

Need and Use of Potash in Turf Development*

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Turf on golf greens requires vastly more attention than that on fairways. On greens it is subjected to abuses of one kind or another. First to satisfy the golfer it must be kept trimmed quite short. Constant clipping keeps the plants small in size and in a disproportionate and unnatural ratio with the root system. Furthermore the clippings from greens being removed means a constant drain on the fertility required for their growth. Contrasted with fairway grasses where less frequent and less drastic clipping is the practice, and where the greater abundance of leaves works more efficiently in processing plant food elements for the larger root systems, greens require feeding with properly balanced supplies of fertilizing nutrients. This is a problem of the first importance.

These conditions suggest consideration of the importance of potash in the growing of turf grasses. That it is important for all plant growth is attested by results of scientific research in every country and clime. Turf grasses are plants, therefore they require potash to function as such.

Analytical data from pure grass turf reveals that in 1 ton of dry clippings there are approximately 35 pounds of nitrogen, 8 pounds of phosphoric acid and 25 pounds of potash. In an estimated annual removal of 3500 pounds of dry clippings per acre, there would be 61 pounds of nitrogen, 14 pounds of phosphoric acid, and 43 pounds of potash. Reducing these acre figures to the basis of a 12,000 foot green, the amount of N, P, & K in the clipping would approximate 17 of N, 4 of P_2O_5 , and $12\frac{1}{2}$ of K_2O . These figures are given not as a basis for recommendations but to emphasize the amounts and proportions of these three plant foods removed in the clippings.

Assuming the 3500 pounds per acre of dry turf clippings to be approximately correct, and the amount of potash removed in the clippings to be $12\frac{1}{2}$ pounds per 12,000 square foot green, here we have a logical basis to begin thinking about its importance in turf development. How much is being applied?

The cry may be raised, "who ever heard of potash being needed for greens?" Or

* (NGSA convention paper)

we are told that most soils are rich in potash and therefore get all they need or we have been told that potash brings in clover. Yes, all of these statements have some element of truth. It is true that few have heard potash recommended for greens. Some soils may or do contain abundant potash but do we know how much becomes available to grasses under normal greens management practices? Potash like phosphorus or lime may be expected to benefit the clover. But let us not for one moment forget that grass needs potash too, and since its health, vigor, and ability to withstand disease or make quick recovery following disease are your major problem, it is important that you make sure your potash status is what it should be.

Despite the belief of many that potash is adequately supplied by the average soil, there is abundant evidence to the contrary. In some areas trouble has been experienced in maintaining turf in the period following the spring rains, especially where liberal and frequent applications of sulfate of ammonia had been made. With the coming of summer and hot weather, even with abundant water, the greens tend to go into a slump. Color even with plenty of nitrogen is difficult to maintain. The grass assumes a washed-out appearance and invariably a limp condition—lack of turgor. The explanation for this condition is no great mystery—it is simply faulty nutrition.

An exhaustive study of these conditions on both lawns and golf greens, employing both soil tests and tissue tests has shown a positive correlation with lack of potash even though potash may have been applied at the beginning of the season in the form of fertilizer or as a component of compost. It was found that where ammonium sulfate had been used frequently, as is customary in the case of golf greens, that the potassium was replaced by base exchange reaction and leached out of the soil.

It is well known in laboratory procedure that potassium, which is absorbed by the clay colloids and organic matter, while available to plants is easily and completely removed by an exchange pro-

cess when the soil is leached with any salt solution. Doesn't it seem a bit strange that no one prior to the research here reported had ever associated the fact that since ammonium sulfate is also a salt, it would remove potash from the soils?

Low Potash Level Corrected

Turf grasses that were turning brown in late July were examined under magnification and typical potash symptoms noted. In these cases (Highland Park CC and Meridian Hill CC, Indianapolis) as much as one pound of ammonium sulfate per 1,000 square feet of turf had been added weekly, so the investigator was advised. One application of two pounds of muriate of potash per 1,000 square feet corrected this condition. The complaint of users of ammonium sulfate of soft, flabby, weak growth on golf greens under heavy nitrogen fertilization may be more truly caused by an unbalance in the nitrogen levels. Putting it bluntly, the difficulty may not be that of too much nitrogen, but most likely one of too low potash level to balance that of the nitrogen.

During the past decade a vast amount of research has been carried on with rapid chemical tests in an effort to establish their values in determining the presence or absence of nutrients in the plant sap. Today, whether called leaf analysis or tissue tests they are accepted techniques and are finding wide usage. Fortunately, as a result of this research we can today use a simplified field test for checking the status of a wide range of plant nutrients in the growing plant tissue.

Test Data Available

Among the tissue test techniques now available for study of the potash status of plant tissue, probably the most extensively used has been the Purdue test kit. For special use on golf greens, an adaptation of this test was made by Dr. G. N. Hoffer in 1945, the details of which were published in *Better Crops with Plant Food* in an article entitled, "Fertilizing Golf Greens." This is available in reprint form and can be obtained by writing the American Potash Institute, Inc., 1155 16th St., N.W., Washington 6, D.C., requesting a copy of Reprint W-4-45.

Of interest and certainly one you might well tinker with in studying potash needs of golf grass, is a test designed by Dr. A. C. Richer of Pennsylvania State College. His article describing the test, like Hoffer's, was published in the same magazine and is available as Reprint B-1-47. The title of the article is—"The Use of Dipicrylamine in Tissue Testing for Potash."

Within the past month another very promising test for potash in plant tissue was brought out by Dr. S. E. Melsted of

the University of Illinois. It is called—"A Simplified Field Test for the Determination of Potassium in Plant Tissue." It appeared in the January 1950 issue of *Better Crops*. Within two months from time of publication, it will be available in reprint form.

In the opinion of Dr. Hoffer and several other men who have studied the Melsted test and used it in the field it is believed to have great possibilities. It is easily transported and the tests easily and rapidly performed, requiring little special skill. The technique to quote Melsted "is an attempted compromise between quantitative accuracy and ease of operation."

The only equipment required is a small metal carrying case about lunch box size, a good pair of pliers, a dropping bottle, a bottle of .5 normal hydrochloric acid, a small vial, and a supply of test paper that has been prepared in the laboratory by spot treatment with varying concentrations of a special test reagent sensitive to three different levels of potassium in solution. The range of the test as now set up is 1000, 2000, and 3000 ppm in the plant sap. The highest reading indicates an abundance for most crop plants, the lowest a deficiency and the 2000 about right. Somewhere between 2000 and 3000 ppm appears to be the range in which golf grasses appear to be happy and reasonably free from the ordinary run of turf troubles.

How to Make Tests

With the simple equipment above mentioned and the special test papers, all that is necessary to perform the test is to take your sample of freshly cut succulent grass, and with a pair of pliers squeeze onto each test spot enough sap to thoroughly moisten the test area. Allow the sap to react with the test paper for about 30 seconds, then dip the test paper into a vial of approximately .5 normal HCl solution for about 30 seconds. If you prefer, you may use dropping bottle containing .5 normal HCl instead of the vial, provided the spots are thoroughly washed with the dropping bottle solution. The test is positive for any one of the three potassium levels, if the characteristic test paper color for that level persists. Similarly, it is negative if the test paper color for that level turns lemon-yellow. Since the blank or negative readings differ slightly in their depth of yellow, an unused test paper should be dipped into the acid to get a true color of the blank.

It is pointed out and this is important when working with grasses that with any succulent plant high in chlorophyll, the green color of the expressed sap may mask the color of the test. To overcome this difficulty use a wider strip of filter

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paper folded lengthwise. Place the test spots on one half of the paper and when they are used for testing the untreated half is used as a filter to absorb the leaf color as the sap is squeezed through it onto the test spot area.

Of one thing we are certain, the delicate balance between the roots and above ground part of golf grasses calls for the utmost care in fertilization. Precautions must be taken to prevent injury from applied chemicals whatever they may be. To overfeed the grass is as bad as under-feeding it. The real problem is to keep them in a high state of vigor through existing means for periodic checking of the nutrient status of the clippings and to supply whatever nutrient or nutrients the chemical tests indicate. If, for example, a negative test for potash is found, less than 1000 ppm, an application of 1 to 2 pounds of 60 per cent muriate of potash per 1000 square feet should be made as an initial treatment to bring the potash level into proper balance. The total amount of potash required for a green, depending upon its size, should be mixed in about 125 gallons of water, sprayed onto the green under pressure and washed in immediately.

Like animals, turf grasses must be fed if they are to live. They must be fed properly if they are going to be healthy, and certainly they must be healthy if they are to measure up to our expectations. In the light of our present knowledge of the value of chemical tests in determining the nutrient status of crop plants, their more general use in studying the nutrient requirements of turf grasses seems certain. They are the surest means of insuring balanced feeding, our major objective.

SUPERINTENDENTS HOLD

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testing which are available to greenkeepers and which undoubtedly will be widely read.

Prof. Lawrence S. Dickinson, Univ. of Massachusetts, an originator of greenkeeper short courses and pioneer in establishing an educational program that has been a main factor in modern golf development, spoke on Practical Training for Turf Maintenance. Twenty-one years ago at the greenkeepers' convention in Buffalo "Dick" spoke on Education for Greenkeepers which then was considered to be a very delicate subject as the greenkeeper who didn't "know it all" was suspected of making an admission he wasn't qualified to handle his job. More than any other one man Dickinson has been responsible for inspiring and nursing into nation-wide vigor and value an educational program that has transformed the nation's golf courses and made