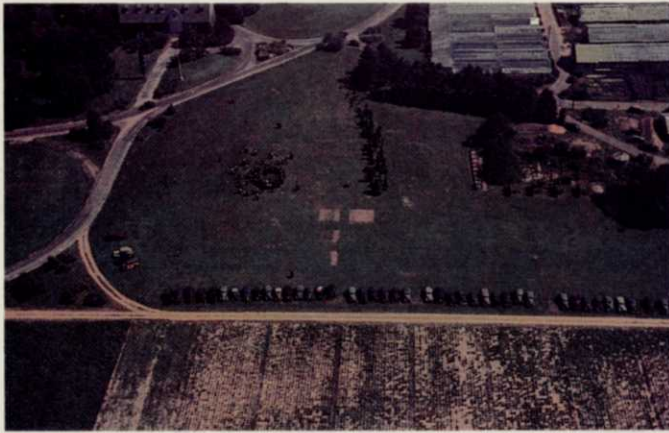
"Many millions of pounds of seed were gathered with strippers beginning in mid-June in Kentucky and the southern portion of the Western District (Missouri north to southern Canada), and following the weather

northward to finish up in Minnesota and Canada during July," says Robert Schery, Director, of the Lawn Institute.

Arden Jacklin of Jacklin Seed Company recalls, "Common Kentucky bluegrass was occasionally overproduced. When I was working for the USDA Soil Conservation Ser-



Arden Jacklin checks a seed field in 1958 in eastern Washington.



Arlington Turf Gardens prior to the construction of the Pentagon (left). Turf plot in front of administration building at Beltsville, MD. (right). Photos by F. V. Grau.

vice in 1936, the government bought up the excess seed and distributed it across the United States in carloads. As late as 1946, there were farmers who had picked up carloads of surplus seed in 1936 and were still trying to sell it to seed companies."

During the stripping process, green seedheads were removed, and laid out in fields to dry. Perhaps half the seed would be good after this process and germination rates were considerably lower than the 90% rate common today. Overall, production in this fashion could generate 20 million pounds of common bluegrass in a year.

Representatives of these seed companies used to meet each year to gauge production and estimate value. This group eventually became known as the Better Lawn & Turf Institute (The Lawn Institute) which now represents many turfgrasses to users.

Common bluegrass is still in demand today. Park common Kentucky bluegrass is still produced in Minnesota and the Dakotas. Of course, there are large producers of Common Kentucky bluegrass in Kentucky, the largest is Robert Dye Seed Ranch in Pomeroy, Washington. Nearly twice as much public and common bluegrass is produced annually in the United States as proprietary Kentucky bluegrass.

By far the most productive area in the U.S. today for grass seed is the Pacific Northwest, the states of Idaho, Oregon and Washington. In the mid-40's, the Jacklins and a few others promoted the improved purity of grasses grown in the Northwest and the better yields per acre allowed by temperate weather. Many offtypes of grasses existed in the Midwest because grasses had a 200 year lead on introduction there.

Modern seed production practices

evolved in the Pacific Northwest. Arden Jacklin, after leaving the Soil Conservation Service, and helping convince his father and brothers to risk part of their vegetable farming business for the turf seed industry, developed many of the current techniques of row planting of foundation seed, improved roguing the field for weeds and volunteers, windrowing the cut grass, and using combines to pick up and separate seed from the straw.

No one had any exclusive rights to the common grasses. The interest and technology to gather large quantities of seed were centered in the Midwest. As the Northwest proved to be a better area to produce turf seed and improved seed from the Northwest brought a considerably higher price, Midwestern seed companies specializing in stripping slowly faded away.

Of course, another major factor in the development and production of improved varieties was the seed company. A look at the incorporation dates of nationally known seed companies reveals these groups:

- local seed store selling garden, agricultural and grass seed to a community. Some of these include Adikes (1855), Northrup King (1884),

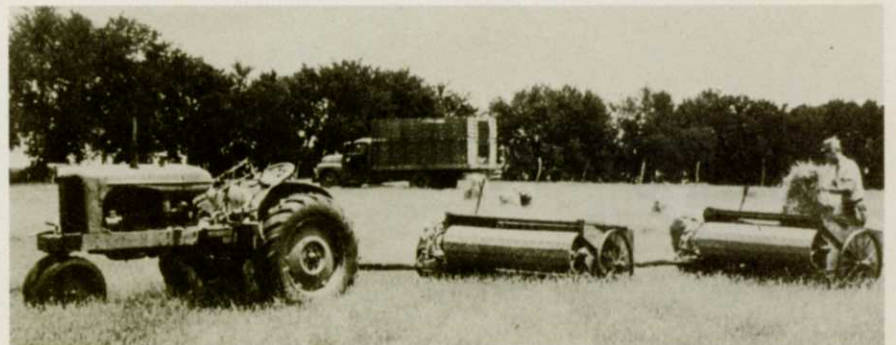


Green seed windrowed in curing yard in the Midwest during common bluegrass production.

Stanford (1910), Rudy Patrick (1911), O. M. Scott & Sons (1870), E. F. Burlingham (1921), and Lofts (1923).

- early recognition of new market potential for turf seed. Some of these include Jacklin (1935) and Warren's (1938).

- created due to new protection by 1970 Seed Act. Some of these include Agricultural Services (1970), International Seeds (1972), Pickseed West (1969), Turf Seed (1970). Whitney Dickinson (1972), and North American Plant Breeders (1973).



Stripping machines on midwestern field during the 50's. Photos courtesy of The Lawn Institute.

THE SEED COMPANY

The structure of the turf seed industry is considered to be in five parts; the breeder, grower, marketer, distributor, and retailer or end-user. A seed company may perform more than one function in this arrangement. For example, Jacklin has a breeding program, owns part of its production acreage, markets the

seed in advertising and at shows, and in some cases acts as the distributor. It also contracts with farmers for production, receives breeding support from universities and other seed companies, and sells bulk to regional distributors. In fact, as part of Vaughan Jacklin Co., its parent company retails the seed.

Scotts, Lofts, Vaughan Jacklin and Northrup King market packaged seed to homeowners. Some companies sell private label seed to chain stores and all companies sell bulk to regional distributors, contractors and garden centers.

Another level of complexity is added in the production, marketing



Early Lawn Institute Officers in the late 50's. Shaking hands are Edward Spears (left) of Paris, KN, and William Gassnor of Kingdom City, MO. Bob Schery is on the far right.

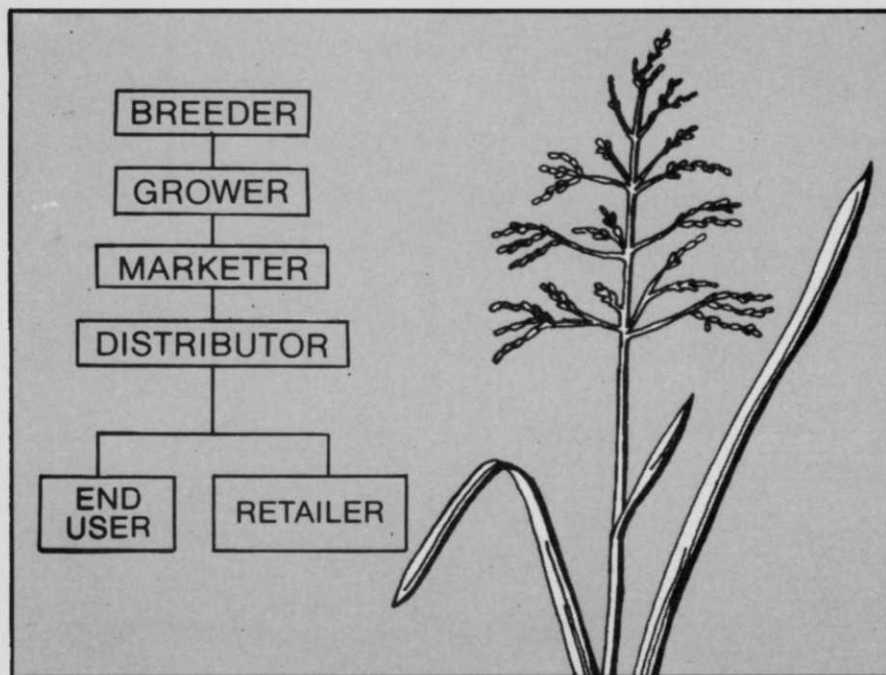
and distribution of European varieties such as Baron, Birka, Sydsport, and Fylking Kentucky bluegrasses. U.S. seed companies go directly or through brokers to European companies and arrange royalties to market European varieties. Barenbrug recently established an office in the Northwest to work directly with growers in production of seed. On the other hand, U.S. companies sell to European seed companies and grow for them under contract.

Commercial interest in producing and distributing turf seed began primarily in the 30's. Regional seed companies such as Scotts, Adikes, Lofts, Stanford, Northrup King and Rudy Patrick realized that recent developments in turf seed collection would create a demand for improved varieties. They treated the turf market for the most part as a special addition to their agricultural seed business.

After waiting patiently through the depression, war years, and most of the 50's, the seed market recuperated with a surge of new varieties. These early companies held the inside track as common varieties were replaced with improved ones. The market looked so good that W. R. Grace purchased Rudy Patrick in 1957 as a growth investment. (Rudy Patrick was also involved with agricultural seeds, so not all of Grace's interest was in turfgrass.) Rudy Patrick had its own development work underway during the late 60's. Dr. Jerry Pepin, a student of Reed Funk and currently research director for International Seeds Inc., did much of the turf seed research for Rudy Patrick during the 60's. Jim Carnes, co-owner of International Seeds, was director of specialty turf.

After a turfgrass is judged to meet quality and seed production standards, a process begins to generate seed for production. Research work may have generated less than 10 pounds of breeder seed. This breeder seed is taken by special growers and planted to produce foundation seed. It may take two or three years to produce enough foundation seed to meet the demand of the growers of the final product, certified seed. Purity is extremely important in all phases of seed production, but especially important during production of foundation seed from breeder seed. It is the foundation seed that is planted to produce the certified seed for market.

Early growers of foundation seed were Otto Bohnert in Oregon and the



Geary Brothers in Oregon. These two growers took four pounds of Merion breeder seed, which Penn State had produced from a thimbleful of seed saved by Fred Grau when the Pentagon forced the move of the Arlington Turf Gardens. They have performed similar roles with other improved varieties. Otto Bohnert was also the first grower of Newport and Penncross.

Today, breeder and foundation seed is produced under control of the seed companies owning the proprietary rights.

Disenchanted with the seed market, W. R. Grace began to divest itself of its seed companies in 1970. As a result, research locations of Rudy Patrick were purchased by investor groups, Northrup King, Olin Corp., and Nickerson, a British concern. The result was the creation of three new seed companies and the acquisition in 1972 of Rudy Patrick seed facilities in the Northwest by Northrup King and the formation of Tee-2-Green Corp. to market Penncross.

Olin Corp. and Nickerson jointly acquired most of Rudy Patrick's Kansas City facilities and created North American Plant Breeders in 1973. Jim Carnes and Willard McLagan (A prominent seed grower) purchased the Halsey, Oregon facilities of Rudy Patrick and created International Seeds, Inc. in 1972.

The third company to come out of this divestiture was Whitney-Dickinson of Buffalo, New York by an investment group including E. L. Townsend and E. J. Glatty.

As a result, Whitney Dickinson gained marketing rights to Manhattan perennial ryegrass, and North American Plant Breeders, International Seeds, and Northrup King divided much of the research work with perennial ryegrasses, bluegrasses and fescues developed by Rudy Patrick.

Another firm established in the 70's, and just beginning to enter turf seed marketing, is Agricultural Services of Oregon. Its perennial ryegrasses Pennant, Premier and Pronto were developed in cooperation with Reed Funk at Rutgers. John Rutkai and Dave Amoth formed the company in 1973. According to Rutkai the extensive breeding advances in the U.S. turfgrass industry will shorten the commercial life of most varieties, creating new introduction more quickly.

Turf Seed of Hubbard, Oregon, was created in 1970 by another Rudy Patrick marketing specialist, Dick Bailey, and Bill Rose, a big producer of Merion seed and president of the Manhattan Ryegrass, Penncross Bentgrass, and Exeter Bentgrass associations. Rose had produced the first foundation seed of Manhattan.

Originally the company concentrated on Merion seed production and Manhattan perennial ryegrass as comarketers with Whitney Dickinson of Buffalo, New York. In 1975, Bill Meyer joined Turf Seed as full-time researcher to improve seed yields of current varieties and create new varieties. Meyer created Pure Seed Testing and played a major role in the introduction of Shasta

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Distributors

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and Columbia Kentucky bluegrasses; Citation, Omega and Birdie perennial ryegrasses; and very soon improved types of Merion and Manhattan. This year Turf Seed will produce and market a new tall fescue, Falcon. Turf Seed also produces seed for Warren's A-20, A-34, I-13, and A-20-6A.

From its inception in 1972, International Seeds Inc. took an aggressive marketing position with material acquired from Rudy Patrick and arrangements with Van Engelen and SUBICO of the Netherlands. They have European rights as well as U.S. rights to many proprietaries.

Jerry Pepin moved to International with the Rudy Patrick breeding program and released Derby perennial ryegrass in 1975 and Regal in 1976. North American Plant Breeders markets both Regal and Enmundi Kentucky bluegrass from International.

International has marketing rights to Emerald creeping bentgrass, Highlight chewings fescue, Merit Kentucky bluegrass, and Shasta Kentucky bluegrass. International is co-breeder and marketer of Admiral Kentucky bluegrass. It produces Vantage Kentucky bluegrass for O.M. Scott & Sons.

International Seeds has entered the southern overseeding market with DixieGreen and Sabre, *Poa trivialis*.

International developed America Kentucky bluegrass which is marketed by Pickseed West Inc.

Seaboard Seed Co. was founded in Philadelphia in 1932 as a farm seed company. Following the war, Seaboard entered the turfgrass seed market, and added a branch in Bristol, Illinois. In 1962, the company was merged into Heritage House Products, part of Diamond Alkali Co. In 1965, E.F. Burlingham & Sons went together with Chris and G.H. Valentine, and Alan Hirsch to purchase the turfgrass seed business of Heritage House as well as the Bristol, Illinois facility.

Pickseed West in Tangent, Oregon was created by Martin and Tom Pick, of Otto Pick & Sons Ltd. in Canada and Kent Wiley, son of a seed broker in 1970. Today they have several agronomists on staff and have acquired rights to a number of improved grasses out of Rutgers and Rhode Island. Touchdown Kentucky bluegrass is one of these that has experienced high acceptance in the market. They have just announced production of America, from Rutgers breeding work. America exhibits

good resistance to disease and good shade tolerance. Pickseed is calling America a low maintenance bluegrass. Recently, Pickseed arranged to begin marketing of material from Rhode Island, such as Exeter, Colonnail bentgrass and Kingstown velvet bentgrass.

Of course, many of these companies would not exist today had it not been for the foundation built by the early seed companies. Jacklin, Scotts, Rudy Patrick, Lofts, Northrup King, Stanford, Adikes, Warren's and Burlingham survived and prospered through the conversion from common to improved turfgrasses. They made investments in research and technology when needed to serve the professional turf market as well as the (homeowner market). They worked with universities, anticipated changes in market demand, and seed production technology, and put marketing money behind the new turfgrasses.

Warren's began as a turf nursery in 1938 by Ben Warren near Chicago. Warren's interest was in improved grasses for sod, not so much for seed. He and his staff were primary collectors of new material from golf courses, parks, and lawns across the U.S. His collection work paid off well with the material that contributed to the production of A-20 and A-34.

Much of Warren's sod production was by vegetative means and only in the last ten years has Warren's sought to produce seed. Today, Warren's remains a sod producer first, and a seed producer second.

Jacklin Seed Company is a multifaceted company serving both the professional and homeowner markets. It was founded in 1935, by Ben Jacklin and his three sons Lyle, Owen and Arden, in Dishman, WA., originally a grower of seed peas. Arden Jacklin after serving the Soil Conservation Service, convinced his father and brothers to get behind the turfgrass market in the 40's obtaining foundation seed from Otto Bohnert and Ed Geary. Initially, the Jacklins produced some field grasses and creeping red fescue. At that time they had to have the seed cleaned at the only seed cleaning plant in the area owned by Max Hinricks. Jacklin received some of the first foundation seed of Merion and put full effort into production.

It has since provided a considerable amount of production and promotion for various other improved grasses such as Glade, Fylking, Newport, Nugget, Birka.



Peter Loft

President of Loft's Pedigreed Seed Co., Peter and his brother Jon manage a diverse company in the turf and vegetable seed industry. Loft's proprietaries include Baron, Jamestown, Ram I, Yorktown, Rebel and Pinto reclamation mixtures.

Jacklin has commercial relationships with nearly all major seed companies in the world. They work closely with Lofts on reclamation mixtures and improved grasses. They work with many European firms for production and distribution. They produce much of the seed for Scotts, Bristol and Windsor, and Warren's A-20 and A-34.

Equally as significant are Jacklin's contributions to seed production technology. Row cropping to produce foundation seed had been done before by Bohnert, but Jacklin applied it to the production of certified seed. The original technology was using a stripper on natural stands in the midwest. In the Northwest this technology was altered to solid seeded stands of grasses which were cut and dried on large concrete drying slabs. Arden Jacklin applied row cropping to the field production of certified seed, used a swather to put the cut grass in windrows for drying in the field, and used a combine to pickup and separate the dried seed from the stems. This technology cut losses of seed during drying and reduced seed handling to a minimum.

In 1972, Jacklin Seed Co. merged with Vaughan Seed Co. of Chicago to form the Vaughan-Jacklin Corpora-

tion. The Jacklin Seed division maintains its original integrity under this agreement according to Doyle Jacklin. In 1978, Jacklin moved to a new location in Post Falls, Idaho, and is rapidly expanding its seed handling and storage facilities there.

Today, Jacklin handles 80 different proprietary turfgrasses, half of which are in commercial production. It owns 5,500 acres and contracts another 16,000 acres for production.

Northrup King Co. began the first commercial breeding effort on the perennial ryegrasses for turfgrass use in 1956.

Northrup King Co., founded in 1884 as a seed store in Minneapolis, Minnesota, entered the turf seed business in the 40's with a line of lawn seeds. It was one of the first developers of improved varieties of agricultural crops in the 30's, with corn, and radishes.

Northrup King was among the first U.S. companies to begin a turfgrass breeding program in 1948, for ryegrasses and Kentucky bluegrass. In 1954, the first turfgrass trials to contain a large group of European varieties was established. During the early 60's, Northrup King released NK100 perennial ryegrass, Holfior Colonial bentgrass, Pelo perennial ryegrass, Prato Kentucky bluegrass and Ruby creeping red fescue. NK100, sold primarily through J & L Adikes, was the first improved turf-type perennial ryegrass made available to the market. Holfior was the first pure colonial bentgrass released in the U.S. and Ruby was the first pure spreading red fescue released in the U.S. Newport was the second improved bluegrass variety released in the U.S., following Merion.

Northrup King was one of the first to recognize and supply an overseeding mixture for the South with the release of Medalist in 1970. In 1972, it released NK200 perennial ryegrass which exhibited improved winter hardiness. In 1974, NK released Aquila and Parade Kentucky bluegrass varieties.

Since that time, Northrup King has been part of the release of the cultivars Adelphi Kentucky bluegrass, Pennfine Perennial ryegrass, Rugby Kentucky bluegrass, Eton, Delray, and Goalie perennial ryegrasses; Wintergreen and Atlanta Chewings fescues; Dawson red fescue; Scaldis hard fescue, and Fults *Puccinellia distans*.

Lofts Pedigreed Seed, Inc. was founded in 1923 by Selmer Loft as a local seed supplier. From its New Jersey location, it has been close to nearly all U.S. breeding work from Rutgers. Today, Peter and Jon Loft manage one of the largest seed companies in the U.S.

In 1962, Lofts purchased Great Western Seed Co., in Albany, Oregon, which had vast production contacts in the Willamette Valley and marketing arrangements with European seed producers. This strengthened its marketing and production position in the turf seed market. Through a series of expansion and acquisitions, Lofts broadened its base even further with outlets in Maryland, New York, Massachusetts, Wisconsin, and recently Sunbelt Seeds in Tucker, Georgia.

Lofts' closeness to university research, Northwestern production, European seed companies, and other U.S. seed companies, positions it very close to the center of the turf seed industry. Lofts and Jacklin are cooperating on reclamation mixtures for the future.

Included in the Lofts' stable of U.S. proprietary varieties are: Baron, Ram I, Georgetown and Mystic Kentucky bluegrasses; Yorktown, Yorktown II, and Diplomat perennial ryegrasses;



Bob Peterson

In the 15 years that Peterson has worked for E. F. Burlingham he has arranged for the proprietaries Bonnieblue, Majestic, Banner, and Falcon.

Rebel tall fescue; Jamestown chewings fescue; and Beamont meadow fescue. Lofts and Jacklin share rights to the Pinto Reclamation mixtures.

O.M. Scott & Sons is greatly responsible for the commercial success of both professional and homeowner seed markets. Founded as a supplier of agricultural seeds in 1870, by Orlando Scott and his sons Hubert and Dwight. In 1890, the company began to handle turf seed and was prominent in the early years of common seed production in the Midwest. In the early 20's Scotts was a supplier of seed and stolons to golf courses and was the first to market German bentgrass to U.S. golf courses. In 1928, realizing the potential of the homeowner market long before others, Scotts began publication of Lawn Care, a small magazine of how-to tips for homeowners. Combined with the seed and the release of Turf Builder, the first turf fertilizer formulated for lawns, Scotts had begun to provide homeowners with a total lawn care package that was supported by educational material on its use. In 1936, the spreader was added to the product line, and in 1941, Scotts was one of the first to market 2,4-D as a turf herbicide. Another accomplishment was the introduction of the first preemergent crabgrass herbicide in 1950.

Scotts was more than a seed producer. Its emphasis was on meeting all the turf needs of a customer, not just one. Scotts has one of the largest turf research centers at its ProTurf headquarters in Marysville. The ProTurf Division was created in 1965 to realign the company with professional users of turf products. The division provides technical assistance in addition to products to golf course superintendents and landscape contractors across the U.S. ITT purchased Scotts in the early 70's.

Some of the improved turfgrass seed sold by Scotts includes Vantage, Victa and Bristol Kentucky bluegrass; Loretta and Caravelle perennial ryegrass; Banner chewings fescue, and Biljart hard fescue. Scotts deals with Jacklin for much of its seed production needs.

E. F. Burlingham and Sons was formed in the early 1900's by E. F. Burlingham as a feed and seed operation in Forest Grove, Oregon. His son Gordon and grandson George have followed in his footsteps. Burlingham has been involved in a variety of ways with the seed market. The company has a reputation as an international trader

of turf seed due to its North American rights to European turfgrass seed such as Sydsport and Birka. These grasses may be sold by other seed companies but they are marketed through Burlingham as the wholesaler.

In 1964, Bob Peterson joined Burlingham from Northrup King and proceeded to arrange marketing rights for new material from Rutgers. These arrangements include turf seed Majestic and Bonnieblue bluegrasses; Banner chewings



Dwight Scott

Son of the founder of O. M. Scott & Sons, Dwight led the company through the first half of the 20th Century. His goal was a complete product line for the turf industry and consumer education through Lawn Care.

fescue; Belle perennial ryegrass; and Falcon tall fescue.

Prior to this new material, Burlingham had handled mainly public varieties such as Merion, Highland bentgrass, Pennlawn red fescue, Linn perennial ryegrass and others. They manage seed production for re-export to seed companies in Europe.

J. & L. Adikes, like Scotts, was founded in 1855 as a local seed supplier and added a line of turf seeds later, in this case the early 30's. Located in Jamaica, New York, Adikes was not far from universities working on improved varieties. The company played an early role in the marketing of NK100 perennial ryegrass. Bob Russell, vice president, tells the story that Northrup King had abandoned the seed as a poor seed producer. He obtained some seed and had it tested in two different locations and it proved to be green longer in the fall and earlier in the spring. Adikes got Northrup King to look for any leftover NK100 seed. They found about 300 pounds and Northrup King took it from there, arranging production and Adikes handling marketing. This was prior to variety protection regulations and Adikes had to devise a way to protect its investment in the perennial ryegrass. This was accomplished by only selling NK100 in a mixture. Adikes took all production of NK100 into the mid 70's. Russell believes this experience with NK100 in the late 50's got Reed Funk interested in a perennial ryegrass improvement program at Rutgers which resulted in the development of Manhattan.

Adikes owns the rights to the first bluegrass hybrid from Reed Funk and Jerry Pepin at Rutgers, Adelphi. Adelphi is considered one of the most consistent bluegrass performers across the country. Adikes was an early promoter of using a blend of bluegrass over a single one in the mid-50's.

Stanford Seed Co. in Plymouth Meeting, Pennsylvania, is a strong supporter of the reclamation market with Penngift crownvetch, Tioga deertongue, Birdsfoot Trefoil and Lathco flatpea. It was also the original marketer of Pennfine perennial ryegrass. The company has placed reclamation and highway grasses as a specialty.

In late 1979, Stanford arranged the purchase of Whitney Dickinson in Buffalo, New York, and thereby regained a marketing role with Pennfine as a member of SPIC. Stanford had earlier been one of the original marketers of Pennfine.

THE BREEDER

In the last 50 years, plant geneticists have brought us from virtual ignorance to space age radioactive mutation techniques. The research, once lagging, is now ahead of the consumer in many respects.

The pioneers in turfgrass breeding had little to go on. Today, students have the opportunity to train under the originators of the science.

For example, Dr. Richard Skogley at Rhode Island, worked and trained under Jesse DeFrance, one of the original specialists in bentgrasses. Skogley's students include Richard Hurley, vice president of research and development at Lofts Pedigreed Seed Co.; Jim Wilkinson, director of research for Chemlawn Corp.; Victor Gibeault, extension agronomist for the University of California; Tom Cook, extension turf specialist at Oregon State University; and Bob Mazer, turf specialist at Clemson University.

Another example is Henry Indyk of Rutgers had considerable influence on Reed Funk's decision to be the first full-time turf geneticist at Rutgers. Indyk came from Nebraska where Fred Grau had helped establish a turf program. Today, Jerry Pepin, Kevin McVeigh, and other Funk students are making substantial contributions to turf breeding.

The future presents significant challenges to turf breeders. Rising costs for water, fertilizer, insecticides, fungicides and herbicides will force development of hardier species for climatic regions. Joe Duich of Penn State points out, "There is still no satisfactory turfgrass for fairways in the North. Fairway grasses must stand up to low cutting, heavy irrigation, and *Poa annua*. In the future, overuse of water and chemicals will be discouraged and the grass on the fairway will have to get by on less. We have been working on a strongly rhizomatous colonial bentgrass. We must adapt to reduced levels of maintenance by developing turfgrasses that match this lower level of maintenance."

For the transition zone tall fescues and other deep rooting grasses are needed to survive without extreme dependence upon irrigation.

In the South, insect resistance must be added to the traits of improved grasses. Work with centipede may eventually obtain this goal.

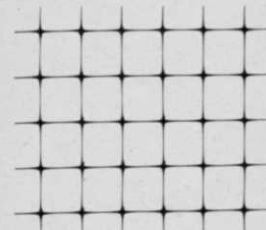
Reclamation grasses are bringing us back to the grasses indigenous to North America, such as buffalograss, gama grass, and reed canarygrass. We are rediscovering our pre-pioneer ecology. These grasses survived years of natural selection and have potential for low or no maintenance areas such as highway roadsides, large parks, and reclamation.

The progress in the next 20 years will match and exceed that of the last 50 years. To be part of this progress, one must know what happened in the first 50, to appreciate the next 20.

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IMPROVED TURFGRASSES

All grasses are Monocotyledons belonging to the family Gramineae. They are constructed of narrow and parallel-veined leaves which grow from a hollow stem, the culm.

The grass family is one of the most numerous and most important plant species to man, with more than 600 genera and 10,000 species.

All cool and warm-season grasses considered turf type today originated outside of the United States. Most cool-season grasses were brought to North America from Europe during colonization, including bentgrass, all fescues, ryegrasses, and bluegrasses. Even crabgrass came from Europe. If you are wondering what grasses are indigenous to North America, they include buffalograss, reed canarygrass, and blue gama.

Warm-season grasses had the following origins; Bermudagrass - Africa, Centipedegrass - S.E. Asia, Zoysia - Asia, St. Augustine - Africa, Bahiagrass - Brazil, and Kikuyugrass - Africa.

Turfseed selection and development is a building process. First collections of turf and forage type grasses are made. Selections from these collections are the first level of improved turfgrasses. These selections are crossed to get first generation hybrids. The most recent group of improved turfgrasses are crosses of first generation hybrids. These are considered second generation hybrids.

The turf seed market has developed into an attractive market with adequate protection for proprietary turfgrasses. The additional push on development of new turfgrass varieties by private enterprise is causing an evaluation of all types of grasses for turfgrass use. The reclamation market and low maintenance turfgrass market are considering grasses which were



Glenn W. Burton

Breeder of the "Tif" series of bermudagrasses and originator of radioactive mutation techniques for turfgrasses.

previously excluded from breeding and selection work. Now, all genera and species are being considered for a role in the turf market.

An outline of each genus applicable to turf are needed to grasp the overall scope of turfgrasses today.

COOL SEASON GRASSES

Bentgrasses

Bentgrasses, because of their importance to golf, received much of the initial attention of turf researchers. Bentgrasses are naturally low-growing and tolerate low mowing. Redtop and German creeping bentgrasses were common on golf courses and other turf areas prior to the 40s. Scotts used to sell German bentgrass stolons to golf courses in the 20's.

Much of the early work of the USDA and USGA Green Section involved bentgrasses. Pennsylvania State, the University of Rhode Island, Oregon State Agricultural Experiment Station, and Rutgers all

contributed to selection and development of bentgrasses.

There are three primary types of bentgrasses used for turf today; creeping bentgrass, colonial bentgrass and velvet bentgrass.

Creeping bentgrass, *Agrostis palustris*, is very aggressive when fertilized and irrigated. It is propagated either by seed or stolons. Seeded varieties at one time exhibited a certain degree of segregation which would cause a green to look patchy. The problem has been resolved for the most part with the newer varieties. Improvements in disease susceptibility have also been made with newer varieties. The latest release is Penneagle (1979) developed by Joe Duich at Pennsylvania State University. Penneagle was evaluated for more than 20 years before its release. Penncross was released in 1954 by Penn State and suffered from lack of protection until Tee-2-Green Corp. was established to represent growers and to control purity in the mid-70's. Tee-2-Green also markets Penneagle.

International Seeds, Inc., distributes a Swedish creeping bentgrass called Emerald. It is known as Smaragd in Europe and is owned by W. Weibull in Sweden. Emerald was developed in Europe from progeny of Congressional, a vegetative variety developed in the U.S.

The oldest seed type creeping bentgrass marketed today is Seaside, selected by Oregonian Lyman Carrier and released in 1928.

Colonial bentgrass, *Agrostis tenuis*, is aggressive but has a lower tendency to creep. The last cultivar to be released in the U.S. was Exeter by Rhode Island in 1963. It too suffered from lack of protection and marketing effort, but will soon be repromoted by Pickseed.



1. Lime is applied to the fields after they have been turned under. Then the fields are plowed again and fine graded, very similar to soil preparation for lawn seeding.



2. Charcoal banding is a process where the seed and liquid fertilizer are layed in rows and sprayed with a band of charcoal covering the seed. The charcoal protects the seed from Karmex or Atrazine applied to kill weeds.



3. Grassland drills are an economical way of reestablishment of the seed crop. This can only be done if the fields are burned to get rid of the straw. Drilling is a one-step process putting down both seed and fertilizer.

Northrup King distributes Holfior, a colonial bent developed in 1940 by D.J. van der Have of the Netherlands. Highland colonial bentgrass is a public variety released by the Oregon Agricultural Experiment Station in 1934. Production of this seed is carefully watched by an association of growers for quality and supply reasons.

Astoria was also released by Oregon in 1936. It does not have the winter hardiness of Exeter.

Velvet bentgrass, *Agrostis canina* L., has an extremely fine leaf which gives it a velvet appearance. It is less aggressive than creeping bentgrass but more aggressive than colonial. Velvet bentgrass is more tolerant of acidic soils than the other bentgrasses but prefers well drained and well aerated soil. New England is a prime area for use of velvet bentgrass in the U.S.

Rhode Island's Richard Skogley released Kingstown in 1963 as a public variety. It was the first velvet bentgrass released since the depression. Pickseed intends to market and promote Kingstown soon.

Redtop bentgrass, *Agrostis alba* L., is a coarse, stemmy bentgrass well adapted for use on poorly drained, infertile soils such as roadsides. It is occasionally used in mixtures for low maintenance areas.

Bluegrasses

Kentucky bluegrass is the most popular turfgrass in North America and as such has more cultivars available than any other turfgrass. The prime factor in bluegrass improvement was the discovery of apomixis, a characteristic which limits cross-pollination of some Kentucky bluegrass varieties. Kentucky bluegrasses which exhibit this characteristic were considered asexual and thus received patent protection prior to the 1970 Plant Variety Protection Act which provided protection to sexually propagated plants.

Dr. C. Reed Funk at Rutgers developed the technique to create Kentucky bluegrass hybrids that were apomictic. His work is part of nearly every Kentucky bluegrass developed since the mid-60's. Most other improved varieties are based upon collection and selection work.

Recently, International Seed, Inc., released a variety of rough bluegrass, *Poa trivialis*, called Sabre. Sabre was developed by Reed Funk and William Dickson at Rutgers for shady, moist areas where a low-

growing bluegrass is desired and for southern overseeding.

Kentucky bluegrass, *Poa pratensis* L., is the backbone of turf in the Northern U.S. Releases of improved Kentucky bluegrasses began in 1947 with the official release of Merion. The emphasis behind improvement programs for Kentucky bluegrass was disease resistance, color, low growth habit, texture, and sod strength. Later winter hardiness, shade tolerance, traffic tolerance, establishment rate, and spring and fall color were added to the list.

Merion had been found as a naturally superior Kentucky bluegrass by Superintendent Joe Valentine at Merion Golf Club near Philadelphia in 1936. It has proven itself under low mowing and golfer abuse. Nature did the work, but it took Valentine to find it and the Green Section's Fred Grau and Pennsylvania State's Musser and Duich to refine and evaluate it for the market.

Other Kentucky bluegrasses collected and selected include the European varieties Fylking, Baron, Aquila, Parade, Sydsport, Cheri, Birka, Enmundi, and Rugby. U.S. varieties collected and selected include Warren's A-20 and A-34; Glade, a shade tolerant bluegrass found by Reed Funk in an Albany, NY lawn; Ram I, which Green Section director Al Radko and Superintendent Ernest Brown found on his golf course in Maine; Scenic, picked out of a field of Merion by seed grower Otto Bohnert; and Newport, found by extension specialists in Oregon.

The selection process continues as an important contributor to new Kentucky bluegrasses. As the germ plasm base is expanded, the number of possible hybrids increases. From selections processed through Rutgers, Funk's team was able to develop the hybrids Adelphi, Bonnieblue, Majestic, America, and Bristol. Rutgers has been involved with the selections Glade, Touchdown, Columbia, Plush, and Brunswick.

O.M. Scott & Sons has developed the hybrid Merit and the selections Vantage, Victa and Windsor.

Dick Bailey, formerly a partner in Turf Seed and now working for Jacklin, found the selection Shasta out of a field of Pennstar. Shasta is considered a bluegrass specifically for the Northwest. Pennstar was a selection by Pennsylvania State. Sodco is a selection developed at Purdue.

SEED PRODUCTION



6. Spot spraying in the spring. The spray is a combination of Roundup and a red dye so one can tell what has been sprayed.



5. Fields are sprayed with selective herbicide in the fall to control broad-leaf weeds. Each swath of the sprayer is 40 feet wide.



4. Fields in early spring. Taller plants are volunteer ryegrass and will be spot sprayed in the spring

Fescues

There is currently a great deal of effort on fescue improvement and development. A number of companies are working to serve the transition zone with an improved tall fescue. Hard fescues are also being studied and two have been released.

There are five types of fescue used for turf; creeping red, chewings, tall, hard and sheep.

Creeping red fescue, *Festuca rubra*, is a fine leaved fescue which is often used in mixtures with Kentucky bluegrass and perennial ryegrass. It germinates more rapidly than bluegrass, but not as rapidly as perennial ryegrass. Fescues tolerate drought and infertile soil better than both Kentucky bluegrass and perennial ryegrass. Under dry periods on clay soils, the fescue may dominate the stand.

Much of the improvement in creeping red fescues has taken place in Europe. D.J. van der Have of the Netherlands developed Ruby and the Sports Turf Research Institute in Bingley, England developed Dawson. Both of these are marketed in the U.S. by Northrup King. International Seeds Inc. markets Ensyva. In 1954, Pennsylvania State released Pennlawn. Prior to that, Oregon State released Illahee. Pickseed markets Agram from the Netherlands.

A chewings fescue is one that doesn't creep. Chewings fescue, *Festuca rubra* var. *commutata*, originated in Europe, but much of the original production took place in New Zealand. In the 30's, much of the chewings fescue on the market came from New Zealand and suffered from poor germination. Rhode Island, Michigan, and New Jersey (Rutgers) experiment stations contributed to the improvement of chewings fescues. Rutgers developed Banner which is marketed by Burlingham. Rhode Island developed Jamestown from material found by Richard Skogley on an abandoned green in Jamaica, NY. Jamestown is marketed by Lofts. Wintergreen was developed at Michigan State from material from the Netherlands. Northrup King markets Wintergreen, and the European variety Atlanta. Turf Seed released Shadow chewings fescue in 1980. International Seeds markets Highlight, developed by Van Engelen of the Netherlands as a chewings type red fescue. Other well-known chewings fescues are Golf-rod from the Netherlands and Cascade developed at Oregon State University in 1964.

Tall fescue, *Festuca arundinacea*, is a coarse fescue with a bunch type growth habit. However, it has a deep root system and survives on infertile, salty, low maintenance areas such as roadsides and parks.

The primary varieties are Kentucky 31 developed by E.N. Fergus at the University of Kentucky in the late 40's, and Alta, developed in 1947 by Harry Schoth, an agronomist with USDA in Corvallis, OR. Fred Grau assisted in getting Alta planted on a number of highways to prove its advantages. Alta is not a preferred grazing grass for cattle.



C. Reed Funk

The first full-time turfgrass breeder in the U.S. serving the New Jersey Agricultural Experiment Station at Rutgers. Funk was the first to develop hybridization techniques for Kentucky bluegrasses.

Kentucky 31 is often used for turf in the transition zone due to its ability to withstand hot humid summers and acid soil. To provide turf managers in the transition zone with finer-bladed tall fescue, Loft has released Rebel tall fescue and Burlingham has released Falcon, developed in cooperation with Bill Meyer at Turf Seed.

For similar reasons, hard fescue, *Festuca ovina* var. *duriuscula* L. Koch, has received attention. In addition to good drought tolerance, it exhibits good shade tolerance. Northrup King markets Scaldis and Scotts markets Biljart developed in the Netherlands. Pickseed markets Tournament from the Netherlands.

Sheep fescue, *Festuca ovina* L., has fine leaf texture and exists on acid, coarse soils. It has good shade and drought tolerance but appears bunched.

SEED PRODUCTION



7. Fields are cut and windrowed while seed is still green and less prone to shatter.



8. Whirlwinds can pick up the windrowed grass and carry it up to a mile contaminating nearby fields of other seed types. Whirlwinds and rain can seriously damage the crop in its last days of production.



9. Combines mechanically separate the seed from the straw by a series of rubbers incorporated in the thrashing machine.

Perennial Ryegrass

Next to Kentucky bluegrass, perennial ryegrass, *Lolium perenne*, has received the most attention from breeders and developers. This attention, however, wasn't attracted until the late 60's when new material from Rutgers and Penn State reached the market.

In the mid-60's, production of perennial ryegrasses rarely exceeded 150,000 pounds. Manhattan, Pennfine and a whole new series of perennial ryegrasses made turfgrass seed buyers take note, and in 1980 growers expect a crop of nearly 25 million pounds.

Bob Russell of Adikes is credited for the acceptance of perennial ryegrasses by northeastern golf course superintendents, sod producers and landscape contractors with his NK100 mixtures. The southern overseeding market was first broken by Northrup King and the other members of the Seed Production and Introduction Corp. (SPIC). Lofts, Turf Seed, Pickseed West, and International Seeds have southern overseeding mixtures available also.

Perennial ryegrasses are sexually propagated by crossing and polycrossing. This is similar to bentgrasses in that various parents are grown together in the seed field and crosspollinate to produce the variety of seed.

In the mid-60's, the New Jersey Agricultural Experiment Station (Rutgers) turfgrass breeding program was led by C. Reed Funk. Jerry Pepin was Funk's student at the time. These two men at Rutgers and Joe Duich at Penn State started a revolution with improved ryegrasses.

Pennfine was released by Duich in 1968, after Manhattan had been released from Rutgers. It was a three-clone variety, with two parents originally from Pennsylvania golf courses and one from a grass tennis court. Duich made the decision to hold off marketing Pennfine until the expected Plant Variety Protection Act was passed (1970). Today, Pennfine is successfully marketed by SPIC.

Manhattan, however, was released prior to the Plant Variety Protection Act and did experience problems early in its marketing. It was first marketed in 1968 by Bill Rose of Turf Seed who had taken six pounds of breeder seed and gotten production started. Today, Manhattan is marketed by Turf Seed and Whitney Dickinson as agents to the Manhattan Ryegrass Growers Association.

Rutgers has taken part in some way with an amazing number of perennial ryegrasses. They include: Blazer, Dasher, and Fiesta from Pickseed West; Belle from Burlingham; Derby from International Seeds; Goalie, Delray and NK-100 from Northrup King; Omega from Turf Seed; Pennant from Agricultural Services; Diplomat, Yorktown and Yorktown II from Lofts; and Regal from North American Plant Breeders.

Turf Seed developed Birdie and Citation. Northrup King has developed Eton, Epic, and NK-200. International Seeds has developed Clipper and Scotts has developed Caravelle.

European material includes Loretta from Scotts and Hunter and Elka from International Seeds.

One use of perennial ryegrasses that is receiving a great deal of attention is as a transition grass for the south. It is overseeded in large quantities to keep greens colorful and soft in the winter. Turf Seed has developed a annual/perennial ryegrass for overseeding, called Oragreen.



Jerry Pepin

A student of Reed Funk's in the 60's, Pepin has carried perennial ryegrass improvement from Rutgers to Rudy Patrick and now to International Seeds Inc. of Halsey, Oregon. He is the breeder of Derby, Regal and a number of other improved turfgrasses.

Crownvetch

Crownvetch, *Coronilla varia L.*, is not a grass or monocotyledon. It is a perennial, dicotyledon herbaceous plant with pinkish blossoms that serves to cover and stabilize roadsides and slopes due to its spreading ability and deep root system. Stanford and Turf Seed market Penngift Crownvetch, which was discovered, produced, and promoted by Fred Grau of Penn State. Grasslyn Farms, managed by Fred Grau Jr., produces much of the seed for Stanford to market.

An odd situation with Penngift was when Grasslyn was the only producer of the seed, the Highway Department would not buy from it because it was a monopoly. This led to the development of Chemung and Emerald Crownvetch by the Soil Conservation Service in the early 60's.

Grau discovered the legume on a Pennsylvania farm in 1935. In 1947, he had produced seed on his farm and gave demonstrations of the cover across the state. Burt Musser suggested Grau scarify the seed to improve germination in 1951. Due to the problem with the Highway Department, Grau had to assist in setting up his competition.

WARM SEASON GRASSES

Bahiagrass

Bahiagrass, *Paspalum notatum* Flugge, was brought to the U.S. from Brazil as a low maintenance turf for semitropical areas. Argentine and Pensacola are varieties developed by the Florida Agricultural Experiment Station in the late 40's.

Hugh Whiting, a private turf breeder in California has developed Adalayd, *Paspalum vaginatum*, to improve the species.

Bermudagrass

Bermudagrass *Cynodon dactylon*, is the most important warm-season turfgrass in the U.S. It is propagated mainly vegetatively.

Many states have been involved in improving bermudagrass, including Florida, Kansas, Texas, California, South Carolina, Oklahoma, Arkansas, Alabama, Georgia and Maryland. However, their work is overshadowed by the developments of Glenn Burton with the USDA in Tifton, Georgia.

Burton began his work on the "Tif" series in 1946 after being encouraged by Fred Grau and Olaf Aamodt from USDA Beltsville. He collected dwarf pasture bermudagrasses and



Bill Meyer

Director of Pure Seed Testing in Hubbard, Oregon, and leading turfgrass specialist in the area of stem rust. Meyer is finishing development work on an improved Merion and an improved Manhattan.

crossed them with selections from golf greens. Golfers were complaining that bermuda greens were too coarse. From these hybrids, Burton selected one released as Tiflawn in 1952. But Tiflawn was still too coarse for greens. A finer turf was required.

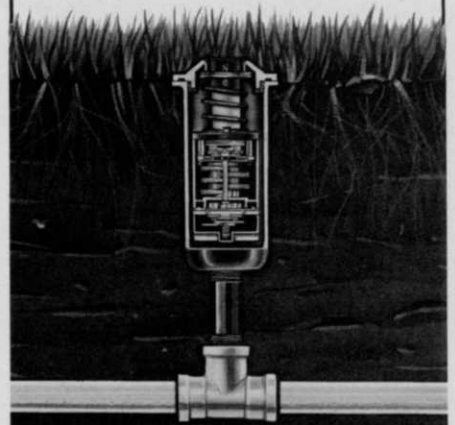
Burton got hold of a bermudagrass from Africa, *Cynodon transvaalensis*, a softer, finer variety. He bred the African bermuda with a dense selection of *Cynodon dactylon*. The result was a sterile, but improved variety which he called Tiffine. It was released in 1953. But the bermuda was sterile and improvement stopped at that point for that turfgrass.

Burton went back to his collection for another *C. dactylon* to breed with *C. transvaalensis*. He selected a bermuda from Charlott Country Club in North Carolina. The cross produced another sterile bermuda which he called Tifgreen. It was released in 1956 and made a much improved bermuda for greens.

Looking for better frost tolerance, Burton made a third cross with *C. transvaalensis*. He got what he wanted but it was stiffer than Tifgreen. This bermuda was released in 1960 as Tifway.

Fortunately, Tifgreen produced a vegetative mutant with finer stems, smaller and darker leaves. Burton

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SEED PRODUCTION



10. Field burning to stimulate the plants for next year's production, remove straw residue from the fields, and disease and insect control.



11. Experimental field burning machines were tried to control the volume of burning but they were dropped as too expensive and unreliable.

Photos courtesy of Harry Stalford, International Seeds Inc.

released Tifdwarf in 1965.

Since 1965, Burton has experimented with ways to cause mutations of the sterile bermudas he has produced. In 1970, he first used radiation to produce mutants and was successful.

This space-age technology has produced more than 150 mutants for evaluation. Burton says he expects to release one or more of the mutants within the next year.

In more conventional methods of selection, good varieties of *C. dactylon* have been developed. U-3 was one of the first selected from material supplied to USDA in Arlington and later Beltsville by Lester Hall. Hall found the bermuda on his golf course in Savannah, Georgia. It was released as U-3 in 1947. Ormond from Florida, Royal Cape from California, Texturf from Texas, and Tufcote from Maryland are selections of *C. dactylon*.

Other crosses of *C. dactylon* and *C. transvaalensis* have been accomplished by Florida (Everglades), Kansas (Midway), and South Carolina (Pee Dee).

Uganda is a natural selection of *C. Transvaalensis*.

Centipedegrass

Centipedegrass *Eremochloa*

ophiuroides, originated from China. It exhibits poor wear tolerance, but provides an adequate turf in warm regions without great care. It exhibits extremely tough resistance to insects and disease which may cause a closer evaluation in the future. It may serve for lower traffic areas on fairways and roughs.

Kikuyugrass

Kikuyugrass, *Pennisetum clandestinum* is another turfgrass brought from Africa for use in the U.S. It is a tough turfgrass which tolerates high temperatures, low cutting, wear, and some shade. Extended cold weather will damage it however.

St. Augustine

St. Augustine *Stenotaphrum secundatum*, is second to bermudagrass for warm season turfgrass use. It is an aggressive, low-growing, heat tolerant, blue-green turfgrass. Like Kikuyugrass, it will not tolerate extended cold temperature. It forms a good sod and can tolerate some shade. Overfertilization can create severe thatch buildup. Floratine is a variety developed by Florida Agricultural Experiment Station specialists.

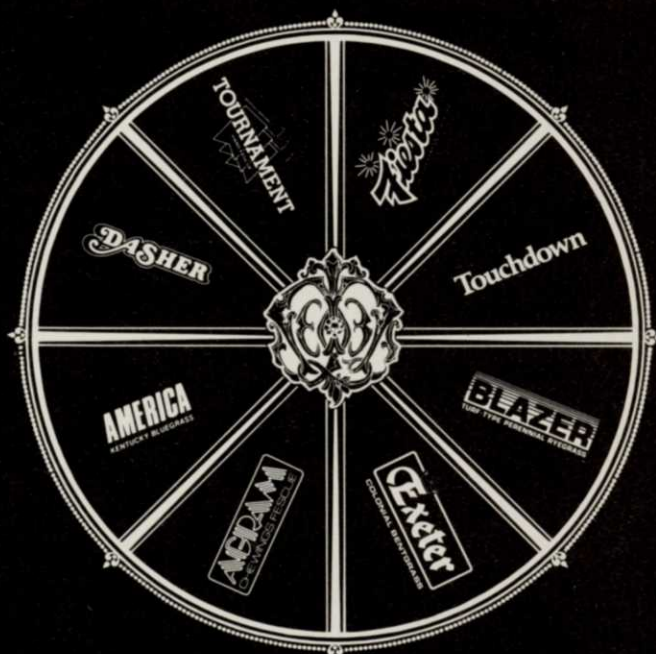
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THE GROWER

The grower turns the hopeful findings of the breeder into reality. He is an agronomist, an engineer, a speculator. If a crop fails, he is responsible for the loss.

In the history of improved turf seed production, there have been three types of growers. The first is the old Midwestern farmer who agreed to keep his cattle off a field of common bluegrass so that the stripping crew could harvest the seed in summer.

The second is the farmer in the Northwest, driven by curiosity and financial temptation, trying something new. Otto Bohnert, Howard Wagner and the Geary brothers are this type of grower. Their curiosity motivated them to enter the turfgrass seed business in the 40's and 50's. Today, there are many more farmers in the Northwest who could grow other seed or vegetable crops, but instead grow turfgrass seed.

The third is the owner/grower. He is more than a supplier to a marketing agency. He owns the land, grows the seed crop, owns the cleaning plant, and has large impact on marketing decisions. The Jacklin family were notably the first. More recently, Bill Rose of Turf Seed and Willard McLagan of International Seeds Inc. wear a number of hats during the year.

These men must contend with things like unpredictable volcanoes, summer rains, environmental regulations about field burning, collecting from distributors, construction and depreciation of large cleaning plants, and how universities are rating their product. Their load of responsibility is tremendous. They have more to lose and they try harder as a result. Without their constant pushing the market may not have progressed as it has.

The ability to control production of a new turfgrass seed has pushed them toward a new dimension, their own breeding programs. Today, a grower can manage seed production from the development of the cultivar to the bag on the loading dock.

The grower has quality standards which he must meet. State seed certification regulations require constant sampling of seed for offtypes and inert matter. Bentgrass or *Poa annua* in bluegrass is disastrous and the grower must constantly prove his product is labelled properly. To a degree, there is a bit of the buyer beware in the seed market. Reading the seed tag is the only way to know what you're buying. Certified seed is your only assurance of that.

The grower is the key link in the production and distribution of turf seed. If he has a bad year, seed prices go up and every turf manager pays. If you buy certified seed, the grower will provide you with a reliable, high quality product on which you can stake your professional reputation on daily.

CERTIFICATION AND MARKETING

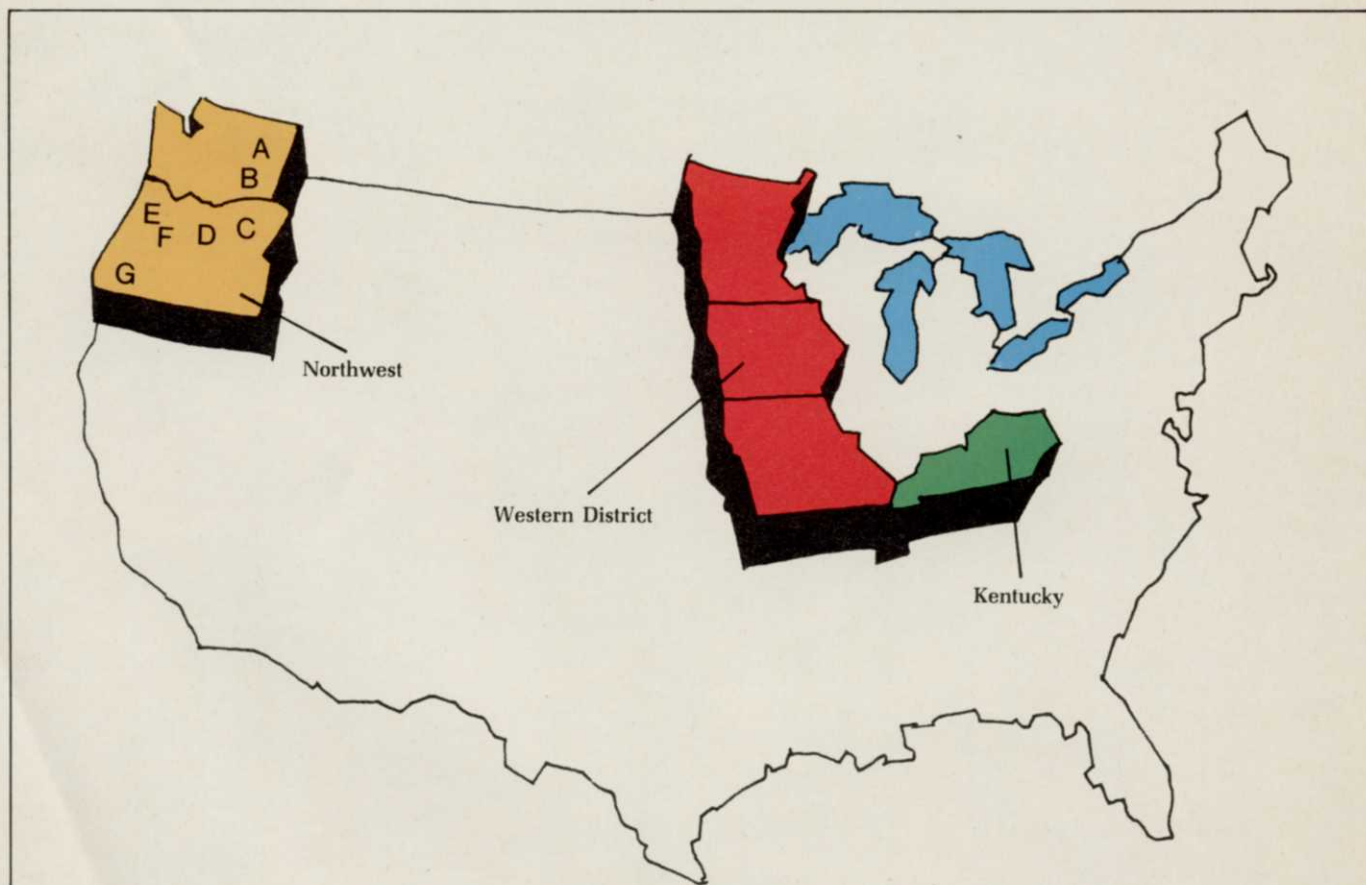
The reputation of a golf course superintendent, grounds manager, or landscape contractor depends upon his materials. Not only is it his responsibility to recommend the appropriate type of seed for a particular site, he must make certain the seed he buys is weed-free.

For example, if you are seeding a

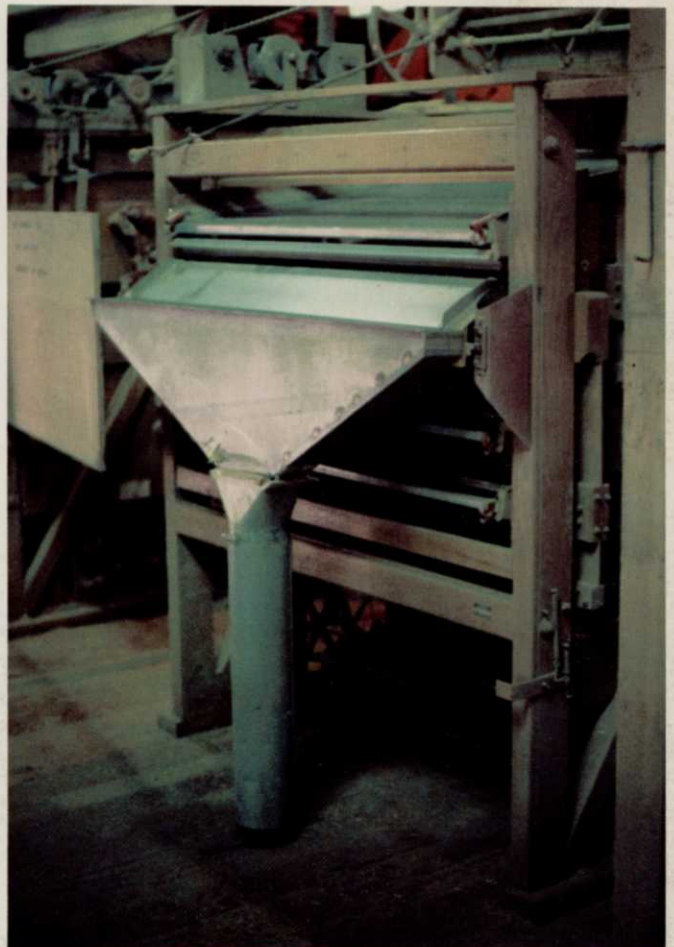
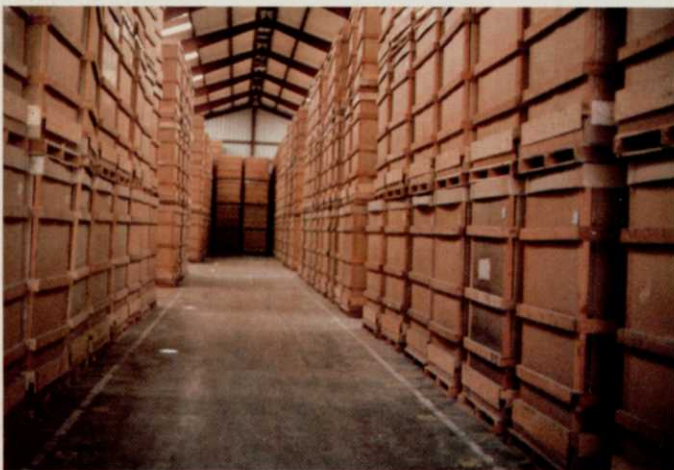
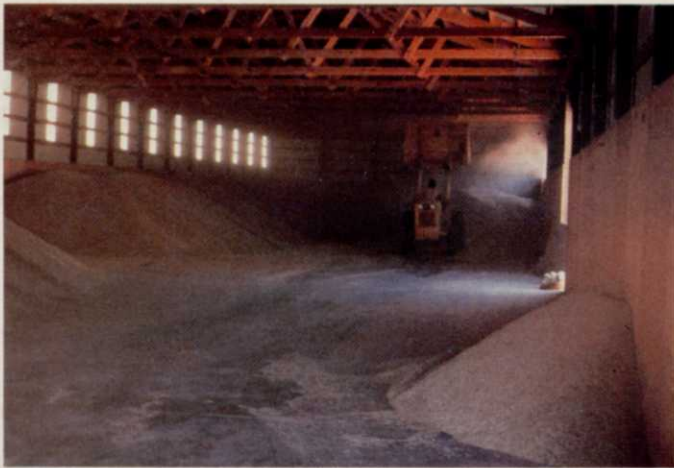
Kentucky bluegrass/perennial ryegrass/red fescue mixture, you could end up with more bentgrass than ryegrass or fescue. Where did the bentgrass come from? If you purchased uncertified seed this is very possible. As little as two percent bentgrass in a mixture with ryegrass or fescue will provide more bent-

grass seeds than ryegrass or fescue seeds.

The need for certification is obvious. Under pressure from agricultural interests, states began to establish minimum purity standards in the 40's. Each state has specific requirements for seed purity. These standards are not merely about



Seed Production Areas. Seed stripping crews started in Kentucky in early June and worked northward in the Western District. Today, some common bluegrass is grown in the Midwest and Canada, but by far the most improved turfgrass seed is produced in the States of Oregon, Washington and Western Idaho. Notable areas in the Northwest are (A) Spokane Valley, (B) Pomeroy area, (C) Union County, OR, (D) Madras area, (E) Willamette Valley, (F) Silverton Hills bentgrass region, (G) Rogue River Valley.



Bin storage of seed following harvest and before cleaning (upper left).

Seed separator (right) which removes weed seeds, improper turfgrass seeds and trash from the seed brought from the fields and stored. **Bulk storage** after cleaning and before bagging (bottom left).

levels of impurities in the final product, they dictate how close a field of one seed type is to a field of another type. Each step of production is inspected by state officials to keep track of the seed lot from planting to bagging.

The purpose of certification is not just to protect the consumer from impurities, it is to protect the genetic integrity of the turfgrass type. With the increased number of cultivars of a particular species of grass, it is critical to keep the seed of one separate from another. The similarities between some Kentucky bluegrass seeds is so great, even microscopic detection is impossible. You may not know what cultivar you have until the seed germinates and the actual plant becomes evidence.

To prevent intermingling of cultivars, fields used for growing seed of one type may be restricted for growth of another seed type. Fields must be at least regulation distance apart to prevent contamination

of adjacent fields. Herbicide treatments are timed to eliminate any weed seeds brought to the surface by cultivation. Burning eliminates all straw, weed seeds, and new generation seed left on a field after combining. Usually a planting produces seed for three years before it is plowed under and a new planting made. The burning does not kill the parent seed plants, only seed and trash leftover in the field after harvest.

Current production techniques were developed to produce purity at a reasonable cost. Seed is drilled into the soil rather than upsetting the soil by cultivation and surface seeding. Soil disturbance uncovers buried, but viable weed seed. Studies have shown that colonial bentgrass seed can remain viable for more than five years when buried.

One method of planting uses a seed drill and a device which covers the seeded row with activated charcoal. Herbicide is then applied with

a boom sprayer and the charcoal protects the foundation seed from harm.

After the seed has germinated and grown for two or three months, a selective herbicide is applied to remove weeds. The grass goes into dormancy for the winter.

In the spring, spot treatments are made during a procedure called roguing to eliminate offtypes and weeds.

In June and July fields are mown when still green. This eliminates losses to seed shattering by equipment. The seed dries on the stalk in windrows in the field. If it rains the windrows are turned over once. About two weeks later, providing rain has not spoiled the process, a combine is used to pick up the windrows of seed and stalk. The combine separates the seed from the other material. The seed is placed in large boxes and stored until cleaned.

Cleaning is a mechanical process involving air separation and screen-



Bags of cleaned and tagged seed ready for pickup by trucks and rail cars.

ing. It is an amazing process that can distinguish between almost identical seeds in huge volumes. Many farmers have their own cleaning plants.

When cleaning of one type of turfgrass seed is completed, the machinery is thoroughly cleaned before the next seed is cleaned. Rarely will the machinery used to clean bentgrass be used to clean bluegrass or ryegrass.

After cleaning, the seed is again stored in boxes until bagged or blended. Bags are placed on pallets and inspectors take representative samples from bags. These samples are sent to state labs for inspection. If the seed meets the standards set for certification, the bags are tagged.

Some of the checks made from seed samples are for weed seed, inert matter, and germination percentage. Perennial ryegrasses undergo a test for annual ryegrass. This test uses ultraviolet light. If more than a certain percentage of the seeds fluoresce under the light, the seed can-

not be certified.

Certification is a process which begins by filling out records prior to planting and doesn't end until the bags leave the hands of the grower. Meeting these standards adds considerably to the cost of the seed. But the results are worth the extra expense from an end-user standpoint.

Marketing and Distribution

Prior to the Plant Variety Protection Act of 1970 there was relatively little promotion of improved turfgrasses. Although chemical and equipment suppliers to the turf industry advertised in the 60's, seed companies did not begin national promotional efforts until Jacklin and a few grower associations started small schedules in 1968. The American Sod Producers Association had been created the year before and Weeds Trees & Turf, then only five years old, started to provide regular coverage of sod production. Jacklin was promoting Fylking in their original ads.

In 1972, Lofts began their promotion of Baron. Pennfine promotion first appeared in 1972. Warren's began A-20 promotion in 1973, as did Burlingham with Bonnieblue.

Today, promotion of improved turfgrasses can be estimated at more than \$1 million with shows, magazine advertising, and direct mail. At the same time the market has grown from an estimated \$62 million in 1965 to an estimated \$400 million in 1979.

The market is more sophisticated than it was in the early 60's. Quality involves more than dark green color, it involves disease resistance, germination percentages, seed mixtures, and many new varieties. Obviously, marketing helped the growers and distributors. But, it also improved the market. The individual industries which use seed are now significant markets of commercial importance. The local seed store is now a million dollar enterprise with many products. Turfgrass seed improvement is to be credited with this achievement.



Ten grams of a seed sample are checked for weed and off-type seed in a lab.

VARIETY PROTECTION

European turf researchers made great strides in the 30's with discovery of bluegrass apomixis by the Swedish researcher Munzinger and developed and released a few improved varieties. Some of the reasons for their gain in this period was variety protection between countries in Europe, a cutback in U.S. efforts during the depression, and eventually the World War II. The fact that the Arlington Turf Gardens was moved to Beltsville so that the Pentagon could be built there, was a clear sign of the setback caused by the war.

Before protective legislation from the USDA, a number of methods were tried to guard the seed from any interested seed grower. Growers of Manhattan perennial ryegrass, Penncross bentgrass, Merion Kentucky bluegrass, and other improved grasses formed cooperative associations to simplify supply lines and to promote their seed. Other tactics used to protect development costs were swelling the seed only in mixtures (Adikes did this with NK-100 in the 50's and 60's) and secrecy. Cooperatives still exist for some grasses, Manhattan Ryegrass Growers, Highland Bentgrass Growers, Seed Production and Introduction Corporation, and Merion Bluegrass Growers Association among others. Many of these associations are sponsoring research which may soon lead to the development of improved cultivars of their primary turfgrass, and which will provide them with exclusive rights under the Plant Variety Protection Act of 1970. Manhattan and Merion cultivars are expected within the next three years.

So, by 1960, technological aspects of seed production had been mastered. The ability to grow large quantities of high grade turf seed existed. The price of improved turfgrasses had become commercially attractive. However, concern existed for the lack of protection of improved turfgrass seed from a commercial standpoint. Grower associations worked with regional and national seed companies to control seed quality. States had begun to require certification of seed to insure the genetic integrity.

When protection was finally obtained from the 1970 Plant Variety Protection Act, a new importance was placed upon improved varieties. The differences between public and patented varieties were stressed by patent holders. Universities began to receive financial support for research into improved turfgrasses and some larger seed companies created their own research department. The seed company could now control production of its improved varieties released after 1970. The term proprietary turfgrass was coined.

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