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AN EVALUATION OF PERENNIAL RYEGRASS VARIETY SEEDING RATES*

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It was found that: 1) There is little reason to seed the perennial ryegrass varieties at a rate greater than 6 lbs./1000 sq. ft. for optimum establishment; 2) A 3 lb. seeding rate will result in a good sward with adequate weed competion, however, the turf will take longer to mature (note excepion of NK-200which would require 6 lbs./1000);3) The 1 lb. seeding rate appears inadequate unless a slow maturing, weedy, possibly "bunchy" turf can be tolerated; 4) The cutting quality of Manhattan, Pennfine, NK-200 and Common is not influenced by seeding rate whereas the seeding rate does influence the appearance following mowing with Lamora, NK-100 and Pelo.

In the past, the cool season species perennial ryegrass *(Lolium perenne L.)* was established in regions characterized by relatively mild winters and cool summers where quick establishment and wear tolerance was needed. The coarse texture and poor cutting quality had to be accepted. Recently, plant selection and breeding within the species has given several improved plant types for turf use. These varieties have resulted in an increased adaptation range and usage potential for the species.

Currently, the suggested seeding rate for all varieties of perennial ryegrass is in the 6 to 12 lb./10000 sq. ft. range. Observation of stands of the newer varieties indicate a lesser seeding rate, with considerable economic implication, may be in order. Unfortunately, observations in this regard are the only information available at present. Therefore, a trial was established at the University of California Deciduous Fruit Field Station, San Jose, in the fall of 1972. It was the objective of this study to evaluate the establishment characteristics of seeding rates of 1, 3, 6 and 9 lbs./l000 sqft. of the varieties Manhattan, Pennfine, Lamora, Pelo, NK-100, NK-200 and Common perennial ryegrass.

The site at the field station was prepared in the normal manner for turf establishment. The soil was a loam with a pH 7.3 and had a low electrical conductivity reading. Phosphorus and potassium levels were adequate.

Each variety at each seeding rate was hand sown to 5 x 20 ft. plots and the plots were replicated four times. Maintenance following establishment consisted of mowing (at 1 1/2 inches), irrigation (to maintain an adequate water balance), and monthly fertilization with ammonium sulfate.

The most important measurements taken to realize the objectives of this trial included percent turfgrass cover and percent weed invasion at regular intervals.

The results obtained are presented in Figures l-7. Each graph illustrates the percent grass and weed coverage over time. The horizontal line at 70% grass coverage indicates a mature, fully useable turf sward.

Figure 1

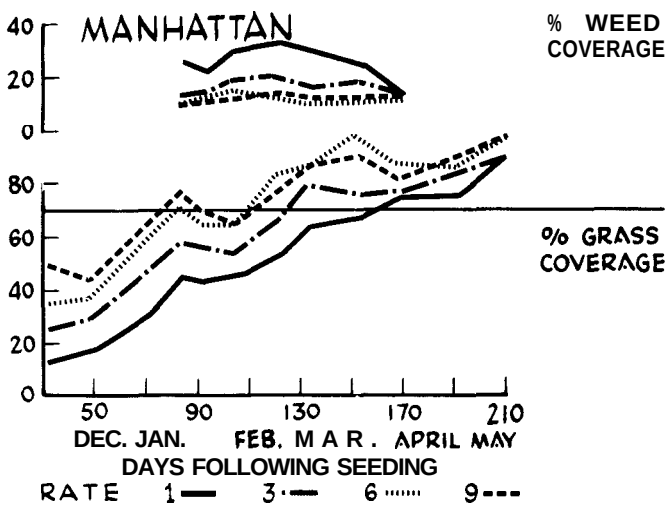

Figure 2

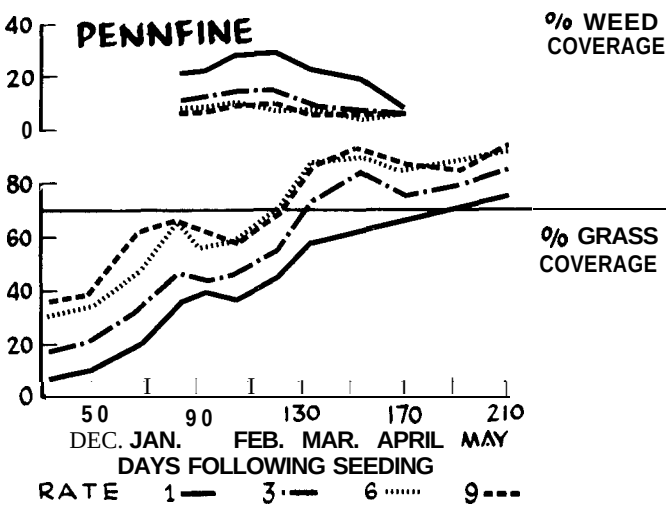

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Figure 3

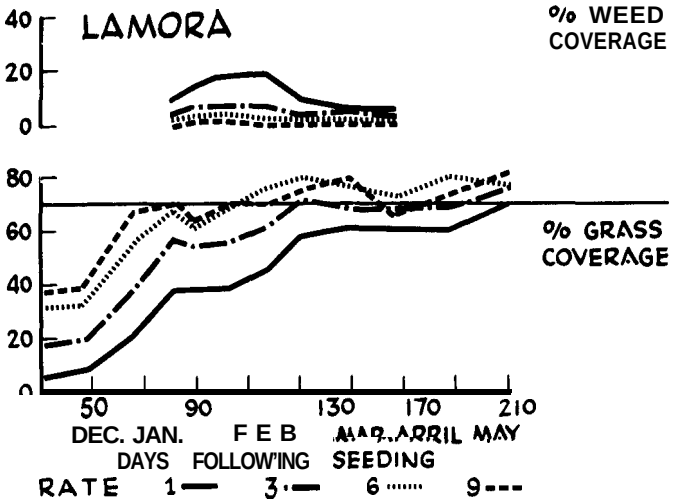


Figure 4

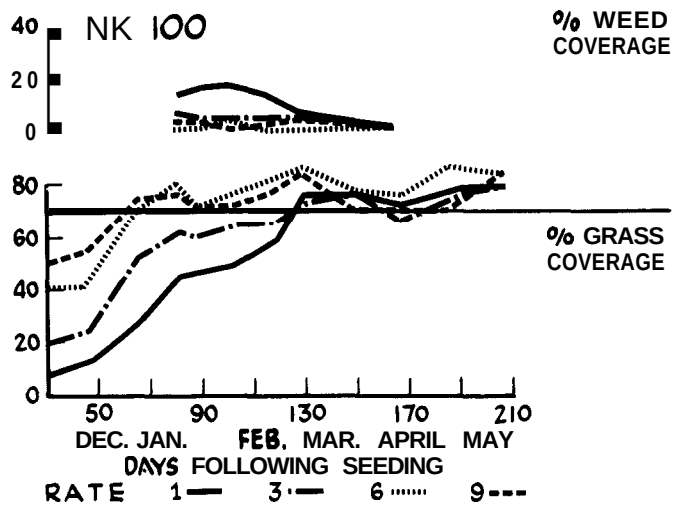


Figure 5

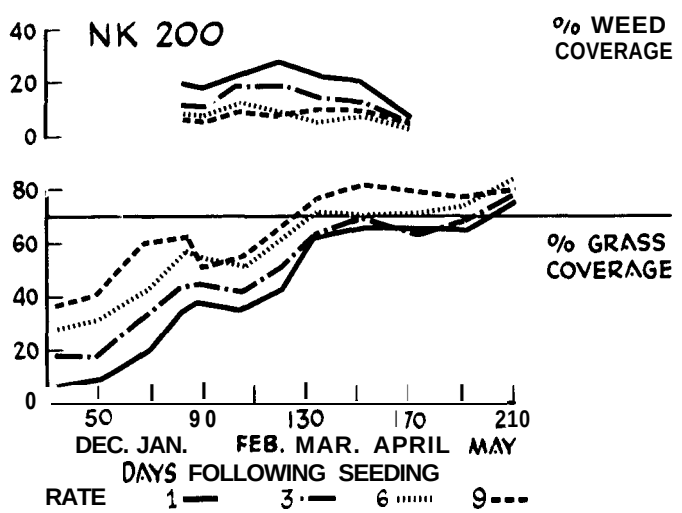


Figure 6

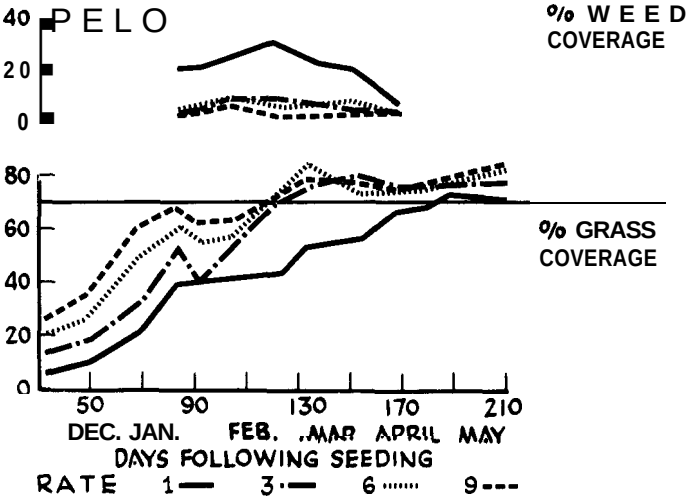
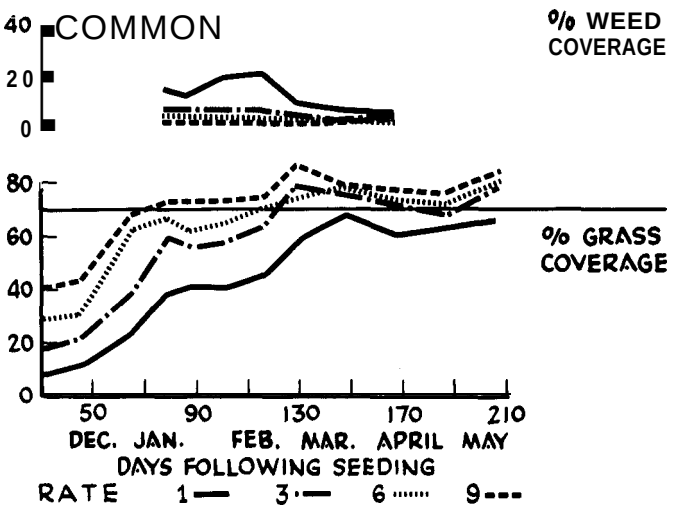


Figure 7



Regarding time to 70% grass coverage, it can be noted that at the higher seeding rates, NK-100, Lamora and Common were the fastest varieties to establish. With all varieties, there was little difference between the 6 and 9 lb. rate. With most varieties, the 3 lb. rate established slower than the 6 and 9 lbs. treatment and the 1 lb. rate was slower than the 3 lb. seeding rate.

The results of the 1 lb. seeding rate are best noted in the percent weed readings. As is shown, there was a considerably greater weed stand in all varieties seeded at the 1 lb. rate. The weed amount decreased significantly with the 3, 6 and 9 lb. rates (note exception NK-200 at 3 lbs.)

Cutting Quality

Following maturation of the above described seeding rate study, visual observations were made during early summer, 1973, on the cutting quality of the seven varieties at the four seeding rates. The results of a June reading are given in Table 1. The rating is based on a 0 to 10 scale with 0 representing poor qutting quality (severe

shredding of leaf blades) and 10 representing a "clean" leaf cut.

It should be noted that environmental conditions (high temperature) and management practices (rotary mower, relatively low notrogen rates), accentuated the cutting quality observations that are reported.

As Table 1 indicates, the seeding rate had no effect on the cutting quality of the varieties Manhattan, Pennfine, NK-200 and Common. Common perennial ryegrass consistently showed poor cutting quality. The cutting quality of Lamora, NK-100 and Pelo improved as seeding rate increased.

To summarize these results, it was found that: 1) There is little reason to seed the perennial ryegrass varieties at a rate greater than 6 lbs./l000 sq. ft. for optimum establishment; 2) A 3 lb. seeding rate will result in a good sward with adequate week competion, however, the turf will take longer to mature (note exception of NK-200 which would require 6 lbs./l000); 3) The 1 lb. seeding rate appears inadequate unless a slow maturing, weedy, possibly "bunchy" turf can be tolerated; 4) The cutting quality of Manhattan, Pennfine, NK-200 and Common is not inffuence by seeing rates whereas the seeding rate does influence the appearance following mowing with Lamora, NK 100 and Pelo.

Appreciation is extended to Northrup, King and Co., Berger and Plate Co. and Germain's for materials supplied for this study.

TABLE 1. CUTTING QUALITY OF SEVEN PERENNIAL RYEGRASS VARIETIES AT FOUR SEEDING RATES (O=VERY POOR: IO=EXCELLENT)

lbs./l000 s. ft. Seedling Rate	Varieties						
	Manhattan	Pennfine	Lamora	NK-100	NK-200	Pelo	Common
1	6.25 N.S.**	7:00 N.S.	3.75 Z*	1.25 Z	6.00 N.S.	3.00 z	1:75 N.S.
3	7:00	8.25	4.75YZ	3.00Y	7.00	4.25 Y Z	1.00
6	6.50	8.50	6.25 X	4.00XY	6.50	4.25 Y X	2.00
9	6.50	8.50	6:00 XY	5.25 X	6.25	5.25 Y	1.75

*Values followed by the same letter are not significantly different at the 5% level.
**Not significant.

AN ALTERNATIVE METHOD OF GREENS MANAGEMENT* Part I

*J. H. Madison, W. B. Davis and J. L. Paul***

This is a two-part article that summarizes extensive research by the authors on a alternative method* of *greens management. The second part will be presented in the next issue* of *California Turfgrass Culture.

We propose a system of frequent, light topdressing as a management practice that favors quality putting turf on greens.

Much material of this paper has been formally presented in one paper (1) and set forth briefly in another (2). There we discuss our proposal extensively and informally so the reader can understand our goals and the approach to achieving them.

In the late '50's, Madison had creeping bentgrass plots which had become thatchbound through a program of heavy feeding and watering. The grass was unhealthy, the plots did not accept water well, and the turf did not respond to nitrogen. The turf problems did not respond to use of fungicides nor wetting agents. Coring resulted in some improvement. Of operations tried, only top dressing restored the grass to vigorous, health growth.

At about the same time some Dano method compost was piled next to another bentgrass plot. The evening winds blew small amounts of compost across a corner of the turf plot.

Over 15 months the grade of the plot was increased from 0" about 6' away from the compost pile to over 2" next to the pile. That part of the turf top-dressed by the wind was beautiful the year around until late in the second summer when, during a hot spell, there was heavy loss of grass associated with rapid breakdown of the organic topdressing. The pattern of kill resembled what is often described as "scald."

On the basis of these observations we became interested in topdressing and initiated some trials. We topdressed monthly with topdressing containing several differ-

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ent amounts of organic matter from different sources. We found that large amounts of light, loose materials such as peat or sawdust resulted in a loose thatch and unplayable turf. Denser materials such as granulated bark produced a better surface but were not as good as plain sand in creating a firm, true surface. Whenever we used 25-50% organic matter, disease problems occurred during hot weather.

Subsequently we ran tests in which all elements of a putting green management program were separated and used individually on bentgrass plots. The first season these showed that a fungicidal preventative spray produced the most thatch and an excellent turf. The high rating of the fungicide treated plots was exceeded in mid-summer when plots receiving insecticide surpassed it. Any use of herbicides reduced turf quality. Coring aided greatly in thatch breakdown. Cored plots were better than the control. Plots receiving a regular sand topdressing showed good quality, but the plots were not outstanding. Not at first. But as time went on, the topdressed plots rated higher and higher until by the end of the second summer topdressing was the best and most consistent single treatment we had.

The above gives the background of experience from which we ban to develop our present concepts.

In the late 60's we had many discussions about greens, about superintendents, about golfers, about turf management, and about what lay in the future. The amount of play had been rising steadily and was continuing to rise. The problem of traffic was being met by coring to relieve compaction and feeding heavily with nitrogen to keep the grass growing and repairing itself. Two things in particular were wrong with this program. We were overdoing the nitrogen so that disease, insect, and nematode pests were being encouraged. Second, coring was encouraging weed problems and use of herbicides was debilitating the bentgrass and appeared to be increasing bentgrass disease susceptibility.

By going to sand greens we had helped overcome the compaction problem, but no one knew what was going to happen to the infiltration rate of sand greens with time. Some greens had been sealed by use of products carried on a vermiculite carrier. In Kansas, Keene reported wind blown silt additions of up to 1/2" per year. It seemed as if we might have to keep on coring sand greens to keep their permeability and to help keep thatch under control.

On the basis of our experience with topdressing, we favored the alternative of keeping the sand surface renewed by frequent, light topdressing. Topdressing would also control thatch and would make coring unnecessary. Without coring or similar operations which create a seedbed for weeds, we should be able to bring weeds under control. Stopping herbicide use would improve grass vigor. A difficulty was the superintendent and his program. Most superintendents are geared to a heavy aeration-topdressing program two to three times a year. They regard topdressing as a major job. Some apply so much coarse sand that the golfer is unhappy for two weeks after, and for two or three weeks the coarse sand grains knock the edge off of the mowers. This makes topdressing a greater problem, Our attempts to get superintendents to change this kind of program have met little success in the past.

After 10 years of promotion we were getting some superintendents to stop topdressing with gravelly sand and to start using medium sand. Perhaps we could use that impetus for change, work topdressing into a total program, and substitute topdressing for something the superintendent was already doing. The more we examined this idea the better it looked.

On paper our program took this form. We kept mowing and irrigation as is. All other programs were combined into one or eliminated. This should provide an appeal of economy of operation. Fertilizing, topdressing, insect control, weed control, disease control, liming, etc. were combined into a single operation; vertical mowing and coring were eliminated. Chemicals and sand were combined for dry application every three to four weeks. If properly chosen for size, materials used should wash out of sight with a light irrigation. Thus a daily golfer should be able to put a green within half an hour after topdressing without being ware that the activity had taken place. There should be no residue to affect mower sharpness.

The weed control part of the program looked especially good to us. We didn't want to use an herbicide because of attendant injury, and it looked as we wouldn't need to. By eliminating coring and by reducing and using great care in vertical mowing, we stop preparmg a seedbed for weeds. Most weed seeds need light to germinate. By continually burying them we reduce germination and emergence. If, in addition, we add bentgrass seeds to the topdressing, we will have turf filling in and competing wherever grass is thin. Bentgrass will germinate earlier in the fall than Poa annua and earlier in the spring than crabgrass so it will be up and competing before they begin to germinate.

Not only would we bury seeds, we would also bury disease inoculum. There seemed a good chance our program would reduce disease problems. Disease control would also be helped by elimination of the thatch layer.

Any program has bugs. We needed trials to find the bugs. Also, we had a major unknown. We wanted to add enough sand to continually bury the thatch. But WC didn't want to add so much that we destroyed the mat or cushion that protects the turf from injury by traffic. Could we bury the thatch and still keep the mat?

We began a research program using an experimental green of "Penncross" bentgrass. The U.S.G.A. assisted our start with funds, and the TARP program is providing continuing support.

In designing our topdressing we proceeded as follows: First, we selected a sand of suitable particle size. This is essential to any program that is to succeed. The sand must be less than 1 mm in size. This means that all the sand should pass a # 18 screen (Tyler #16, New U. S. std. # 1). Don't try this program if you can't get a sand of this size. To be effective, the sand must drop down into the thatch so the golfer doesn't see the sand and so the mowers don't cut it.

To this sand we added appropriate amounts of all im-

portant mineral nutrient elements, not on the basis of demonstrated need for grass growing in our green mix, but rather on the basis of assurance that our results would not be affected by a hidden dificiency. For our nitrogen source we used a mixture containing ammonium ions, nitrate ions, and organic N (from Milorganite). This was taken from careful research done at Rhode Island by Bell and De France (3) and represents the optimum balance between the three sources for bentgrass growth. We are aware that any N source can be used, but we used the Rhode Island results so we would have a recognize source that would not introduce nitrogen source as a variable in the experiment.

In the appropriate season we added an insecticide (Diazinon or Sevin) and/or a fungicide (thiram, Dexon, captan, Koban or Daconil 2728). These were added to the topdressing as wettable powders. We also used 1-2 oz. of "Penncross" seed per 1,000 sq. ft. During the first year of our experiment we used only one variable, frequency of topdressing. We applied as little sand as possible, about 1/28th inch, and adjusted the amount of addends so all treatments got the same amount of chemicals during the year.

When we applied topdressing every week, grass growth was depressed and during the slow growth of autumn we almost smothered the grass. At two-week intervals we were still adding too much sand. We buried both the thatch and the mat. When a ball was pitched to those parts of the experimental green, there was no cushion to absorb the shock, and the grass was killed. Traffic rapidly abraded the grass around the holes.

When we topdressed at 4 week intervals the sand just buried the thatch but left an adequate cushion, However, the grass was low on nitrogen the last week of the four. When the interval was much greater than 4 weeks, we built alternate layers of sand and thatch, and this we wanted to avoid. Roots do not penetrate these layers very well, and soil-water relationships are impaired by the layer cake condition.

As a result of these observations, for our second season, we used a standard topdressing interval of 3 weeks with 1/28th inch of sand added at each topdressing and a check. Variables were the use or non-use of insecticides and fungicides.

During this, our third summer of treatments, we are using only two treatments. One is our check which is standard management with topdressing 4 times a year combined with hole punching, and fertilizer applied monthly with sprays as needed. The other is the toy dressing program again using the } week interval with seed and all fertilizer and pesticide chemicals in the topdressing. This summer we are just looking for failures to show in the program. We don't expect them, but we alert and watching.

LITERATURE CITED

1. Madison, John H., J. L. Paul, and W. B. Davis. 1974. "An alternative method of greens management." Proceedings of the Second International Turfgrass Conference. Madison, Wisc. (In press).
2. ——— ——— —— 1974. "Consider a new managcment irogram fbr greens." U.S.G.A. Green Section Record. 12(3), 1974.
3. Bell, R. S. and J. A. DeFrances. 1944. "Influence of fertilizers on the accumulation of roots from closely clipped bentgrasses and on the quality of turf." Soil Science 58:17-24.

POA ANNUA*

***Victor A. Gibeault** **

Annual bluegrass *(Poa annua L)* has probably been the most talked about, written about, cussed about and praised about species in the field of turfgrass management over the last 25 years. Prior to the 1950's, annual bluegrass was just one of the grasses that made up a turfgrass sward. However, since that time the desire for a uniform stand of a desirable turfgrass species or mixture of desirable species has brought increased attention to the ever-present but unpredictable annual bluegrass plant.

Whether to cuss at annual blue and. consider it a weed or to praise annual blue and consider it a friend is dependent on several criteria. These would include:

1. Amount
   a. It has been argued that if a turfgrass location has from 0 to 40% *Poa annua* present, the chances of removing it and stimulating the more desired species by cultural and chemical approaches are pretty good. Consider it a weed!
   b. If turfgrass location has from 60 to 100% *Poa annua,* perhaps it's not such a bad species after all. Total renovation may be out of the question so let's consider annual bluegrass a friend and learn to live with it.
   c. If the turfgrass location has from 40 to 60% *Poa annua,* a decision must be made whether to take steps to eliminate it or take steps to foster its growth.
2. Location

Since annual bluegrass is most unpredictable in areas of environmental stress, the geographic location is important in determining if *Poa annua* is a friend or foe. In locations that have characteristically high summer temperatures, as an example, the potential loss of annual bluegrass is greater than in areas that have more moderate temperatures. The subtropical plant climate zones (warm season

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areas) represent the former while much of the California coast represents the latter.

3. Facility Preference

The final criteria is the wishes of the particular facility that has, or does not have, annual bluegrass present. Does the membership of a golf course want to play on *Poa annua* greens, or greens with a percentage of annual bluegrass present? Can an athletic facility tolerate the possible loss of the grass stand during the summer months? Is a facility willing to spend the necessary funds following installation to insure that annual bluegrass does not not invade and reach a troublesome percentage of the turfgrass sward? These are questions that only can be answered by the particular turfed site; hopefully the answer will be the result of a thorough understanding of *Poa annua's* desirable and undesirable characteristics as well as a realistic evaluation of the management practices and costs involved if annual blue is to be considered a weed.

The following identifies some of the characteristics of annual bluegrass which can be helpful in a decision-making process.

Desirable Turfgrass Characteristics

1. Can tolerate close, frequent mowing.
2. Can tolerate moist soil conditions.
3. Dense and fine textured.
4. Tolerates compacted soils.
5. Moderate shade tolerance.

Undesirable Turfgrass Characteristics

1. Low temperature susceptibility.
2. High temperature susceptibility.
3. Low tolerance to drought.
4. Moderate to poor salt tolerance.
5. Low smog tolerance.
6. Seedhead formation irrespective of cutting height.
7. Susceptible to numerous diseases.

Whether the choice is to live with annual blue or attempt to control it, an understanding of the growth and development of the species is important.

To begin with, several factor infiuence the germination of *Poa annua* seed. Optimum germination is noted when maximum temperatures are in the 75-80°F range with moderate minimums, when light is present, and when the soil pH is in the range suitable for turfgrass growth (6.0-7:5). Seed germination therefore is greatest in the late summer and early fall, decreases as temperatures decrease, and incrases again in late winter/spring if viable, non-dormant seed is present. Germination generally ceases during the summer months when temperatures are high. Many plant types of annual bluegrass have a built in dormancy requirement to insure survival through the summer months.

The percent germination of *Poa annua* seed is increased following mechanical operations which "open" the turf and allow light to penetrate (i.e. close mowing, aerification, verticutting). A facility that chooses to live with annual bluegrass should time maintenance operations to stimulate germination, and maintain suitable pH levels. Conversely, if annual bluegrass is considered a weed, aerification and thatch removal should be avoided at periods of maximum potential *Poa annua* germination. The pH should not be greatly altered since the desired turfgrass species could also be affected.

Following germination the growth of *Poa annua* is influenced by a number of environmental factors.

1. Temperature, light-Plant growth is greatest with high light intensities and alternating day/night temperatures in the mid 70's and mid 60's, respectively. Plant growth increases with increasing day-length. Plant growth decreases with increasing temperatures above this optimum; tissue killing can occur if temperatures exceed 100°F. Syringing is often used to modify plant level temperatures during the summer months if a facility wishes to live with annual bluegrass.

2. Moisture-Annual bluegrass usually has a restricted, or shallow root system under turf conditions. This is not an inherent characteristic of the plant; instead it is a response to soil conditions, mowing and fertilization practices common to turfgrass use and management. Because of the shallow root system and the limited soil/water reservoir that is available for water uptake, annual bluegrass requires frequent water applications, especially during periods of high evapotranspiration. Plant death quickly results if lack of water and high temperatures combine.

3. Nutrition-Growth response has been shown to be affected by nitrogen and phosphorus applications. Although supplemental nitrogen is needed by all grasses for optimum growth, it appears that annual bluegrass is more susceptible to minimum phosphorus levels than are other turfgrass species. Managers wishing to control *Poa annua* should keep phosphorus levels as low as possible. If living with annual blue, more frequent phosphorus applications are certainly in order.

Temperature, light, moisture and fertility influence the growth and development of annual bluegrass. As the plant matures, it is characteristic of the species to produce seedheads which are certainly a detriment to the appearance and playability of a turf sward. Seedhead production does not appear to be influenced by daylength or cutting height (seemingly normal seedhead production can be observed on putting or bowling greens maintained at 1/4 inch). Nitrogen applications, however, have been shown to increase vegetative growth while retarding inflorescence formation.When phosphorus and potassium were added, seedhead production again increased. Al-

though seedheads can be seen throughout the growing season, maximum seedhead production occurs in late spring-early summer when the plant come under high temperature stress. It is at this time that annual blue can die out leaving a scarred turf for the remainder of the summer. Seed germination and subsequent growth will occur as temperatures cool in the late summer. The cycle of germination, growth, seedhead formation, and death is then complete.

Of course, not all annual bluegrass plants die during the summer months. This is because all annual bluegrass plants are not annual; there are long-lived plant types within the *Poa annua* species. Recent work on perenniality within the Poa annua species has shown that a sub species designation would be an appropriate methods of differentiating the two plant types. The characteristics of each would be as follows:

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subspecies annua (annual)	***subspecies reptans (perennial)***
1. Upright growth habit.	1. Creeping growth habit.
2. None or few secondary tillers per culm.	2. Numerous secondary tillers per culm.
3. Prolific seedhead production.	3. Minimal seedhead production.
4. Seed following formation is dormant.	4. No seed dormancy.
5. Minimum rooting on culm/tiller.	5. Several adventitious roots on prostrate culm/tiller.
6. Six nodes or less per culm/tiller.	6. Greater than six nodes per culm/tiller.

When a survey was conducted in Oregon, it was found that in excess of 50% of the *Poa annua* plants collected had perennial characteristics. Whether a site has the annual or perennial plant type (or mixed), will certainly influence the management and control method.

To summarize the foregoing, I have attempted to pull together the bits and pieces into a cultural management program. Once this basic decision of friend or foe is made on a facility, this chart will be of assistance in managing or removing *Poa annua.*

POA ANNUA is a . . .

	friend	***foe***
Irrigation:	Water use is similar to other turf species but usually characterized by short root system. • Irrigate frequently • Early morning irrigation to reduce disease incidence. • Syringe for temperature control.	More desirable turfgrass species usually have deeper root system. • Irrigate as infrequently as possible (for the desired species). • Early morning irrigation. • Syringe for temperature control only if needed for desired species.
Mowing:	• One inch is optimum cutting height for maximum competitive advantage. • Brush to remove seedheads. • Frequency is dependent on growth rate.	• At recommended cutting height for desired species. • Avoid scalping/close mowing at times *Poa* germination. • Frequency dependent on growth rate.
Fertilization:	• Frequent application of N in growth season. • Cut back N in summer, • Avoid regular use of acid forming fertilizers. • Pay attention to P levels. • Watch boron toxicity.	• N applications as needed in growth season. • Cut back N in summer on cool season species; increase N in summer on warm season species. • Acid forming fertilizers o.k. on bent. • Reduce levels of P. • Watch balance between N and K.
Aeration:	• Aerify frequently with small spoons. • Do at times of maximum germination. • Avoid summer aerification.	• Aerify frequently at times of minimum Poa germination (spring, early summer). • Any fall aerification should be late in season. • Use small spoons for summer aerification on cool season grasses.
Verticutting:	• Verticut during periods of maximum germination. • Verticut frequently during growth period. • Avoid summer verticutting.	• Avoid verticutting at times of *Poa* germination. • Coincide with maximum recuperative potential of the desired species.
Pesticides :	• Avoid use of preemergence herbicides. • Control weeds, diseases, insects for desired appearance	• Note below.

If annual bluegrass is considered a weed, there are several chemical approaches that can be used, either singly or sometimes in combination. By necessity, these will be discussed briefly but the reader is urged to pursue the practices as described in other resource materials. The chemical control methods presented are intended as a review of existing practices and should not be interpreted as a recommendation by the author. Label directions of any herbicide used should be closely followed.

Preplant Treatment

If an area is to be established, or reestablished, and annual bluegrass seed is known to be present, a preplant treatment is often used. The two methods are sterilization for seed kill and plant treatment with a non-selective herbicide. With sterilization, the seedbed is prepared, and the area is treated with products such as Methyl bromide, Metham, and Dazomet prior to establishing the desired turf species. With non-selective herbicides, the seedbed is prepared. *Poa annua* is allowed to germinate and then treated with materials such as Paraquat or Weed Oil. Seeding of the desired species is done with minimum soil disturbance.

Preemergent Treatment

In mature turf, preemergent materials are often used to prevent *Poa annua* establishment from seed. The materials are applied prior to annual bluegrass germination in late summer, early fall and again in mid-winter. The herbicides most commonly used include Bensulide, Benefin, Terbutol and DCPA. Calcium arsenate and Kerb (on bermudagrass) are also used. The preemergent treatment is based on the concept that annual bluegrass is annual in nature and works well where this is the case. The presence of perennial *Poa annua* in part negates this concept.

Seedhead Inhibition

Attempts have been made to inhibit seedhead formation and thereby curtail future *Poa annua* establishment. The materials examined include Maleic hydrazide and Posan. Turf injury has been noted with the former; the latter has been released for use.

Postemergent Treatment

The ideal chemical control for annual bluegrass would be a material that selectively removes the weed from the desired grass or grasses. Kerb possesses this selectivity but *only between the bermudagrasses and annual bluegrass.* It is therefore restricted in its use and should never be applied to desirable cool season species. Check label directions careful1 before application. Depending on the method of use, Calcium arsenate can also be considered a postemergent treatment.

In summary, *Poa annua* is a widespread species that is commonly found on turfed sites. Whether it is a friend or foe is dependent on a number of factors, including the preference of a particular location. If a friend, there are many management practices that can assist its growth; if a foe, there are many cultural and chemical practices that can effect its control.

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