

THE EFFECT OF LOW PHOSPHORUS ON POA-ANNUA PUTTING GREENS

By Paul Voykin, Superintendent, Briarwood Country Club, Deerfield, IL

In the course of my education I have found out that nutrients may enter plants through the leaves, stems, or roots. The most natural and major way is through the roots. The soil is a storehouse for water and nutrient needs by plants. Therefore, we know that good soil management should make a constant and adequate supply of required and necessary nutrients available for growing plants. While doing my studying and my research I became very interested in one particular element — phosphorus. I found out that adequate P levels in the soil would promote fast, vigorous root growth during the seedling stages. And also if some roots were destroyed new roots would be produced so fast that little injury would be evident. Perhaps that's why the North American Indian advised the pilgrims to place a fish below each hill of corn — not on top but below where it would do the new plants the most good. The flesh gave the plant some calcium (Ca) and K, and the fish bones provided lots of P. We still use fish fertilizer but we bottle it and use it for house plants.

I also read that young plants have a high nutrient requirement relative to their size. Their nutrient content is from two to several times greater than in mature plants. Furthermore, nutrients accumulated in young plants may redistribute as the plant matures. To back these discoveries, I then read in farm magazines that P uptake was greatest for the first growth stage and decreased with plant age. This is generally true for turf, but this can be at lower rates because turf grasses need less P than high yielding grain crops and vegetables. Farmers long ago found out that sugar beets, corn, wheat, alfalfa, barley, etc., do much better when P is band applied at proper depths. If fertilizer is broadcast randomly over the soil surface it will be diluted with soil and little will be available for uptake by early developing roots. It has long been recognized that banded P application is more important than for other nutrients.

A greenkeeper puts P in the root zone when he seeds a nursery or other turf areas. How deep to apply a starter P fertilizer has never been critically determined for turf. From my experience, I think it would be just beneath the surface. P is subject to little leaching. Therefore, after the initial application, very little P may be needed to maintain adequate levels. Most superintendents for some reason do not adhere to this theory. Keep in mind that fertilizer applications were started as a supplement to that available under natural soil conditions. Therefore, I think there is a tendency to maintain too high amounts of P in mixed fertilizer goods. K, on the other hand, is leached by waterings or rainfall. Thus with heavy water, especially on sandy soils, the K moves from the root zone. Also, clipping removal causes a steady drain on nutrients, particularly N and K. So from this, and other less relevant factors, I conclude that P needs should be based on soil test. Adding more to a mature crop is wasteful and does nothing more than encourage notorious shallow-rooted weeds such as chickweed, crabgrass, and poa-annua, whose seed as you know is available in large quantities at the soil surface. Maybe the whole key to this is this: where putting-green root penetration is deep, lower rates of

soil P can be maintained than where roots are shallow, such as with the above-mentioned weeds whose swift germination and health is based on higher levels of phosphorus. However, if soil tests show that a green desperately needs P, which in our midwest area is not common, then the phosphorus should not be broadcast over the turf randomly, but be put down closer to the roots through slicing, spiking, and, perhaps best of all, laid down after aerating the greens. We know P will not move far from its point of placement; however, on high sand greens P may move well through the profile. Just throwing it over mature turf by broadcast methods doesn't do much to get it down into the root zone. My observation has been that most greenkeepers don't allow enough time for granular phosphorus to dissolve and it is usually picked up by the greensmower.

When I came to Briarwood twenty years ago, I found that a recent soil test indicated that phosphorus levels in my greens were extremely high and that K levels were extremely low. Twenty years later, by not using P at all except on special occasions and by using K and N only as required, I have reduced the P levels by half or more. Which is still too high. However, I have brought up the K to desirable levels. In the process I have found out that by not overfertilizing with P in concert with other good maintenance procedures, my poa population has not increased in recent years. In fact, I believe it has diminished. So now after twenty years I can boast that I have as much or more Washington creeping bent as when I first started. At that time the greens, despite high phosphorus content in the soil, were almost all bent. This was due mostly to the fact that the course was public before the Briarwood people took it over. Being a public course the greens were mowed extremely high and watered very infrequently. However, I know of three private courses in my area which, twenty years ago, had beautiful creeping bent; but the "new" supts. who took charge of them overwatered their fine turf, overloaded them with P on poorly drained soil that wasn't exactly good sandy loam and now are devastated with poa-annua on their greens. In fact, one of them is seriously thinking of resodding all the green surfaces with fresh creeping bent and hauling the poa-annua away. But what is the use of this enormous expense if his practices are going to remain the same? He comes to my place and says, "Boy you sure have lots of bent. You're lucky!"

Recently Roy Goss, extension agronomist at the Western Washington Research Extension Center, wrote: "Phosphorus applications significantly increased poa-annua in all our plots in our tests, which suggests that rates of phosphorus possibly as high as those used (4 pounds per 1,000 square feet P_2O_5) or higher may be required for normal bluegrass development. It should be pointed out, however, that most golf course superintendents and other turfgrass managers have in my view consistently overapplied phosphorus. In nearly all cases in the Pacific Northwest, putting green soil tests reveal extremely high phosphorus levels.

Thomas W. Cook, now at Oregon State University,

wrote: "As you have undoubtedly heard before, one of the most commonly abused management tools is the fertilizer program. In attempting to control poa-annua it is important to keep phosphorus and nitrogen levels moderate. Excessive nitrogen and phosphorus and disregard to proper balance of nutrients has helped to make the poa-annua a problem much worse than it should be."

In 1978, Dr. Al Turgeon showed at the U. of Ill. field day that fertilizer containing phosphorus resulted in better poa-annua turf plots than where straight N was used. He also pointed out that P deficiencies rarely are observed in established turf unless the P level in the soil is extremely low.

A research report compiled by the team of Drs. Beard, Turgeon, Riehe, and Vargas prescribed a cultural program for annual bluegrass greens, under the heading "Fertilization Phosphorus." They stated the application rate should be based on soil test using a program that maintains a moderately high level of soil phosphorus. Applications are best made in the spring or fall. Well, how much proof do you need that we are throwing away good money and good creeping bent greens by using phosphorus? I would like to see the fertilizer manufacturers put a big skull and crossbones on each bag of fertilizer containing phosphorus "poison" in the same manner the druggist once did with medicine bottles.

But let me say again to you that just putting down less or no phosphorus is not going to keep the poa out entirely. It's just one of the more important tools in the overall maintenance program that a good supt. works into the picture. I carry out other cultural practices that I believe diminish the encroachment and germination of poa-annua. They are as follows:

1. If I have to use a little fertilizer containing P (such as activated sewerage sludge), I do it only in the hot temperatures when poa isn't germinating well. I am talking about the latter part of June until the second week in August. I believe that in hot weather P applied on mostly organic sandy soils is utilized or tied up by the time climate conditions are again beneficial for poa-annua germination.
2. I aerify and topdress only in the fall. The popular statement by some experts that poa-annua comes in the fall in the aerifying holes in our area is not always true as far as my observations are concerned. Two hundred miles south it might be a desired situation but I am making an observation about my area only. Of course, if you have nothing but poa on your greens, then what do you expect? A miracle encroachment of bent grass? That will hardly be the case. But I'll give you a little secret. Throw some creeping bent seed into the topdressed holes wherever the grass is weak, wherever the riding mowers turn, or over the whole green if its mostly poa-annua. I sometimes get very good germination. If your other cultural practices, such as fertilizing, watering, topdressing, seeding, and spraying, are done with common sense you aren't going to get any more poa infestation than you would in the summer. But I caution young supts. in our area to watch out for spring aerifying when poa is germinating.
3. Twice or more during the summer I reseed all ballmarks on the greens. This practice also adds fresh bent to our greens.
4. I try to use the proper fungicides in the summer. Fungicides mixed in plenty of water won't shock the grass if they are applied per label. Into my fungicide

solutions, I always throw in a little soluble nitrogen — never any other fertilizer. This method keeps the greens in good color but with no appreciable growth to cause a poor putting surface.

5. For many years I used lead arsenate in my last fall and my first spring fungicidal program. Arsenics are taken through the plants roots in a similar manner to that of P. Arsenic and phosphorus are difficult to separate and since the plant needs the P this causes problems, especially for young plants. When the arsenic level is fairly high compared to P in the soil, the poa-annua and other plants will take up arsenic to cause trouble.

C. W. Lobenstein has noted poa control success depends upon very careful control of the arsenic and phosphate levels in the top layer of the rootzone so that the weedy species absorb toxic quantities of arsenic in the place of phosphate while the desired turf species escape injury. The use of phosphate fertilizers preceding or soon after arsenate application must be discouraged. He then goes on to conclude that an arsenical program ought to be even more effective on soils of low phosphate content. It should be noted that research has demonstrated that arsenic applications on soils low in available P has caused serious damage to Kentucky bluegrass turf.

Last, and perhaps most important of all, I use good watering practices. In my opinion, I use less than anyone else in my area. Carl Swartzkoph puts it this way: "As a result of using minimal amounts of water at Briarwood, additional physiological stress has been experienced by the poa-annua, thereby giving the more desirable and permanent grasses a chance to become established on greens and fairways."

Maybe along with all this I also have been fortunate in having had good superintendent friends to advise me, to show me their errors and their secrets and their golf courses in stress times and good times. Plus a lot of commercial people who were helpful with their fertilizer information. Plus a few wonderful outstanding agronomy professors from major universities who have been available whenever I had a question or a big problem. And, of course, my friends in the USGA have been very helpful. So twenty years later, every time I look at my creeping Washington bent in the month of the "falling yellow," when old lonely October turns them dark purple, I realize with pride that I still have 90 percent (or better) creeping bent greens. I know in my mind that I have done the right thing and I know in my heart that *I have been lucky.*

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