PROCEEDINGS

of the

13th ANNUAL NORTHWEST TURF CONFERENCE

Sept. 23;24-25, 1959

WASHINGTON STATE UNIVERSITY PULLMAN, WASHINGTON

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1. Annual Dues payable on or before May 15th each year. Dues are based on annual due date non pro-rated.

2. Membership includes registration fee for one person at Annual Turf Conference. Other persons from member organization registration fee $5.00

3. NO INITIATION FEES ARE CHARGED

4. Non members may attend the annual Conference by paying a $10.00 registration fee. For further information on Dues, contact Northwest Turf Treasurer.

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WELCOME

Dr. George Fischer
Acting Dean, College of Agriculture
W.S.U. Pullman, Washington

I'm not sure a welcoming speech is necessary. I have many times been on your side of the fence and wished the speaker would finish so that we could get down to the business of the day. Nevertheless, it seems to be customary for some brass hat, or reasonable facsimile thereof, to make an address of welcome. Since Director Madsen is gone they asked if I would mind doing it. I said, "Sure I would be glad to," and here I am. It does, however, seem a little superflous to me. You know you're welcome or you wouldn't be here, and we don't host affairs like this unless we want them. Nevertheless, to those of you who need to be assured that you are welcome, let me assure you here and now, and I hope that you find this Turf Conference, as the 12 before, resourceful, profitable, and enjoyable.

I don't think I have to remind you that it does do me some good to realize that once a year when this conference comes to pass attention is being given to turf and that recognition is being given to the importance of turf. When you stop to think about it, everywhere you look you see grass. And while grass, of any kind, may be accidental here and there, good turf is not accidental. Good turf comes with the application of science knowhow -- what grasses to use under different soils and climates, how much fertilizer to use, what kind to use, how to apply it, how much water to use and when to apply it, control of plant diseases, supression of insect pests. All those things enter into good turf, and as much as we know about all those matters of soil, climate, fertilizers, disease control, insect pests, and what not, there still remain problems to solve. There are still issues to be discussed, which is exactly why you gather here for this occasion every year.

To this end we appreciate very much the financial aid you have given us through research grants during the past several years. You may wonder why a public-supported institution like this one should need additional money over and above what the state legislature provides. This is a legitimate question. But the fact is that we never quite have enough money to support the research that needs to be done. Whenever anything is demanded over and above the usual routine, then we try to get the organization that is doing the demanding to put up some of the money. The response is usually quite generous, and I think all of us realize that there are good dividends on the investment.

I am glad to say that the joint experiment station and extension position which you people helped to sponsor and foster at Puyallup has been established and that Mr. Roy Goss is on the job as of the last of July. This is now a good, firm, permanent position, permanent so long as funds are appropriated by the legislature to support it. But that same provision also applies to my job. So Roy Goss's job may be said to be as stable as mine. He will be responsible for all turf work on the west side of the state -- the lawns and so-called noncommercial turf as well as for the commercial turfs in the form of the golf courses, cemeteries, and what not. In the eastern part of the state, his domain will extend as far as it concerns what we still call commercial turf -- everything but the home yard and lawn.

Speaking of the noncommercial turf, I think it is well we recognize that turf has an importance over and above a game of golf. I think the home owner has a vast interest in lawns that we who work in state-supported institutions

cannot afford to overlook. We have tended in recent years gradually go change our emphasis from the farmer to the urban dweller. His problems of a yard, lawn, and garden are small. His holdings do not have much commercial value perhaps from the standpoint of increasing or contributing to production, but they are of vast importance to him. With that in mind, we are glad to have our personnel give attention to lawns and to the problems of the urban dweller. With "pure" farmers becoming fewer and fewer and farms becoming larger and larger, some people think that we should continue to devote all of our attention to a bigger and bigger operator. I am among those that think that this is the wrong philosophy and that we owe just as much allegiance to the urban dweller or the so-called sundown farmer who perhaps has a piece of turf, yard, or garden if nothing else.

I repeat to you that if you need to be assured that you are welcome, you are hereby assured, and I am glad to say it looks like we are going to have good weather for you. We have had a most miserable month of September, and you must live right to have the weather turn out right just when you arrive. Thank you very much.

TODAY'S GOLF COURSE SUPERINTENDENT AND HIS QUALIFICATIONS

Elmer G. Border
President, Golf Course Superintendents of America
Los Posas Country Club, Camarillo, California

Today's golf course superintendent is of necessity a man of numerous skills. He is a humble man for he knows full well how fickle mother nature can be. This humility is a detriment many times. If he were more outspoken, he would be better understood and better paid.

Golf course maintenance today is a combination of art, science, personnel relations, salesmanship, and business administration.

What are the qualifications of today's superintendent?

1. He must be a teacher and a personnel relations man. The quality of maintenance is controlled to a great extent by these two factors. He must be a leader, not a driver. Those of you who are fortunate enough to receive Bill Bengeyfield's Turf Letter in which he highlighted, "How good a boss are you," realize how important this is. I suggest that you get Bill's questionnaire and rate yourself. You may be surprised. I know I had a rude awakening.

2. Salesmanship. You may have all the knowledge and know how to maintain a first-class golf course or other-type turf area, but if you are unable to sell your ability and ideas to the proper people, your knowledge and ability will be unappreciated. You must sell yourself. If you feel that you are lacking in this ability, why not take a course in salesmanship. It can be rewarding.

Before proceeding to the more obvious knowledge necessary to being a good superintendent, I must say that I believe items 1 and 2 are the primary requisites.

3. The successful superintendent of today must be well grounded in the following arts and sciences: hydraulics, auto mechanics, soil chemistry, fertilization, fungicides, herbicides, drainage engineering, soils and plant pathology, agronomy, landscape design, arboriculture, dendrology, carpentry, plumbing, painting, road construction, building construction, electric wiring, pumping plant construction and maintenance, tennis court construction and maintenance, refrigeration and air conditioning equipment servicing. To be able to handle these various things efficiently, he must keep complete records of the entire operation and be able to submit an operational budget to cover all these items.

How does the superintendent acquire these abilities? Through formal education, practical experience, extension courses and attendance at Turf Conferences both on a local and national basis, by joining both your local and National Golf Course Superintendents Associations where you exchange information with your fellow superintendents. This is an ever-changing and progressing profession, and we must continue striving to produce a better product.

To summarize, may I repeat: 1st--good human relations; 2nd--salesmanship; and 3rd--continue schooling by extension courses, reading, attending conferences, and exchange of experiences with your fellow superintendents.

You are professional men who are in charge of plants with a value of $500,000 to $5,000,000. Be prepared to maintain that plant the same as any manufacturing plant manager would do, and by so doing you will be recognized by your employers as well as having a feeling of self satisfaction in a job well done.

Question and Answer Period

Question: Is there any indication that being a member of the National Golf Course Association will improve the superintendent and his earning power?

Answer: Well, naturally as he upgrades himself, his earning power increases, and I could sight many instances. I don't like to mention names. But this is countrywide, and Charlie Wilson could verify this and so could Bill Bengeyfield. As these men become better acquainted with their jobs and with their fellow superintendents and are better educated, they in turn increase their salaries, and this is typically true of members of the National Association. This has some effect on salary because all the high-salaried superintendents of the United States are members of this association. I can say this much: there are some superintendents now that draw as high as $17,500 per year, and they go on down the scale. I think that many times this is due not because they do not do a good job but they pay for ability up to a point. There are many clubs that do not pay according to ability. But the more knowledge you have the better able you are to present this knowledge to the people you work for because the more you attend these conferences the broader your experiences become. The saying that travel broadens is certainly correct, and I might state that it hasn't been too many years ago that I was at a little 18-hole country club like some of the rest of you are and it wasn't too good a club. One of my break-ins into this field to get into a better class of pay was back in 1951 when I took a week of my vacation and imposed on Charlie Wilson. We got in a car, and we made 35 golf courses in the next five days. We didn't sleep, I can guarantee that. I mean that we got to bed about 2:30 in the morning and were up at 6:30 in the morning, and I saw how 35 people did their job. We saw the equipment they used and everything else, and believe me this was the most wonderful experience in my life as far as gaining knowledge as a golf superintendent. That was the beginning and gave me an extra urge to go ahead and try to better myself in every facet in this calling. I have lots of room for improvement as everyone else, and I know my faults as I have said before better than anyone else knows them. I continue to study day in and day out to try and do a better job and increase my earning power, and this is the way to do it. Belonging to such organizations as this is one way to educate yourself and to increase your earning power.

Question: Are you permitted to attend the National Turf Grass Show without being a member of the National Association?

Answer: Yes, you pay $5.00 more than a member does. That is the only difference.

Question: Will there be a meeting this year?

Answer: Yes, at Houston, Texas, Feb. 1 - 6 at the Shamrock Hilton Hotel. I have a few copies of the national publication here. Sorry to say at the last minute, in my rush we ran out of August copies. The new September-October issue will not be out on this publication until after the 25th of this month. I was unable to get those, and this was the last we had left in the office in Jacksonville, Florida, but as far as they go you are welcome to take these. See the

type of periodical we put out in this publication. It is growing each and every day, and we hope to make it the magazine of "Turf Grass Culture" in the United States, and I don't think there is any question but that we are going to do it. We have hired as our executive director, Dr. Gene Nutter from the University of Florida, who has done experimental work down there for many years. He is well rounded in turf culture, and he is now editor of this magazine as well as our executive director, and we look forward to really great things in this organization. We have taken in some 253 members already this year, and we expect another 75-80 before the first of January.

Question: Where is the Camarillo Club located?

Answer: It is 53 miles north and west of Los Angeles. It is about 17 miles south of Ventura if that rings a bell.

Question: Do you have a local golf course superintendent's association?

Answer: We have a local organization of about 120 members in southern California and have a monthly meeting on the second Tuesday of every month. There is one in northern California which is the same type, and I think it has somewhere in the neighborhood of 105 members. All of our local association members are class A members of the National Association also.

Question: Elmer, are your members generally members as individuals or is their membership a club membership they belong to?

Answer: The club in many cases pays their dues to the National Association and also pays their expenses to the conference each and every year. I think that more than 50 per cent of the superintendents in the country now have their expenses paid to the conference and to the Annual National Turf Conference and Show. You see we have quite an extensive show where every piece of equipment that is used in golf course maintenance is shown and those which are not commonly used are shown at this show, plus the Education Converence which lasts for five days.

RESEARCH PROGRESS REPORT

Roy L. Goss
Turf Specialist, Puyallup, Washington

Since the last Turf Conference, new research projects have been initiated and old projects continued or completed. This report is intended to point out some of the turf research that is going on and the progress which has been made up to this time.

Arsenic Studies

The use of heavy doses of arsenicals is not a new or uncommon practice in the Pacific Northwest. In other areas outside of the Northwest, this is an even more common procedure.

To set the stage for the discussion to follow, let us review some of the various instances where the arsenicals have been recommended.

1. The control of annual bluegrass. Amounts ranging up to 80 or more pounds per 1,000 square feet over a 10-year period have been recommended.

2. Control of night crawlers. This would necessarily require heavy doses.

3. Crabgrass control. Requires heavy doses to be effective.

4. Control of other weeds including pearlwort (Sagina spp.).

The inorganic arsenicals, to be effective in the control program outlined above, must be applied in massive doses in order to raise the "salt concentration" of the soil up to the phytotoxic level of the species to be controlled. What happens to this applied arsenic? Inorganic arsenicals, for all practical purposes, are practically immobile in the soil. They cannot be leached, therefore remain indefinitely in the place where they were applied.

Literature Review

It is thought proper at this time to review with you a small portion of the vast amount of literature pertaining to arsenic toxicity.

According to Clements and Munson (1) a high level of phosphorus reduces but does not prevent the absorption of arsenic. The degree of injury depends upon the amount of the toxic element absorbed. Higher absorption of phosphorus tends to reduce the arsenic injury. A ratio of 10 parts of phosphorus to one part of arsenic reduced the yield of sudan grass by 21 per cent. Hurd and Karrer (2), in nutrient solution studies, showed that phosphates produced a protective effect if the concentration was five parts of phosphorus to one part of arsenic. Meyer (3) states that calcium arsenate at 25 pounds per acre reduced the yield of rice by 20 per cent and 200 pounds per acre by 60 per cent. Montgomery (4) reports that 1,000 pounds per acre of white arsenic applied to kill grubs in the soil caused reduction in cane yields of 50 per cent. Cabot (5) states that arsenious acid is highly poisonous to plants, causing dwarfing and killing of roots. An even more interesting aspect is that lower forms of animals (angle worms included) are more resistant than plants to the injurious effects of arsenic. Where then does this classify arsenic for worm control?

Cooper et al. (6) made a series of very interesting experiments with heavy- and light-textured soils. They found that arsenic in the amounts of 25-100 pounds per acre produced serious effects on Norfolk sand. It took considerably more arsenic to produce this same effect on Davidson clay loam. When considering the soil movement of arsenic, Jones and Hatch (7) point out that arsenic accumulation is surface localized and penetrates to a depth of mechanical mixing only.

Some other direct effects on plants were pointed out by Gourley (8) who found that rye was stimulated by low arsenic concentration (less than 20 p.p.m.). However, from 30-90 p.p.m., injury was evident; above 100 p.p.m., there was little growth; and above 200, there was none.

From the herbicide viewpoint, Grafts (9) points out that sodium arsenite is three times more toxic than sodium arsenate. Macheis (10) found that addition of sodium arsenite to a nutrient solution caused immediate plasmolysis of the roots and wilting of the leaves of sudan grass followed by discoloration of the roots and necrosis of the leaf tips and margins. This shows that arsenic affected a sudden decrease in the movement of water in the plant. Finally, Swingle (11) reported that arsenic has a germicidal action toward nitrification organisms.

Greenhouse Studies at the Western Washington Experiment Station

Recommendations for the use of arsenic have been made in several cases where the accumulation in the soil will approach 3,000 pounds per acre of lead or calcium arsenate over a 10-year period. This greatly exceeds the rates pointed out in the literature review and points to the fact that this may ultimately lead into serious trouble. To antagonize further this situation, on putting greens, we are concerned with soils which usually are classified as sands, and, as such have little buffering capacity.

Since little or no published data are available on arsenic turf studies, pot tests were made to determine seedling response to various levels of arsenic (applied as lead arsenate) to Puyallup sandy loam. Lead arsenate was weighed and mixed into the surface one inch of soil so that seeds and roots would have to contact treated soil at all times or until the roots extended below the arsenic layer. One hundred seeds, each of Poa annua and Colonial bent, were seeded alone in six-inch clay pots. The arsenic treatments ran from 5 pounds per 1,000 square feet to 81 pounds per 1,000 square feet. (It was assumed here that it is possible to accumulate 81 pounds per 1,000 square feet in 10 years.)

After eight weeks, the existing growth was clipped to a height of 1/2 inch and weighed. The following tables show the mean clipping weights and any statistical significance.

Table 1. Poa annua Clipping Weights

Treatment	Avg. (4 reps.) (wt. in grams)
1. 5#/1000 sq. ft.	10.50
2. 10#/1000 sq. ft.	13.75
3. 20#/1000 sq. ft.	8.00
4. 30#/1000 sq. ft.	10.25
5. 40#/1000 sq. ft.	8.25
6. 45#/1000 sq. ft.	9.00
7. 52#/1000 sq. ft.	9.75
8. 57#/1000 sq. ft.	8.25
9. 64#/1000 sq. ft.	9.75
10. 69#/1000 sq. ft.	8.00
11. 76#/1000 sq. ft.	7.75
12. 81#/1000 sq. ft.	5.50
13. 0	11.50

C.V. 21.6%

L.S.D. .05 = 2.87

.01 = 3.85

Table 2. Bentgrass Clipping Weights

Treatment	Avg. (4 reps.) (wt. in grams)
1. 5#/1000 sq. ft.	4.75
2. 10#/1000 sq. ft.	4.00
3. 20#/1000 sq. ft.	3.00
4. 30#/1000 sq. ft.	3.50
5. 40#/1000 sq. ft.	1.75
6. 45#/1000 sq. ft.	1.25
7. 52#/1000 sq. ft.	1.25
8. 57#/1000 sq. ft.	2.00
9. 64#/1000 sq. ft.	1.75
10. 69#/1000 sq. ft.	1.50
11. 76#/1000 sq. ft.	1.50
12. 81#/1000 sq. ft.	1.25
13. 0	5.75
C.V. 34%	
L.S.D. - .01 = 2.72	
.05 = 2.03	

Conclusions:

From this data the following conclusions can be made:

1. The rates of arsenic tested produced a statistically significant growth reduction upon both the Poa annua and bent.

2. The bent was more suppressed in growth than was the Poa annua. (This was substantiated also by stand counts, not shown here.)

3. The application of arsenicals for the suppression of Poa annua will remain permanently in the soil. Even though no great effect is noted upon mature turf at medium arsenic levels, no assurance is given as to the probable effect on seedlings in an overseeding program.

4. Soil applications of arsenicals which will raise the residual level over 50 p.p.m. will not be recommended nor condoned in the Pacific Northwest.

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Question and Answer Period

Question: Did you fool around with Bluestone copper sulfate?

Answer: We didn't test the copper sulfate primarily for the reason that the line between toxicity and herbicidal activity is quite a fine one. There is evidence that it is being used all of the time in algae control, particularly in municipal water districts. But as far as applying it, no we didn't use it. We were looking for something possibly a little safer to apply, but it is effective. You have very acid soil conditions over there, and, of course, that is where copper becomes toxic.

Question: Did you do anything with daisy this year?

Answer: We have a bellis perennis which is English lawn daisy. We have it in pots at the station. We took it off the Tacoma Country Club fairways about four months ago and never have had time to run it up to Mt. Vernon where there is a green house sprayer and where we can calibrate for small doses for application to pot tests. That is one of the first things on the agenda after we return from here. Daisy will continue to advance from now on through next spring. Again I might point out that on this particular weed various attempts have been made to control it with sodium arsenate, 2,4-D, and combinations of 2,4-D and 2,4,5 TP and NCP and various other concoctions with relatively nothing to brag about as for results. That's what it amounted to so we are going to go at it systematically with probably 25-30 different herbicides and replicate them and try to come up with something. We hope we will have something by next year.

Question: In your fall annual work in your pots, did you make any other nutrient checks along with this. In other words, did you check out phosphorus levels in that particular soil?

Answer: No, we didn't -- primarily because we have plenty of soil tests on the area where the soil came from, all very high in phosphorus.

Question: Did this have any effect on the seed production of the poa annua?

Answer: The seed production was not affected even at rates of up to 200 pounds of lead arsenate per 1,000 sq. ft. We have poa that is tall with very nice heads on it. I didn't check them for viability. It is very possible that they had no viability, but we did not go so far as checking the viability of the seed.

Question: How long did you carry this test?

Answer: We actually had the pots in the greenhouse for a period of three to four months, but we terminated on the clipping weights after about eight weeks.

Wilson: The reason I mentioned that point is that arsenity does not stop these weeds from germinating and with us in the Midwest and in the East at any rate it germinates and looks just fine until we enter a period of stress. It can be either real cold weather as of last year or very hot weather, and then suddenly the poa or the crabgrass, whatever the case may be, will collapse.

Goss: We have cases of that now, and I have noticed no collapse to date of treatment on our putting great at the station. We have very healthy and vigorous

poa annua that has better than 20 pounds of arsenic per 1,000 sq. ft., incorporated into our putting green. These grasses continue to get nothing but better with time because the root system extends below the arsenic level, and that is another important thing. Now, unless you are going to incorporate the arsenic to a depth of the probable root system of the species, then I think that you are going to get even a better growth than before you had no suppression. Now I point this out on the basis that I know of no direct experimental results along that line. If you can sight any evidence on it, I would very much appreciate it for I am very much interested in it. Anytime we poison our soils, as with arsenicals, we are going to live with it from now on until we remove it.

Question: Are you saying that arsenicals have no place in our turf program?

Answer: Massive doses of arsenicals as such have no place in our program. Anything over 50 parts per million of applied arsenic to soils have no place in our turf program in the Pacific Northwest at present.

PROGRESS REPORT

OTHER HERBICIDE INVESTIGATIONS

Roy L. Goss

During the year 1959, we have made a good start in two other areas of weed research. Lawn moss can certainly be classed as a weed, but many people consider algae as something that grows in ponds and stagnant bodies of water and an organism that plant physiologists use in photosynthetic and respiration studies. However, since algae is a member of the plant kingdom and causes serious problems in some turfs on the West Coast, we will refer to it as a weed.

Lawn Moss Control

This has been a serious weed in many turf areas for a long time, but on intensively managed turfgrass areas today, we should have very little problem in the control of this plant.

Perhaps the best control of lawn moss is a good nutrition program and adequate watering during the growing season. As long as nitrogen levels are high enough and a reasonable balance of phosphorus and potassium are maintained along with a suitable pH range for grass growth, little trouble should be encountered with moss. If these conditions are met and moss is still a problem, then one should investigate his watering practices to see that the turf is in a vigorous growth condition during the summer. Summer dry areas are probably the bad moss spots in the winter.

Several herbicides were tested last winter in an attempt to discover a cheap and practical control of established moss. The following table will give some information on what has been done.

Lawn Moss Experiment

Product	Rate (Product)	% Control
NOXMOSS	10#/1000 sq. ft. in 10 gal. of water	70%
Puraspray	16 oz/1000 sq. ft. in 10 gal. of water	40%
Iron Sulfate	2#/1000 sq. ft. in 10 gal. of water	60%
Iron Sulfate	4#/1000 sq. ft. in 10 gal. of water	70%
Ammonium Sulfate Iron Sulfate	5#:2#/1000 sq. ft. in 10 gal. of water	60%
DSMA	5 oz/1000 sq. ft. in 10 gal. of water	45%
Neburon	2 oz/1000 sq. ft. in 10 gal. of water	50%

It can be seen from the above results that some materials will help to reduce moss considerably. However, trials will be continued this fall and winter to find materials that are even more effective. With better controls available, moss clean-up can be hastened, and fertility programs will be more effective.

Algae Control

We are primarily concerned with the control of one algae, which is a member of the blue-green group. We refer to this one as black algae, since

great masses of this single-celled plant appear as a black scum on bare soil surfaces or in thin turf.

Perhaps the putting turfs in the Northwest represent turfs that are most damaged by this plant. The blue-green algae require high amounts of nitrogen for optimum growth and development. Whether the area of infestation is on a putting green or lawn, ample nitrogen is usually available on the surface due to decaying organic matter and higher rates of applied nitrogen.

Algae is a secondary organism in most cases. It seldom invades a turf area where drainage and vigorous grass growth are optimum. Hence, poor drainage, shade, loss of turf from various causes are all linked together to encourage the invasion of algae. Once established, algae multiplies very rapidly, causing a slick scum on the surface which effectively seals off air and water penetration and becomes progressively worse during wet winter months. Heavy traffic on turf areas, especially on putting greens during the winter when grass vigor is low and soils saturated, helps injure the grass further and encourages algae.

Experiments were designed and conducted in three localities last winter to find an effective control for algae. These locations were Inglewood Golf and C. C., Overlake Golf and C. C. in the Seattle area, and the Grays Harbor Golf and C. C. at Aberdeen, Washington. The following table will reveal the treatments and response. Similar results were observed at all three locations.

Product	Rate (lbs. active ingredient)	% Control (Avg. of 4 reps.)
Diuron	1/4#/ac.	100
Diuron	1/2#/ac.	100
Neburon	1/2#/ac.	90
Neburon	1#/ac.	100
Simazine	1/4#/ac.	10
Simazine	1/2#/ac.	10
Check	0	0

These tests indicate that the substituted urea herbicides have great potentialities for the control of algae. It should be pointed out, however, that the heavier rate of diuron causes some turf injury.

Further studies will be conducted this winter to determine if the above products applied before algae invades will keep the area clean and make some determinations as to the number of applications which must be made for the entire season.

Question and Answer Period

Question: Any connections between lime and the lack of it on algae?

Answer: There probably is. I don't know that this has been demonstrated particularly, but I think the connection would be an indirect one in that where you do have low pH you would have other affecting factors and so you would naturally have a loss of turf vigor. You could expect poor turf and better algae under those conditions. I think liming would possibly be one management practice you could put in that would help to overcome algae conditions, but I don't think there is any direct connection because I can take you to areas that have been limed very heavily during the winter months where it is actually very

white on the surface and there is plenty of active algae present.

Question: What connection do you think there is between your feeding program and the forming of the algae?

Answer: Well, you can have a correctly fed turf and you will still have a condition that will promote the growth of algae. But assuming all other factors optimum such as your drainage and soil conditions, then I think that a nutritional program is very important. If you do have a very vigorous turf with good drainage conditions even under high rainfall, you probably won't have the problem with algae that you would otherwise. I should point out to you that algae requires high nutrition. Under high nitrogen conditions, you are going to have algae doing even better, and under all turf conditions you are going to have ample nitrogen generally in the surface soil, particularly on the putting greens because they receive a much higher level of nutrition than do our lawns. Closer cut could be a factor, and shading is a factor. Algae can orient its chloroplasts and can do a lot better on a lower light intensity than can some of the others. Some algae has been known to get along on very low intensity that no green would live on.

Question: Have you done anything with Phygon X-L?

Answer: I tried Phygon X-L at the station and had no results with it at all. I think it comes back to this. I am not trying to knock neburon or other products. We only are giving information on what we have answers to at this present time. It looks as though neburon is probably one of the safer ones, and I can certainly be one of the first to assure you that you can certainly go out there and burn up your turf with it if you want to put it on at seven times the recommended rate. Neburon is like 2,4-D. You're dealing with chemicals every day that are much worse to handle than neburon. I know that most of you measure fungicides pretty carefully, and when it comes to dealing with neburon you should measure that pretty carefully too.

Question: You are mentioning this on a per-acre basis?

Answer: Yes, when I say this, it is all on a per-acre basis.

Question: On a poorly drained area, putting green, or soggy soil, did you notice any difference between organic and inorganic fertilizer?

Answer: In all cases, we found that with organic-type fertilizers we have noticed a perceptible increase in algae conditions over where mineral fertilizers have been the basic source of plant nutrients. This can also be typed to the application of some of these materials at the time when we hit the algae season. I think the time would probably be during our drier months and the place is anywhere you wish. I think we can verify this in a number of instances. We did carry out one experiment in the plot on some very young turf, and we noticed a very perceptible build-up having mold on all organic plots and no mold on the inorganic plots. This mold I didn't attempt to identify.

CRABGRASS INVESTIGATIONS IN WASHINGTON

Roy Goss and Alvin G. Law

This report is intended to explain the Crabgrass situation in western Washington and is one part of a joint report made by me and by A. G. Law, who has conducted a similar study in eastern Washington. This report should point out the better controls for the state as a whole and any treatments that may be better in either western or eastern Washington which may be induced by climatic and species differences.

Both Digitaria sanguinalis (hairy Crabgrass) and Digitaria ischaemum (smooth Crabgrass) have been identified in western Washington. However, smooth Crabgrass seems to be more prevalent in the Seattle area. It appears that hairy Crabgrass is more dominant on lighter (warmer or earlier) soils of the Spanaway series located in Pierce, Thurston, and Lewis counties.

This year, due to a cold, wet spring that extended up to July 10 in western Washington, no Crabgrass seedlings emerged before July 15, after which the development was normal. At the present time, a full seed crop from smooth Crabgrass is maturing and should insure a good crop for next year.

Pre-emergence applications of herbicides were applied at two locations in the greater Seattle area on April 2, 1959. Post-emergence sprays were applied on the same areas on July 27, 1959, when the seedlings were in the two leaf stage. The following table will show the treatments, rates, and degree of control. No location is shown since similar results were experienced in both locations.

Timing	Product	(Rate of Product)	No. of Treatments	% Control
Pre-emergence	OR-1548	20#/1000 sq. ft.	1	40
Pre-emergence	DAC-893	5.7 ounces/1000	1	100
Pre-emergence	Halts	6.25#/1000	1	60
Pre-emergence	Neburon	2 ounces/1000	1	40
Post-emergence	DSMA	5.3 ounces/1000	2	30
Post-emergence	U-9613	35 C.C./1000	1	20
Post emergence	M-1329	8 ounces/1000	1	30

Data for eastern Washington were obtained from experiments cooperative with Charlie Mitchell, Clarkston Golf and Country Club. The infestation treated was hairy Crabgrass growing in a fairway of creeping red fescue, Kentucky bluegrass, and annual bluegrass. Data obtained were as follows:

Timing	Product	Rate of product lbs./1000 sq. ft.	% Control
Pre-emergence	DAC 893	8 ounces	90
Pre-emergence	Chlorodane	20 pounds	90
Pre-emergence	Calcium arsenate	18 pounds	90
Pre-emergence[1]	Neburon	2.5 ounces	40
Post-emergence[1]	D.S.M.A.	5.3 ounces	75
Post-emergence	A.C.P.	22 ounces	50
Post-emergence	PMAS	2.4 ounces	50

[1] Three treatments at indicated rate after initial emergence of crabgrass.

These data show pre-emergence treatments of DAC, Chlorodane, and Calcium arsenate gave good control of Crabgrass. The equivalent rates per acre of Chlorodane and Calcium arsenate are 90 and 688 pounds, respectively. These are extremely high and may cause considerable residual harmful side effects.

The Dow product, M-1329, arrived too late for pre-emergence application, but will be tested as such this winter. Further tests will be conducted with all of these products in the next year as well as some new ones not tested this year.

The Diamond Alkali Company's product seems to have great possibilities for Crabgrass control, but due to some thinning of desirable species, more work will have to be done with rates.

It appears at this time that the massive-dose arsenicals should not be used on large areas due to the amount of arsenic which remains residual in the soil due to this treatment.

EFFECTS OF GOLF SHOE TYPES ON PUTTING GREEN TURF

Bill Bengeyfield
Western Director, USGA, Garden Grove, California

Golf shoes with "ripple" soles leave a characteristic mark on putting greens. When these shoes began to find favor, many golfers were concerned about their effects upon putting green turf. At some golf clubs, players were not permitted to wear shoes of this type.

Because of the need for accurate information pertaining to the damage to be expected from shoes of various types, a series of tests were inaugurated at Texas A & M College under the direction of Dr. Marven Ferguson, Mid-Continent Director and Research Coordinator of the USGA. The studies were carried out by two undergraduate students in the Department of Agronomy who are recipients of Trans-Mississippi Golf Assoc. turf scholarships.

This study had two objectives:

1. To determine the extent of damage which might result from heavy traffic imposed by the sole types in question.

2. To determine the effect of surface marks left by the "ripple" sole shoe on the course of a rolling ball.

Procedure

Tests were conducted on a turf of Seaside Bent. The first objective was to study the effect of traffic imposed by the various sole types.

The tests consisted of three treatments and a check or untreated strip. Tests were conducted in quadruplicate. Each individual plot was one foot wide and 30 feet long.

The plots were traversed daily, with the two men exchanging plots on alternate days. One man weighed 160 pounds and wore a size 9 1/2 shoe while the other man weighed 180 pounds and wore a size 11 shoe.

Walking began on April 29 at 15 traverses per day and continued until May 13 at this rate. At that time the traffic was increased to 20 traverses per day. This daily amount of traffic was continued until June 3. Each of the plots receiving traffic was subjected to 630 traverses during this period of time.

Visual ratings of turf density were made on May 13, 20, 27, and June 3. In these numerical ratings, the check plot was undamaged and rated at 10. The traffic-damaged plots were given lower ratings, depending upon the extent of the damage. Ratings were made individually by the two investigators, and the weekly ratings were averaged.

Other evaluation methods were employed. The double quadrat method was one.

Another measurement of damage was considered to be the amount of compaction or surface deformation that occurred in each path. A straight edge was placed across each path, and the curvature of the surface was measured and plotted.

The second objective of the experiment was to determine the effect of the ripple sole footprint upon the course of a rolling ball.

The ball was rolled from a curved aluminum tube and was released from a constant height. The point at which the ball came to rest was marked and later plotted to scale. This test was conducted on a slight slope and under the following conditions: (1) unblemished turf, (2) one deep ripple sole footprint located three feet from the end of the tube in the path of the ball, (3) one deep ripple sole footprint 6.7 feet from the end of the tube in the path of the ball. The points where the ball came to rest were plotted.

Discussions and Conclusions

The visual density ratings showed a progressive injury to the turf as the experiment continued. The ratings also showed that the replications behaved uniformly and that the individual ratings of the two investigators were in close agreement.

There was a gradual decline in the turf subjected to traffic until May 13. During the week May 13 to May 20 there was a rapid decline of plots traversed by spike shoes and rubber cleats. The plots traversed by the ripple soles continued to decline gradually. These ratings showed that all types of traffic produced some injury. They further indicate that the most severe damage was produced by the spikes and that intermediate damage was produced by the rubber cleats. Turf with a rating below five in this evaluation would be completely unsatisfactory for putting.

The double quadrat method results were in fairly close agreement with those obtained by the visual method.

The third criterian of damage that was used is the measurement of compaction or surface deformation. In each replication, the ripple sole shoes made a slightly wider path, and the spike shoes made a slightly deeper path.

From these ratings and measurements, it is concluded that spike shoes wear out the turf more quickly and more completely than the other type shoes in the test and that ripple sole shoes produce the least damage.

The second part of the experiment involved measuring the effect of ripple sole footprints on the direction of travel of a rolling golf ball. A diagrammatic study revealed that these footprints produce no appreciable effect upon a rolling golf ball. The result is the same whether the footprint is near the point of release or near the point where the ball stops rolling.

There is an interesting sidelight to this portion of the experiment. It was found that to attain uniformity in direction and roll, the ball must be released in precisely the same manner each time. If the ball is released in such a manner that it rolls straight over, it is not easily deflected, even by serious defects in the putting surface. The ball roll is so certain that it is possible to place 23 out of 25 balls in the cup from a distance of eight feet even when it passes over a very deep footprint. On the other hand, when the ball is released

in such a manner that it has a slight sidespin (detected by a stripe around the ball) its path is unpredictable.

The results of this experiment indicate that according to these techniques and under these conditions, there is no reason for discriminating against ripple sole shoes.

Question and Answer Period

Question: How do ripple soles react on a pivot?

Answer: They do less damage than the spike. I don't think we'll ever convince golfers that the ripple soles are the ones to use, but I think it points up the need to do something about the spike soles we have.

Question: What time of the day were they putting on that ripple sole shoe?

Answer: I can't answer that. I don't know.

"NEMATODE PROBLEMS IN TURF AREAS"[1]

Walter J. Apt and Roy L. Goss[2]

Turf management, like the growing of many agricultural crops, is beset by a multiplicity of problems, of which many are biological. They include attacks by various insect pests and diseases caused by fungi, bacteria, and viruses. Within the past decade another type pest has been recognized as being parasitic on turf grasses and may cause serious damage; this pest is the nematode. Basically, a nematode is a worm-like animal; it has been commonly called an "eelworm," or "threadworm," but differs from worms and certain insect larvae with which everyone is familiar, such as angleworms and wireworms. One of the principal differences is in size. Nematodes rarely exceed 2 mm. in length and generally can be seen only with a microscope. They are found in almost all soil environments as part of the natural biologic complex and occur in enormous numbers. One of the fathers of the science of nematology, Dr. N. A. Cobb, is credited with the statement that if all other constituents of the earth cover were removed, we would still be able to trace the contours of the earth by the mass of nematode bodies; this statement gives some idea of their vast numbers. Although Dr. Cobb's statement is figurative, it can be safely said that every acre of cultivated land contains several hundred million nematodes. However, many of these are not parasitic to plants; in fact many are useful in the breakdown of organic matter, while some are predatory on other nematodes and on insect life. The remaining nematodes, the plant parasitic forms, feed principally on the roots and other parts of living plants.

Nematodes are considered important plant pests because of their association with the following symptoms: stunting, growth malformations, root rots, and various yield and growth declines. These symptoms are expressed when the nematodes

1. reduce the amount of available plant food by direct feeding;

2. destroy cells and tissues leading to the malfunction, inefficiency, and growth retardation of primary and feeder roots; and

3. cause malformation of plant roots which interferes with the passage of food and resultant plant growth.

In addition to causing direct damage, the lesions or wounds formed by their feeding habits may become ports of entry for fungi and bacteria which cause root rots and other diseases. Under such conditions, the secondary organisms may cause more damage than the nematodes. Some forms of nematodes (called ectoparasites) attack the small feeder roots and root hairs externally, while other forms (endoparasites) move within the root to feed. In either

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[1]Cooperative investigations of the Crops Research Division, Agricultural Research Service, United States Department of Agriculture, and the Western Washington Experiment Station.

[2]Respectively, Associated Nematologist, Crops Research Division, Agricultural Research Service, United States Department of Agriculture, and Junior Agronomist and Extension Specialist in Agronomy, Western Washington Experiment Station, Puyallup, Washington.

case the roots on which they feed are usually shortened and become brown or necrotic or affected so as to form galls.

While nematodes have been investigated for many years on field and horticultural crops, it was not until 1951 that Tarjan and Ferguson (4) reported the first association of these pests with turf decline. They described the disorder as "yellow tuft" disease involving the stunt nematode (Tylenchorhynchus sp.). Reports by Troll and Tarjan (5) in Rhode Island and by Christie, et al. (1) in Florida indicate that several species of nematodes may be causing serious damage on both northern and southern turf grasses as either primary or secondary plant invaders. The seriousness of the problem was emphasized when research workers in Florida instigated an active nematode research program in turf. In a recent report, Nutter (2) reviews development of the nematode problem in turf on a national scale and states "nematodes are apparently well distributed throughout the country, but recognized damage seems to be more prevalent on the lighter soils in the warmer climates. As such work continues and is expanded to other areas, undoubtedly new parasitic species will be revealed and the nature of presently recognized forms better understood."

In Washington, investigations of nematodes in turf were not instigated until the summer of 1958 when a number of putting greens, in the Seattle area, exhibited severe loss of vigor and in one case 75 per cent loss of the grass. Sampling of these greens revealed very large populations of parasitic nematodes, especially on the green where damage had been severe. A number of different types were identified, but the most prevalent was the spiral nematode (Helicotylenchus sp.). This particular nematode has been reported in Wisconsin by Perry (3) as the cause of a disease of Kentucky blue grass (Poa pratensis). Further sampling in Washington has shown that several species of nematodes are prevalent in turf areas. These are (1) the stunt nematode (Tylenchorhynchus sp.), (2) the spiral nematode (Helicotylenchus sp.), and (3) the lesion nematode (Pratylenchus sp.). It is expected that continued surveys will reveal additional parasitic species in turf of the Pacific Northwest.

Nematode infestations in turf will usually manifest themselves in localized areas and spread outward from those centers. The turf will exhibit a general loss of vigor and will become thin and show a dieback or decline condition. In severe infestations the root hairs and feeder roots may be destroyed, and living roots may be reduced in depth to less than two inches. With such conditions more intensive management will be required to maintain growth. If the damage continues to progress the turf will no longer respond to treatment and will go into a severe state of decline in both above- and below-ground parts. The root system has been damaged to the extent that it is unable to supply the water and nutrient requirements of the turf and is largely responsible for the diseased and declining condition of the above-ground parts of the grass.

These symptoms alone should not be relied upon for nematode diagnosis. Numerous other factors such as general nutrition, physical condition of the soil, soil moisture, and disease-complex may also cause turf decline. It is essential that a proper determination of nematode infestation be made before extensive control efforts are attempted. The mere presence of nematodes does not prove cause of turf decline as the soil may contain many species of nematodes not parasitic to plants and nematodes which are parasitic on some plants but may not injure turf. The only positive method for determining infestation and identification is by submitting soil samples to a qualified nematologist for observation.

The condition of soil samples is important for correct determination of nematode infestation. If it is desired to submit soil samples to state agricultural experiment stations or federal laboratories for nematode diagnosis, a few rules will give definite and accurate results in the determinations:

1. Take several samples to a depth of six inches immediately around the area of greatest damage and also from relatively healthy areas.

2. Composite each group of samples from one area and submit at least a pint of soil for nematode determination.

3. Take samples when soil is moist (not saturated) and package in polyethylene gabs which will prevent loss of moisture. It is essential that samples arrive in moist condition.

In considering nematode control, turf areas should be classed into two groups: Large-acreage - low maintenance areas and small-acreage - intensively managed areas. It is the latter in which serious nematode problems may develop, and treatment may be necessary if the turf is to survive. Low-maintenance areas are probably not as infested with nematodes, and the cost for treating such areas would be high.

With the discussion directed toward the more intensively managed areas, the control of nematodes may be divided into three phases: (1) in the plantbed, (2) top-dressing sanitation, and (3) in established turf.

The Plant Bed

Soil sterilization should be a basic requirement where turf is being established in areas found to be infested with parasitic nematodes. Fumigation with one of the recommended soil fumigants is the most effective and dependable means known at present for controlling these pests. Soil to be used in valuable areas such as greens, tees, and high-quality lawns may be sterilized in bins before it is placed. However, it is more practical and efficient to sterilize the topsoil in place after grading, leveling, and mixing have been completed. A number of soil fumigants are available for this purpose. These include such materials as D-D, Telone, E.D.B., chloropicrin, and methyl bromide. D-D, Telone, and E.D.B. are recommended only for the control of nematodes and some soil insects and have no appreciable effect on soil fungi, bacteria, and weed seeds. Their cost is in the neighborhood of $30 to $50 per acre, or about $.70 to $1.20 per 1,000 sq. ft. Methyl bromide and chloropicrin cost upwards of $300 to $500 per acre, or about $7.00 to $12.00 per 1,000 sq. ft.; however, they are recommended for control of soil insects, fungi, bacteria, and weed seeds in addition to nematodes.

Top-Dressing Sanitation

A nematode-free turf may become infested with nematodes by the use of contaminated topsoil or top-dressing materials. Therefore, it is good management to sterilize such materials before placing them on valuable turf areas. This can be done with a soil fumigant such as methyl bromide, which has proved to be one of the most effective and practical materials for this type of sterilization. Fumigation may be quickly and efficiently done by spreading the soil or top-dressing material in a small pile upon the ground or concrete slab, covering with a gas-impervious cover such as a polyethylene tarpaulin, sealing the edges, and introducing the fumigant under the tarp by means of an inexpensive applicator.

This process may also be done in sterilization bins, if they are available. As previously stated, the use of methyl bromide functions not only as a nematocide, but also reduces weed, disease, and insect problems and thereby justifies its cost.

Established Turf

The control of nematodes in established turf presents a somewhat different problem as most present-day soil fumigants are highly toxic to plants and cannot be used in their presence. However, two chemicals which are much less toxic and may be applied on established turf without injury to it have been developed. These are Nemagon (emulsifiable formulation) and VC-13. Nemagon functions as a soil fumigant by the diffusion of vapors through the soil mass. VC-13 is a 75 per cent emulsifiable concentrate which mixes easily with water; it is not a soil fumigent and does not diffuse through the soil as gas does, but is distributed through the soil by water movement or by mechanical means. Both of these materials have been extensively tested on turf and in most cases have given promising results but have been disappointing in others. The disappointing results are not necessarily the fault of the materials, for little is known concerning the nematodes that attack turf. Much additional work needs to be done with each species of nematodes found to be associated with turf: their life cycles, mobility, host preference, resistance, and ecology should be studied.

Nutter (2) has very efficiently listed a number of steps as suggestions for approaching the nematode problem on established turf. These suggestions are presented until expanded research supplies information for more specific recommendations.

1) "Maintain the turf under a good nutritional status with proper regard for pH and minor element balance.

2) Be thoroughly familiar with the disease and insect problems of the area -- their symptomology, environmental relationships and control.

3) Maintain proper soil moisture -- aeration relationships. Avoid compaction, water logging and mat formation.

4) Make periodic inspection of the root system. If appearance suggests nematode damage and the above factors are not involved, have nematode tests conducted by a qualified nematology laboratory. Follow good sampling procedure.

5) If nematodes are found which are known parasites on turf grasses, set up a spot test on a small section of infested area, using Nemagon and VC-13 nematocides.

6) Be sure that the soil is moist before application of the nematocide and that a liberal amount of water (1/2 to 1 acre inch) is applied immediately after the chemical. This water seal prevents evaporation of the toxicant and aids in carrying the toxicant into the root zone. Use high gallonage application. Generous quantities of a good wetting agent will improve wetting and penetration of the nematocide into the soil.

7) Base further control efforts on results of the spot tests. Be sure to allow sufficient time for the materials to react before making evaluations.

8) Following treatment, practice careful sanitation with topdressing materials and equipment to avoid re-contamination of treated areas.

9) Keep in contact with Turf Research Centers and commercial representatives for latest information on nematode problems and control recommendations on turf grasses."

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Question and Answer Period

Question: Are there two types of Nematodes?

Answer: That's right. You need the roots and the soil and the top because to give you one further explanation we have two different types, endo and an ecto. The endo lives within the roots and spends most of its life's cycle in the roots so we need the roots and we also need the soil because many of them are ectoparasites; they feed on the outside of the roots except for the actually piercing the root itself, and they never enter other than just their head portion so we need both the root and the soil.

Question: Does aerifying help?

Answer: To tell the truth, I couldn't answer that question because my experience with turf areas is so limited. It is essential that we get to fuming it down in there whether we use neburon or B.C.13. It has to be an emulsifiable formulation so that it goes down with water. Aerification perhaps will distribute it much better. As for myself, I have not gone into that, and I cannot truthfully answer that question.

TURF DISEASE RESEARCH DURING 1959 IN WESTERN WASHINGTON

Charles J. Gould[1]

The Disease Picture in 1959

The disease situation in 1959 was normal with Red Thread and Fairy Ring diseases being common on lawn-type turf during the spring and fall. Fusarium Patch appeared briefly in the spring on golf green turf and then disappeared until early September, when it rapidly became serious on untreated greens. Brown Patch appeared for a few days on one golf course during an unusually warm period in the summer. Both Helminthosporium and Curvularia were isolated from indefinite yellowed areas on golf greens, but their pathogenicity has not yet been established. The survey of turf diseases is continuing in cooperation with Dr. Maksis Eglitis of our laboratory.

Control of Red Thread (Corticium fuciforme)

Another effort was made to find fungicides effective in controlling Red Thread. Applications were started in May of 1959 and continued at two- or four-week intervals on a fescue plot donated by Dr. Herman Austenson. None of the treatments has yet given outstanding control of the disease, but the experiment is being continued. Our main recommendation for the control of this disease continues to be the judicious use of nitrogenous fertilizers.

Control of Fusarium Patch (Fusarium nivale)

Based on research in a plastic greenhouse and in field experiments on greens in western Washington, the following facts can be summarized:

1. Certain mercury and cadmium compounds have given best control. Cadmium fungicides produce a thicker turf than do mercurials.

2. Of the mercuries, phenyl mercuric acetate (PMA) types have usually given better control than other types of mercuries. However, commercial preparations of PMA were found to differ in their phytotoxicity.

3. Research with PMAS (10% PMA) has shown that

   a. 3/4 oz. in 10 gal/100 ft.^{2} is sufficient for disease control; 1/2 oz. is "marginal" 1 and 1 1/2 oz. are too phytotoxic and do not give any better disease control than does 3/4 oz.

   b. 3/4 oz. in 5 gal/1,000 ft.^{2} burns turf much more than does 3/4 oz. in 10 gal.

   c. 3/4 oz/10 gal/1,000 ft.^{2} every two weeks gives as good control as every 10 days; threatment every three weeks is "marginal," and treatment every four weeks is inadequate.

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[1]Plant Pathologist, Washington State University, Western Washington Experiment Station, Puyallup, Washington.

d. Addition of neburon (for algae control) to PMAS decreased disease control.

e. Addition of iron sulfate did not reduce the phytotoxicity.

f. Addition of nitrogenous compounds to PMAS reduced the burning when used at certain rates. However, the type of nitrogen used is important; Urea, for example, increased the disease.

4. Research with cadmium fungicides has shown that cadmium chloride gives much better control than the other types of cadmium tested. Since it has produced a thicker turf than have the mercury compounds, it is being recommended for trial use (preferably alternating with PMA) at 1 oz. of Caddy/ 10 gal/1,000 $ft.^2$ every two weeks.

5. Penncross continues, in general, to appear to be resistant to Fusarium Patch.

Fairy Ring

Mr. Ted Filer, a graduate student in the Department of Plant Pathology, has begun an investigation of Fairy Ring, particularly into the reason why the fungus rarely grows back into the area previously infested. If he can determine this, the knowledge should aid us greatly in finding an easier method of control.

General

Reports from England (Sports Turf Research Inst.) indicate that: (1) Fusarium Patch in Poa annua was increased by applications of lime and (2) damping off of young seedlings was reduced by treating seed with captan. Spraying of the seedlings with this material might also help. Observations indicate that sprays of thiram are also beneficial in controlling damping off. Both materials should be tested at regular spray rates.

In response to several requests, we have prepared the following chart on turf diseases in Washington. The recommendations are based on our own research findings and on the most recent reports in the literature. Suggestions about the chart will be welcomed.

This research has been aided by grants from the United States Golf Association Greens' Section, Northwest Turf Association, Northwest Golf Course Superintendents' Association, Oregon Golf Course Superintendents' Association (through the Northwest Turf Association), California Spray-Chemical Corporation, O. M. Scott Seed Co., and W. A. Cleary Corporation. It has been carried on in cooperation with Roy Goss, V. L. Miller, Drs. Eglitis and Herman Austenson of the Western Washington Experiment Station, and Golf Course Superintendents John Jaslowski, Henry Land, Sr., and George Lawton. To all of them - and many others unlisted - I express my sincere appreciation for their assistance.

LAWN TYPE TURF - Recommendations for Disease Control in 1960

C. J. Gould and M. R. Harris*

Disease	Symptoms	Type of Weather	Presence in Washington		Recommendations for Control	
			Western	Eastern	Cultural	Fungicidal
RED THREAD (Corticium fuciforme)	Bleached or tan-color irregular areas, 2 in. to 24 in. with pink or red fungus strands 1/8 in. to 1/4 in. long.	Cool Moist	Very Common	?	Adequate nitrogen fertilization	Under test. Meanwhile try heavy applications of cadmium fungicides or Kromad.
FAIRY RING (Marasmius oreades)	Rings of dark green grass, sometimes dead toward center, with or without tan mushrooms 1-2 in. in diam.	Cool Moist	Common	Fairly Common	Adequate fertilization and watering.	Suppress with drenches of phenyl mercury acetate. Eliminate with methyl bromide. See Wn. State Ag. Exp. Sta. Circ. #330.
HELMINTHOSPORIUM BLIGHTS (Helm. spp.)	Tan to purple spots on leaves, or yellowing & rotting of entire plants, singly or in clumps.	Varies Moist	Common	?	Water in morning, pick up clippings. Don't let grass get matted.	Phenyl mercuries, Kromad, captan, Actidione, zineb, Tersan OM, Thimer; apply in Spring.
MATTING (Unidentified basidiomycete)	Clumps of brown matted grass with white mold on bases.	Cool Moist	Fairly Common	?	Reduce cutting height. Remove thatch. Apply nitrogen.	Probably not needed. Try broad-spectrum types if desired.
FUSARIUM PATCH (Fusarium nivale)	Browning and thinning of turf in large (4-18 in.) rather indefinite spots.	Cool Moist	Fairly Common	?	Promote air drainage. Avoid high nitrogen.	As for golf greens on reverse side.
RUST (Puccinia graminis)	Reddish or brownish powdery spots. Mostly on Merion.	Warm	Uncommon	Fairly Common	Increase nitrogen; water during dry periods.	Fungicides usually not necessary. Try sulfur sineb, maneb or Actidione RZ.
ANTHRACNOSE (Colletotrichum sp.)	Gray or tan-colored stems & leaves with small black fungus bodies.	Cool Moist	Common	?	Adequate fertilization & watering. Remove clippings.	Probably not needed.

LAWN TYPE TURF - Recommendations for Disease Control in 1960 (continued)

Disease	Symptoms	Type of Weather	Presence in Washington		Recommendations for Control	
			Western	Eastern	Cultural	Fungicidal
POWDERY MILDEW (Erysiphe graminis)	Gray-white powdery masses on leaves & stems, which may yellow and die.	Warm Humid	Uncommon	?	Fertilize and water to maintain vigor. Promote air drainage.	Usually not needed. Sulfur, Karathane, or Actidione.

* Plant Pathologist (Washington State University, Western Washington Experiment Station, Puyallup, Washington), and Extension Plant Pathologist (Washington State University, Pullman, Washington). September 23, 1959.

GOLF GREEN TURF - Recommendations for Disease Control in 1960
C. J. Gould and M. R. Harris*

Disease	Symptoms	Type of Weather	Presence in Washington		Recommendations for Control	
			Western	Eastern	Cultural	Fungicidal
FUSARIUM PATCH (Fusarium nivale)	Spots brown, round, 1-2 in.	Cool Moist	Very Common	Common	Avoid excessive nitrogen. Promote air drainage.	PMA (3/4 oz. of 10% type) types (PMAS, Tag, Puraspra, Scut 1, etc.) or Cadmium chloride (1 oz. of Caddy) in 10 gal. water per 1000 sq. ft. every 2 weeks.
SNOW MOLD (Typhula itoana)	Irregular, dead bleached areas, 2 in. to 2 ft. with a dirty-white mold - usually associated with melting snow.	Cold Wet	Unknown	Common	Avoid late fertilizing	Phenyl mercury compounds as per manufacturer's recommendations before snowfall.
RED THREAD (Corticium fuciforme)	Spots ring-like 4 in. to 24 in. Weeds or annual bluegrass in center.	Cool Moist	Infrequent	?	Use adequate nitrogen	Under test. Meanwhile try heavy applications of cadmium fungicides or Kromad.

GOLF GREEN TURF - Recommendations for Disease Control in 1960 (continued)

Disease	Symptoms	Type of Weather	Presence in Washington		Recommendations for Control	
			Western	Eastern	Cultural	Fungicidal
COPPER SPOT (Gloeocercospora sorghi)	Copper-colored spots 1-3 in. Color rubs onto handkerchief.	Warm Humid	Infrequent	?	Try adding lime in small amounts	Use cadmium fungicides as manufacturer recommends.
BROWN PATCH (Rhizoctonia solani)	Greenish or brownish black, thinned areas, spreading rapidly, 1 in. to 36 in.	Hot Humid	Rare	Infrequent	Avoid high nitrogen and frequent watering.	Mercuries, particularly mercurous + mercuric chlorides, Tersan OM, Thimer.
DOLLAR SPOT (Sclerotinia homeocarpa)	Gray or golden-colored spots, 1-2 in.	Warm Moist	Unknown	Infrequent	Apply adequate nitrogen and water.	Apply cadmium fungicides, Tersan OM, Thimer or Kromad as soon as disease appears.
Damping off of young seedlings (Various fungi)	Dying of young seedlings, singly or in clumps.	Cool Moist	Fairly Common	Probably Common	Avoid excessive watering after seeding.	Try treating seed and spraying young seedlings with captan or thiram. Fumigate soil with methyl bromide.

* Plant Pathologist (Washington State University, Western Washington Experiment Station, Puyallup, Washington), and Extension Plant Pathologist (Washington State University, Pullman, Washington). October 26, 1959.

GLEANINGS FROM MIDWEST REGIONAL TURF FOUNDATION

Alvin G. Law, Prof. of Agronomy, Pullman, Wash.

At the invitation of Dr. Daniel, on behalf of the Midwest Regional Turf Association, I attended and took part in the 1959 Turf Conference at Purdue University.

That this meeting is the largest of its kind in the North American continent is a tribute to Dr. Daniel, Purdue University, and the people in that area concerned with turf. There were 537 in attendance; 277 golf courses represented, 63 sod and landscape services, 27 parks and industrial grounds, 11 cemeteries, 8 school ground's groups, and 115 turf material and suppliers. These people were from six states adjacent to the host state, Indiana.

Golf course superintendents, park people, and the supply houses furnished 75 per cent of the program, counting number of papers. The program covered Student Training, Soils and Construction, Grass Utilization and Performance, Weeds and Weedy Grass Control, and Management. In addition to such familiar names as Noer, Wilson, Watson, there were invited speakers from New Jersey, Maryland, Texas, and Washington.

One of the things that stands out in this extensive program operated jointly by the Midwest Regional Turf Foundation and Purdue University is the student training program. A student majoring in the Turf Management option at Purdue has academic training in Equipment Maintenance and Operation, Soil Fertility, Soil Physics, Soil and Plant Analysis, Turf Management, Plant and Animal Chemistry, Insect Control, Nursery and Greenhouse Management, Plant Diseases, and Weed Control. In addition each student must work at least one summer in some activity related to the turf field in order to acquire practical experience. In addition each student must work on the Turf Research Program at Purdue University during the four-year course of study. The 14 undergraduate students currently enrolled in this option will be a real asset in the field. An important aspect of this program is the recognition given turf by the establishment of a major in this field by Purdue University.

A second standout at this conference was the paper by Layton Boyd, Superintendent of the Camargo Golf Club, Indian Hill, Ohio.

Mr. Boyd described a turf service his crew provides for its members. Started in 1947, the income to the club maintenance division has jumped from $1,100 to $17,800 in 1958. He reports that the direct golf course maintenance was reduced by about $10,000 as a result of the program. Moreover, a regular crew is kept year-round.

Any kind of work involved in grounds operation is done. This includes lawns, trees and shrubs, fertilizers, insecticides and fungicides, regarding, equipment repair, till lines, blacktop repair, seeding, etc. The club handles all billing for the work. A regular schedule of costs has been developed over the years that is satisfactory to the club and to the customers. How satisfactory is indicated by the fact that school lawns and playfields are regular clients. Over the years a "bible" has been developed that helps keep the service on a top-notch basis. I would guess there are courses in the Northwest that could profit by a similar arrangement.

I found our mutual friends annual bluegrass and crabgrass were problems from New Jersey to Florida to California to Washington. It is impossible to report all the work being done on these two "Terrors of the Turf." Success in treatment depends on the total management program, soil type, temperature, fertilizer level, kind of desirable grasses present, time of application, irrigation practices, and possibly the religious preference of the applicator!

In New Jersey, Engel found 1/2 pound of endothal per acre applied in early spring reduced annual bluegrass and clover in bentgrass. Sodium arsenite is used successfully by Wolfrom on the Maple Lane Golf Club, Warren, Michigan, in accordance with the following:

Daytime Temperature	Sodium Arsenite lbs/acre
40 - 50 F	2 in 75 gal/H_2O
50 - 65 F	1.5
65 - 75 F	1.0
Above 75 F	don't

He uses three treatments between September 1 and May 1. This eliminates grubs, reduces worm casts, chickweed, and annual bluegrass. On greens he reduces the above rates by 60 per cent for greens treatments.

Calcium arsenate at 20-24 pounds per 1,000 square feet has successfully controlled annual bluegrass in the Purdue area. Reseeding has been desirable following treatment. Used on greens, Daniels recommends 16 pounds per 1,000 square feet in three applications of six pounds in early spring, six pounds one month later, and four pounds in the early fall. This should then be followed by annual applications of four pounds per 1,000 square feet. The arsenicals become less effective on soils high in phosphorus. Moreover, they are expensive so the search for other chemical controls is continuing. A successful herbicide will be one that will gradually weaken the annual bluegrass with no harmful effects to the desirable perennial grasses. This will permit a gradual elimination of the annual bluegrass and a buildup of the turf by good management.

More extensive data are available regarding crabgrass. Considering first pre-emergence experiments, in New Jersey chlorodane at 80 pounds per acre applied mid-March to mid-April gave good control. Arsenicals were less satisfactory in New Jersey. In the Purdue area, calcium arsenate at 12 pounds per 1,000 square feet applied in the fall has raised havoc with crabgrass. After initial use annual applications of three to four pounds per 1,000 square feet are needed. Lead arsenate at 24 pounds per 1,000 square feet has been equally effective.

Chlorodane and the arsenates are effective against crabgrass in other areas. However, at the rates required they are expensive. Also there is the ever-present danger of harmful buildup in the soil. Thus the search goes on for less expensive, less dangerous, and equally effective treatments. Some promising leads are discussed in the research section of this report by Goss and Law.

Post-emergence treatments of various chemicals have been promising. These normally require two or more applications after the crabgrass germination period has started. Potassium cyanate is an old standby and with repeated application at the manufacturers recommended rate will reduce infestation. PMAS at one to two ounces of 10 per cent solution every 10 days has been effective in New Jersey. Some injury to the turf may occur so the rate will have to be adjusted. Also high temperatures increase the chance of burning. The effectiveness of these and other pre-emerge treatments are reported by Goss and Law in the research section.

GLEANINGS FROM THE MIDWEST TURF ASSOCIATION

Norman Goetze, Extension Agronomist
Oregon State College, Corvallis, Oregon

At the Conference we had around 500 people, so we had only part of the time when we all met in one group. We tried to put a group of renegades together for the program, and we put Al in on that particular program. Needless to say, he stole the show. He was in his prime that afternoon. Al did a remarkable job in telling the people in the Midwest about the seed industry and some of the problems you have in seed production and in raising turf here in the Northwest. Those of you who have not traveled out of this area should understand that the concept of the man who lives in the Midwest is that there is nothing out here after you get past Denver; that when you get to Denver you just go over the hill and there is the Pacific. I think that Al really helped straightened out some of those people to the fact that there are some people living out here and that we are doing some things. He really helped our standing in that regard.

Al has asked me to talk about the turf program at Purdue as far as training is concerned. It is just starting. It has been in operation for about 8 or 10 years; we've now finally got some students interested in the program! We have both graduate and undergraduate training. We have currently about 15 undergraduate students training in turf. They work directly with Dr. Daniel and others who are active in turf extension on the staff. These boys unfortunately either go on into graduate work or into industry, so the number of boys who have graduated in this program and have stayed in turf at the applied level has been rather few. The majority of them are now working as technical representatives for industries. That is very good. I think they are doing as much or more in that area as they would on an individual golf course, but it has been rather disappointing to the golf course superintendents. I think that will correct itself very shortly, because it has been rather unusual at Purdue.

Our agricultural enrollment this year is up 12 per cent, and that means that we are going to have more students in turf, whereas most other agriculture schools this year are down in enrollment. In graduate work we have turned out quite a few masters' degrees in turf. Some of those boys have now gone into industry; others have gone out into their own private business; and we finally let one Ph.D. fellow out. I think they got tired of me after four years, and they turned me loose about two weeks ago! I quickly got back out to my home area, and needless to say I am glad to be back out here in the Northwest working with you fellows, and I hope to become acquainted with you and your problems as soon as possible. I find that things have progressed very quickly while I have been gone, and I am looking forward to getting reacquainted with Roy and the others who work out in the Puyallup station as well as working with John Ellsworth here. For my two minutes that are left, I would like to throw my two bits into this arsenic thing while we are talking about it.

You folks here in the Northwest are going to become increasingly concerned with crabgrass, I think. There is only one way that the amount of crabgrass can grow, and that is up, and it is never, I believe, going to be as serious as it is in other parts of the country. Part of the reason for that is that your season for crabgrass is shorter; in other words, you don't have crabgrass for many months as other parts of the country do. As a result I think that some

of these materials that we have thrown away in the Midwest as far as being practical solutions in crabgrass control may work here because you have a shorter season. Secondly, I don't believe that you have such tough conditions for breakdown of those materials on the soil surface. I am referring now specifically now to chlorodane. We don't think much of chlorodane for crabgrass control in the Midwest because it does not give us a permanent full-season control. But here in the Northwest it may because you don't have such high soil temperatures, you don't have such high moisture as we do back there in midsummer, and I believe that it may remain more active throughout the season. That may in part explain the reason why you are not forced into using arsenics for crabgrass control as we are in the Midwest. We really don't like to use those high amounts of the material, but we have been forced into it because other materials have not been effective as we would like to have them. Chlorodane under Midwest conditions, if we would use it at 120 pounds to the acre of active material, is effective. It is just a little on the expensive side.

Dr. Daniels for about six years has had considerable experience with the arsenic materials and their activity, and he hasn't gone into it quite as deeply as the boys at Puyallup have, but he has gone into it in a manner of reducing the toxicity once you build it up too high. He has found a direct relationship between arsenic and the amount of phosphorus that is in the soil. For example, if you are on an extremely old putting green which has received lead arsenic historically over a long period of time, he finds that it takes a considerable amount of lead arsenic to give good activity against poa. The higher amount of phosphorus you used seems to tie up the activity of the arsenic, but just recently during the last year we have some preliminary results that it takes just a small amount of calcium arsenic to release the activity of that lead arsenic that is in the old soil. Now this is preliminary, so we can't talk much about it yet, but it looks like the calcium arsenate may give us much activity from the old residual lead arsenate that is still there. We are going to work more on this to check it out, but it does look rather interesting. Now, what happens if you slip up. What happens if you put on too much arsenic and what can you do? You don't necessarily have to leave the county and you don't necessarily have to find a new job. If you really get in a pinch, you can apply more phosphorus, because this phosphorus then ties up the arsenic. How far you can go building one on top of the other we don't know. We do know, however, that additional amounts of phosphorus will cut down the arsenic toxicity in grass. Now this is not true in some of these old orchards that have been abandoned here in the West. Some of those crops are much more susceptible. How much to use depends upon soil conditions. I don't have enough experience here yet to really say. So, whereby Roy has some very good data here, I would agree with them completely, especially in regard to Bent. There is no question in anyone's mind that arsenic definitely slows up Bent grasses. If you don't believe that, go out on a putting green that has received a lot of arsenic, especially calcium. Calcium is much more dangerous to use than lead, and on a hot dry afternoon if you haven't sprinkled at noon along about three or four in the afternoon you look into the sun at that grass and you can spot a very good looking blue color. That grass is just on the verge of going. If you know what you are looking for, you can spot that damage.

We also have found that we can effectively control poa annua in Bent grass under those conditions if we get enough arsenic in there. In many cases where the phosphorus levels are already high, it just takes an ungodly amount of arsenic to do the job. Unfortunately some of these other materials that we have tried will also do the job. I had some beautiful trials out of St. Louis, at the Sunset Country Club. Neburon has very good activity on poa annua. For poa

annua control in bluegrass, there is no question in my mind that neburon is the chemical to use because bluegrass will tolerate a lot of neburon and the annual bluegrass will be removed. But Bent grass under our conditions is quite susceptible to neburon. I think out here especially, on the west side of the mountains, we may find that Bent grass is more resistant to neburon than in this particular area.

Question and Answer Period

Question: What materials did you use in St. Louis that were so successful?

Answer: Vegetex is the material I used. It has some activity on poa annua. Unfortunately it also has some activity on Bent grass, but I personally feel that the activity it has on Bent grass is not due to the vegetex itself but to the oil that is formulated in the materials. It is nothing to recommend at this time, but if you are really desperate and want to get ahold of some, try it. I was just trying some on some small nursery areas.

Penncross back there is a grass that they can seed again. You can put it into a damaged green without completely renovating the whole thing. One of the parents in Penncross is Pennlu. Some people in the Midwest like Pennlu, but the golf course superintendents have not liked it. As a result we are not using much. With the use of Pennlu they did not have to spray so often. It did, however, need to be fertilized more heavily than the other grasses to keep the dark-green color. Remember that Penncross is a polycross, meaning that it has a lot of types in it. After you use Penncross for several years, the particular types in that mixture that are best suited to your soil and your management are the ones that are going to survive. On your neighbor's course Penncross may act completely different in two or three years. Don't be confused by that; it is still Penncross. Different types will probably survive and segregate out under your conditions.

ARE YOU GETTING YOUR MONEY'S WORTH?

Verne C. Fish
Service Representative
Toro Manufacturing Corporation

Are you getting your money's worth from your grass-cutting equipment? You say, yes, no? How do you know? If you stop to think a few minutes, you might be surprised to learn that you don't know the answer to this vital question.

First of all, let's establish Toro's interest in this subject. Machines that wear out prematurely through improper care and maintenance do result in an increase in parts business. The improper machine for the job and abuse do result in early replacement of the equipment. This should make Toro happy. It doesn't. Choose the correct machine for the job and then take care of it. We can wait for your replacement.

Here's a simple formula which might help you determine whether or not you are getting your money's worth from your mowing machinery.

$$\text{Machinery operating costs} = \frac{\text{Original cost + repair costs}}{\text{Time}}$$

Let's take this formula apart and look at it a piece at a time. First, original cost. Why does a tractor cost so much money and still need repairs and replacing? Actually your golf-course tractor is practically hand-made, not a production-line tractor such as a farm tractor. There is more labor involved, thus higher price. The golf-course tractor is engineered to eliminate as much damage to turf as possible and still equal or better the power and durability of other types of tractor. Actually, it costs around $2,600, which is about the same as you pay for a medium-priced car, less accessories. On the average, you turn that car in at 30 to 35,000 miles. Let's see what happens to the tractor during its life span. Tractors usually run about seven hours a day and five and one-half days a week. Allowing six full months for idleness in a year, the tractor totals about 924 hours per year. When pulling gang mowers, the tractor travels approximately five m.p.h. which equals 4,620 miles per year. However, tractors pull mowers in second and third gear.

Tractor time in third gear (70 per cent) or 647 hrs/yr. at 810 r.p.m.

Tractor time in second gear (30 per cent) or 277 hrs/yr. at 1480 r.p.m.

If you combine the engine speed, plus the hours run in each r.p.m. category, apply the result to an average (high gear) of an automobile, the net result will be equivalent to 22,057 miles per year. Tractors are used on your course a minimum of five years or an equivalent of 110,285 miles. This $2,600 tractor now appears to be doing its share for the budget.

Well, maybe the above is true, but $395. for the 21 inch Power Greenhouse sounds darn high. And besides, we are always buying bedknives and bushings for it. How come?

PGM statistics are of little value unless applied in such a manner that they compare against some other piece of equipment. PGM's actually run substantially more than you might think.

a. five cuttings per week at three hours per cutting equals 15 hours per week.

b. 26 weeks per year of cutting equals 360 rolling operative hours per year.

c. at an average mowing speed of three m.p.h. that machine travels a a total of 1,170 miles per year.

These rolling 1,170 miles mean actual operating wear. If we adjust downward 10 per cent for transporting purposes -- green to green -- the following figgures begin to come to light.

a. 1,170 miles mean the reel bearings must deliver accurate to within .002 inches some 7,949,800 revulutions per year.

b. The bedknife received 55,598,400 cuts per year, and a lot of that cutting is being done under wet and sandy, hot and dry, conditions, not to mention loose spikes dropped from some member's golf shoes.

c. The front rollers, which are constantly being exposed to sand and grit, along with the corrosive effect of chemicals, must deliver to within 1/64 inch accuracy some 2,205,492 revolutions.

Assuming that your club has six power Greensmowers, we multiply the above unit statistics by six and an obvious pattern of wear shows up. Six PGM's cost approximately $2,400. This is nearly the same cost as that $2,600 tractor. However, the six PGM's travel a total yearly mileage of 7,020 or nearly 2,400 more miles than the tractor (actual rolling miles), or about 35 per cent more mileage than the tractor.

As you probably know, a club which has six Greensmowers receives a longer life span from its equipment and experiences lower maintenance costs than if it were to use three Greensmowers for the same amount of work. The reason for this is that when all the greens are being cut with only a small number of machines, each machine has to be run faster. These excessive speeds not only increase wear, but the operator does not have time to notice harmful objects such as sticks, stones, spikes from golf shoes, and coins. It is our feeling that enough machines should be used at the club to prevent abuse or overuse of the equipment. Actually you can operate on fewer dollars by spending more for equipment.

These figures are quite realistic and certainly give us an idea as to the type of performance that is expected of your equipment. Building this performance into golf-course mowing machinery is Toro's job. Our experimental and product engineering departments are continually striving for QUALITY-PERFORMANCE AND LONGEVITY. They subject the machines to many tests such as: dropping them from various heights, driving them down flights of steps, mowing nails with reel mowers, and mowing down 2 x 4's with rotarys, and occasionally they even try them on grass. Seriously though, it is not a small job to decide which brand of machine is best for your purpose. We know that TORO's THE BEST YOU CAN BUY. Assume you've bought Toro equipment. You now ask yourself, "AM I GETTING MY MONEY'S WORTH?" We don't know until we look at repair cost.

During the last war it was discovered that automobiles would perform for several thousand miles more than was anticipated. Prewar cars were junked at 30 to 35,000 miles. These same cars were run 100,000 and more miles when it became necessary. This, of course, was due to proper care and maintenance. The same is true with grass-cutting machinery. Naturally, there are certain moving parts that are going to wear out, but we can offer suggestions to help prolong their lives. These suggestions are for the most part outlines in the Owners' and Operator's manual, which comes with each machine.

A. Daily checks

1. loose bolts and nuts
2. belts and chains
3. cleaning mowers

B. Lubrication

1. oil level and air cleaners
2. zerk fittings
3. check gear case levels

C. Adjustments

1. follow factory recommended procedures
2. correct tools
3. weather conditions
4. regular adjustment

D. Training the Operator

1. difference in operators
2. correct instructions
3. induce personal pride

One common reason for a shortened life span and high maintenance costs is the use of the right machine in the wrong job. For example, in most cases a distributor has no jurisdiction to where small home owner type machines are sold. The sales force is cautioned about selling these machines to commercial users. A small machine is used by the home owner about 20 weeks a year with an average use of two to three hours per week. The machine will last the home owner perhaps 10 years, which means 500 hours running time. This 500 hours means about 12 weeks of use to commercial users. In many instances the machine is worn out before the warranty has expired.

In choosing your equipment, here's a few things which might be considered:

1. Consider the area to be cut. Is it wooded, rough cutting, hilly or formal areas? Then decide if a reel-type or rotary-type or sickle-type machine is to be purchased.

2. Consider the amount of usage. Perhaps the machine will be used in large extensive areas and figures are available as to the capacity of the machine. If the machine is to be used for trimming purposes and the usage is not too extensive, a small, light-duty machine can be used, but high maintenance costs must be expected.

3. Simplicity of design is very important, as a complicated machine has many moving parts and will have a high maintenance cost. Also it may be difficult to adjust, and a trained expert may have to be used for adjustment and repair.

4. Constructions and durability. The machine should be substantially built, well-braced with good bearings. The side-frames, handles, or drawbars should be heavy enough to do the job. The bed bars, reels, and blades should be rigidly constructed.

When you've made your decision, then check with your dealer. He will probably have suggestions for your consideration. We have now purchased TORO Equipment and set up systems for maintenance and repair. Now we ask again, "ARE YOU GETTING YOUR MONEY'S WORTH?" You still don't know - no records.

It is wise for every user of heavy equipment to keep a record of operation and maintenance. Over a period of years, it will pay dividends. This record should show the following:

1. name of machine

2. serial number

3. date purchased, dealer and price

4. all lubrication points

5. accumulative running hours

6. parts replaced due to wear or breakage and cost

7. total labor for installing parts

At the end of the cutting season, this record should show the number of hours your equipment has run, plus the cost of maintenance. It will also serve as a record to help promote new equipment.

There is not set life span for any machine, because there are too many intangibles. The questions of "cost per machine per year" and "useful life span" can only be answered by you. The variation is terrain on which the machine is used, the type of lubrication it receives, the correctness of repair, the treatment by the operator, storage, accuracy of records, all have bearing, and in fact determine the answer to these questions. Comparison of your own figures over a period of years will enable you to see when machines should be replaced due to high maintenance costs. Also it will show the life expectancy of any piece of equipment at the time of purchase.

Buy QUALITY equipment!

Buy the right machine for the right job!

Operate and maintain it properly!

Keep adequate records!

MACHINERY MAINTENANCE

Mr. Brinkworth

Sometimes we talk about preventative maintenance, but I think today we are concerned about the causes of our troubles. This is similar to the lady that went to the doctor and complained bitterly of having 14 children. She mentioned definitely that she was not going to have any more. The doctor was quite interested to know how she knew so definitely, and she said that now she knew what was causing it. So that is what we are mainly here today to do - find out what causes it. I've got some slides that I know some of you have seen before; I've tried to get some new ones, concerning the old job of repairing machinery. You must keep it running, and, of course, in the eyes of the factory too long sometimes. But if equipment is properly maintained and properly cared for with daily checks, adjustments, lubrication, and by choosing the proper machine for the proper job, you are operating safely. Of course, one way that we can assure this is by the proper training of our operator - by training the operator to clean and store this equipment properly. Now turf can be made to look beautiful by a number of ways. You fellows know how to grow grass and how to care for it. But the final thing you do to grass is to cut it, and it is actually how it looks after this operation that sometimes keeps us in our jobs. At a motel in Phoenix, I was sure a competitive machine had cut the lawn until I checked with the superintendent, and he notified me it was one of ours. So it gives you an idea of how it makes you feel. But this machine, believe me, was just incorrectly adjusted. We checked into the matter and found out that the operator had no idea how to adjust it and kept no daily record of its run. So we brought to his attention that a booklet comes with his mower. It had some very descriptive pictures of the unit and had some very fine tips on how to set up a record on this type of equipment.

Then you can cost account and figure your maintenance, cost, working hours right on a record, and know just whether or not you are getting your dollars' worth out of your machine. You can also anticipate problems by having these records. Now we all know that the airlines do a bang-up job in keeping their records intact. If they don't, we read about it in the newspaper. Now let's start with daily checks. This is something that the operator should be trained and taught to do, because in daily checks a lot of problems show up that would normally result in breakdowns during your operation and cost you extra money. Make sure that he goes over his machine every morning, checking for loose belts, nuts, proper greasing, etc. Also make sure that replacement parts go in ahead of a failure, because again a breakdown here cannot only strip off a gear but can damage a chain as well. These things mount up very rapidly, and in the daily checks let's make sure that even if we do have an excellent maintenance program that there is not something out of place with the equipment. Now if we look closer here we will notice that this man did a beautiful job of cleaning, painting and keeping up his equipment. But you will notice that this reel is in backwards. The person that did this is in the room. I am not going to mention his name; I told him I wouldn't, but anyway you will notice that nuts and bolts that are loose at a very important point on this equipment could easily cost a lot of money not only from the loss of the bolt but also the damage to the reel because of the bearing hanger does perform a very important part in the daily operation of that machine. Make sure that even if it comes out of the shop for a chain replacement that it lines up. You will notice that this chain is out of line. This can cause wear to the sprockets and the roller and chain, and all the time it is operating puts undue stress on the equipment. These are just some of the tools that I would like to incorporate with a

daily check especially on your greens mowers. In the height of cut set, make sure that you are cutting at the proper height setting your reel to bed knife adjustments. Use a grease gun, and Jim Watson likes to see everyone sharpen those greens mowers as often as possible. Jim would like to see it once a day, and Charlie will go along with this because the sharper the mower the better job it will do in helping your grass grow better. Now we get into the adjustments. I think we have specifically three types of equipment that we are concerned with regarding adjustments. Now the reel to bed knife adjustments are the most delicate of all rotary mower adjustments. Oil is one very important part of the machine that should be checked. Make sure that the height is at the proper level and that a good clean oil is used. We don't recommend any specific kind, although I have heard it argued back and forth on detergents vs. nondetergents and the 10, 30 oil. You can get into quite a discussion when you start talking about oil. We recommend a good 30 weight oil in any four-cycle engine under heavy-duty work. Change the oil frequently, because this is a small crank case, and if it shows a little wear in the engine you rapidly build up the carbon in the oil. A good way to check it is with a white pan because you will notice the carbon residue build up on the pan as you let it run down. Another way to see if it is necessary to change the oil or not is to dip something into the crank case or put a drop on a piece of white paper. Let it run down and hold it up to the light. You can see the carbon building up in the oil. Now a lot of men say change the oil every 30 hours. If you are operating in a dusty region, this is not often enough, and I think many factors have proved that dust getting into the engine does accelerate the wear very quickly. Now let's keep a sharp look, and if it is every five hours that we have to change the oil let's change it. But let's check to see if it needs changing. Now how do we change it? Do we just drain it out the morning before we go to work? I think this is a poor idea because nine times out of ten the dirt has settled to the bottom of the crank case. When you drain out your clean oil leaving the residue in the bottom of your crank case, you add the new oil to this dirt, and the dirt condition still exists. A good practice is to let the engine warm up and let it run for five minutes then drain it or drain it after a day's operation. I think that you will find that you will get a better cleansing of the crank case doing it this way. Now here's just a little example of how carbon can build up and again we send you back to the owner's manual because this fellow's excuse was that he didn't know that he had an oil filter on his tractor. We almost had to use powder to get that out. Believe me it weighed about four pounds, just loaded with carbon; this was building up rapidly, wearing his engine to the point where it cost a very pretty sum to get the engine put back in shape.

Hydraulic Systems

Hydraulic systems when they are working, and you are going to find a lot more of your heavier type of equipment coming equipped with hydraulic systems, must be kept clean. I think that dirt around a hydraulic system can cost no end of money. There are screens in there for small amounts of dirt, but not for dirt that is well accumulated. I think you are running an extra chance of letting it get in the actual resevoir, and again I say, that with hydraulic equipment, you are going to have to go by the specification as laid down by the manufacturer.

Greasing

I've seen grease on equipment, I've seen people grease it, and there is a point of controversy everywhere I go. How often should I grease the ends of these rollers? Well again, it is like the crank case on your engine. It's the

condition that you are operating under that is important. I think that if you are operating under dry, dusty conditions, more frequent greasing is necessary. Is three times a day often enough? I would say that it would be a minimum of greasing. Even though most manufacturers now equip the bushings with optional equipment that will last, the bearings need grease. It's not that it takes grease to keep them running. It is a flushing action that we are doing. We are flushing that dirt out more than we are adding grease. Do a bang-up job of greasing the ends. Here is one place that I wish everybody would lay off greasing, because it is right next to a clutch or next to a belt. It seems that these easy to get next to fittings get the most attention, and the grease is loaded on. But parts down underneath, where a guy has to get down on his knees, are sometimes neglected. Here is a common cause of belt wear and deterioration of rubber on the belt. This is an example of overgreasing and, of course, again it's a convenient place to get to. I can't tell you how careful you have to be about greasing rollers. We are well aware that grease kills grass and leaves an ugly scar on golf greens. When you do grease at this point, be sure to wipe off any excess that you might accumulate. Then grease in the gear boxes. This is a good consistency of grease that I happened to show here. Here the operator punctured a hole in his side plate and instead of taking it off and having it welded, he went merrily along. He let sand and dirt accumulate in the gear box until it formed an emery compound grinding out his gears and the end of his reel shaft. It just cut it. Instead of a $3 welding job on the plate he wound up with a $70 or more maintenance bill on this particular unit.

Bed Knife Adjustment

This is the most important adjustment on the entire machine. In doing the adjustment as you see here with a long-handled wrench, you can really get lots of torque on there. Our engineers built a lot of stress into this opposing adjustment, but with a long-handled wrench you can strip off the bolts. If it gets to the point where you have to get a long-handled wrench to make that adjustment, something is wrong. Let's go back again and look at it. What are we doing wrong? Well, for instance, we are not bringing the bed knife up to the proper position, but let's say that maybe we have gone past the sharpening date. Maybe we are trying to get an extra week out of a sharpening job, and when we came in last night it was ragged cutting. We thought, "Well, we'll just sock her down just a little more to get the final adjustment out of it, and we'll send it out because we're busy." Here's what happens under those conditions. You tightened it down, and then a chain reaction starts throughout your whole machine. (1) A tight reel to a bed knife will rifle barrel your bed knife. (2) Undue stress is put on the belt drive, driving mechanism. (3) Undue stress is put on shaft assembly and undue wear on your sprockets and chains. Finally your motor overloads. By tightening this adjustment too tight, and I don't care on what type of equipment we're talking about if this reel to bed knife adjustment is too tight, you are putting undue stress on your entire machine, plus the fact that you are damaging your grass. You are damaging your grass seriously by bruising it instead of cutting it. I see more pliers and channel grips on many jobs. I think these should be filed under X and kept away from equipment. Use the proper tools in making repairs and adjustments. A sprinkler is a serious danger to a reel on a lawnmower, and can knock pieces out of it.

What's causing some of the wear on our machines? Let's be able to recognize what is happening instead of just adjusting something and thinking that is all there is to it. Consult your owner-operator manual. Keep gas, oil, and grease away from belts. Every manufacturer puts an adjustment on to compensate for the wear in the chain. Where I see a good maintenance program in

effect, I can usually pick the places to go. All factory men like to go to satisfied customers. Another headache of turf men is an operator running with a leaking gas line, and not noticing it until it is too late. Gas is a permanent way to get rid of grass.

Choosing the Proper Machine

Don't try and make one machine do all the work. I don't know of a machine that will do every kind of grass and weed cutting. Primarily, the rotary is made for cutting the roughs. It is a rugged unit and will stand a lot of guff. The old hand scyth sometimes has to be used. The gang mower should be used in the fairways. Some grass conditions are due to the soil. You men should be able to recognize these conditions, so let's look a little further than at just the mechanical side of problems.

Safety

1. Make sure that your operator knows the function of the mower.

2. Don't leave your machine parked with the starter rope tied to the handle when there might be children around. Children get hurt and hurt badly when they don't know a thing about this equipment.

3. Get off your machine when you are going to load it.

4. Stay clear of running machinery. Don't walk in front of it.

5. Don't try and make an adjustment when the operator has his foot on the clutch. It could very easily slip off.

THE TURF OF AN ENGLISHMAN

Arthur D. Elliott
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Seattle, Washington

I don't really have enough time to do justice to this or any subject, as I'm more or less a "ringer" filling in some open scheduled program time due to a cancellation.

However, I have accepted the privilege of saying a few words about a trip I took to England and Scotland this summer. While there, I called on a few golf course and park superintendents, and on the Moulton Agricultural Institute. I also called on Ransome, Simms and Jefferies, the largest mowing equipment manufacturers in England. Since I am a merchant, and not a turf agronomist, my visit was primarily for the purpose of discussing the use of turf equipment, both mowing and irrigating.

The best-looking turf I found in the parks -- more specifically, on the bowling greens. Some of these bowling greens were known to have been in the same location for over 300 years. Mowing these greens is done daily, mostly with 12 inch hand mowers. Compared with U.S. labor for this work, it is inexpensive, and many of the employees have followed their fathers who had followed their fathers -- working in the same parks and on the same golf courses.

Generally speaking, it seems to me that it is not practical to try to discuss intelligently the comparative uses of turf equipment without getting into the agronomy aspects of it. For instance, a discussion of the use of sprinklers and irrigation equipment soon brings up the subject of weather, soil porosity, types of grass seed, etc. The use of mowing and aerating equipment as opposed to rollers and compaction, soon again brings up the subject of worm casts, soil texture, and porosity and again the prevailing rates of precipitation, involving turf growth and frequency of mowing it.

The general consensus of opinion, however, was that England, generally speaking, has an excellent climate and soil condition for the growth of good turf, and lots of cheap labor for frequent mowing and lots of gentle rain for cheap irrigation. Despite all their advantages, I found that, except for greens, both golf course and bowling, our turf in the Pacific Northwest compared very favorably. While it seems to me that it has been the custom here in the Pacific Northwest to compare English turf with Pacific Northwest due to the similarity of weather and comparable latitude, the Englishmen hastened to point out to me when making this comparison that their soil was "older" and therefore much better and in this respect, at least, the similarity of conditions diluted by 50 per cent.

The golf course fairways and open park areas which I visited were poor pasture grass, and the roughs are really rough -- full of prickly Scotch broom tail weeds. A golf ball lost in this rough is really lost. Maybe that is the reason they are good golfers. They have to stay in the fairways or buy more golf balls. The greens were more prevalently bunkered than most of the golf courses of the Pacific Northwest.

The matter of cutting turf maintenance operating costs through the use of better equipment for the most part fell on deaf ears. This I attributed to the

fact that who would you fire; most of the men have spent their lives on this course or in this park and at their job and they know their job and do it well. "These economics might be all right for America but where not necessarily practical for economics in England" was a frequent comment.

All of this brings us to the point, I suppose, that English turf is a product of English soil and English weather and English turf men; and that Northwest turf, likewise is now and is going to continue to be a product of Northwest soil, Northwest weather, and Northwest turf men.

With this somewhat unlikely comparison as a basis, it would seem to me that continued support and growth of the Northwest Turf Association which we can use to compare notes, have seminars and exchange good ideas among ourselves, involving our own soil and our own weather and our own economic problems, is the most worthy contribution we can make to the continued improvement of the turf industry of this great and growing Pacific Northwest area.

FACTORS IN THE DESIGN AND MAINTENANCE OF PARK AND RECREATION AREAS

Harold T. Abbott
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From a casual reference to this subject, "Design and Maintenance," it is quite obvious that the many implications which such a topic presents cannot be adequately covered within the limited scope of this discussion. The many details governing the standards set forth for the proper design of sports facilities alone, including baseball diamonds, tennis courts, running tracks, or golf courses, might very well occupy our attention to the exclusion of all consideration of the equally important aspects of boulevard development, bridge approaches, arboretums, or rose gardens. Such details as are required in the play lot or the neighborhood playfield only your individual localities can dictate. Recommendations based on general research and experience are covered most adequately in George Butler's "New Recreation Areas." With such a volume and several free evenings, a very complete picture of the facts themselves, such as the size of this or that facility, the orientation, the fundamentals of good construction, and how to go about building a well-rounded recreation area, can be gained.

In the consideration of the design and maintenance of park and recreation areas, it is necessary to commence by assuring ourselves that we agree on the terms. For the sake of brevity, I shall assume that the differences, if any, which exist between the terms park and recreation have been sufficiently thrashed out in your respective cities. I shall assume that you have finally agreed that no issue exists. May I conclude also that the term area has been brought down to earth so that we can appreciate its true meaning, namely, "any plane surface, as of the floor of a room or church, or of the ground within an enclosure, or an open space in a building." That embraces a wide territory, and we have little difficulty in visualizing plenty of examples of AREA. On the other hand, we have another term which is now being used with extreme freedom and without too much serious thought. This word is used by park and recreation people about as loosely as is the phrase "juvenile delinquency." I refer to our use of the term "facility." According to Webster of dictionary famr, a facility is "that which promotes the ease of any action or course of conduct." It is just as simple as that; yet just stop to evaluate how great a scope it encompasses. Facilities are as varied as the interests of the people who use them. A lawn in a park, a lighted tennis court, a scenic overlook, a swimming pool, or a magnificent old tree affording welcome shade; all these are facilities. Their value as facilities depends upon our ability to appreciate and to demonstrate their proper use in providing recreation for the people. The merits of a facility are first judged by the principal use for which it was designed, and second by the ways in which it might serve other activities. It has been proved by experience that idleness or infrequent use results in ultimate abuse, neglect, and final abandonment. It seems that in almost every instance a facility which is not used either has no reason for existing, is unsafe, is improperly designed for its intended use, or proper direction for its use is lacking.

We have been informed that, regardless of circumstances, places, or persons, recreation is refreshment of body or mind. When it comes to the creation of such refreshment, we know that beauty of environment and physical

exercise must not be divorced. In the proper design of areas for physical competitive sports, experience has shown that the mere provision of the facility for the sport itself is not sufficient. Swings for small children, a soft ball diamond for teenagers, and tennis courts for adults have, in many cases, been neglected or abandoned wherever attractive surroundings have not been provided at the same time. The adjacent turf, shade trees, and planted windbreaks are as important adjuncts to the facility as the drinking fountain, rest rooms, or spectators' benches. The finest golf course in the country would be forever unpopular if only the fairways, tees, and greens were provided. The preservation of existing tree stands, or the planting of new trees, is essential not only to add interest to an otherwise monotonous course, but to provide background for the greens, to define the fairways, to accentuate variations in topography, or to provide needed shade for players on a hot day.

While we are on this subject of plant materials, the importance of turf in the design of any recreation area is essential to full enjoyment of that area. Turf, like all plants, has a definite purpose in the design, and the effectiveness of it is governed by a careful study and proper planning of the separate units of the design in relation to the whole scheme. All plant materials having been introduced for the interest in plants themselves must also perform definite functions as well. They are used for screening of unattractive features in the landscape; they serve to enframe distant views or possibly short vistas of architectural importance; they aid in separating one use area from another; and in combination they serve to create pleasant transitions between the horizontal and vertical lines of topography and architecture, respectively.

If we should turn back the pages in the history of recreation areas, we would find that many changes have taken place in the design of not only parks and playgrounds, but of cemeteries, school grounds, parkways, stadiums, public squares, and even golf courses. For the most part, the requirements are the same, the need is the same, but the manner of solving the problems has changed. If we were to examine the accounts of planners of the late 19th and early 20th centuries, we would see that much emphasis was placed on the creation of restricted play and a country atmosphere within the confines of heavy border plantings. The general layout of a park was a complex thing, with mass plantings of a great many species of plants; large expanses of turf were created to provide strolling areas for crowds who did not have a horse and buggy or one of the earlier horseless carriages. It was a time when large lawn areas were used for group activities carried on without the use of permanent facilities. It was a time when labor was cheap and plentiful with much time devoted to the maintenance of extensively planted grounds.

In 1893, Charles Eliot emphasized certain principles for the guidance of future park boards and the executives responsible for the creation of park systems.

"Municipal pleasure grounds," wrote Mr. Eliot, "comprise all such public open spaces as are acquired and arranged for the purpose of providing favorable opportunities for healthful recreation in the open air. As there are many modes and means of open-air recreation, so there are many kinds of public pleasure grounds. Agreeable and numerous open-air nurseries and playgrounds for small children present a more complex, but perhaps more necessary, type of public ground. Very few public open spaces suitably arranged for this special purpose are to be found in American cities. Playgrounds for youths are needed, but these may be further removed from the crowded parts of towns. Public flower gardens are sometimes provided; but

these are luxuries, and ought to be opened at the public expense only after the more essential kinds of public grounds have been secured. Promenades, concert grounds, outdoor halls, nurseries, playgrounds, gymnasia, and gardens may, of course, be combined with one another, as opportunity offers."

In specifying the manner in which such park systems should be administered, Eliot says, "The direction of park works may probably best rest with a small body of cultivated men, public-spirited enough to serve without pay, who should regard themselves, and be regarded, as a board of trustees, and who, as such, should make it their first duty to hand down unharmed from one generation to the next the treasure of scenery which the city has placed in their care."

In the day of Mr. Eliot the purpose of parks was, of course, the preservation of scenery in urban districts which were becoming rapidly and congestedly built up. There was a keen realization on the part of Mr. Eliot that proper environment was essential for effective recreational activity. He was aware that the youth of his day could not be happy and contented at play if that play couldn't be carried on in clean, attractive surroundings. The emphasis was placed on recreation in the open air regardless of whether it was swimming at the beach and playing baseball in the summer, or skating and tobogganing in winter. As far as adults were concerned, the working day was long, and there was little desire to participate in indoor recreation at the end of the day's exhausting labor.

Our early park boards had their beginnings as the result of public demand that the cities should not develop at the expense of the loss of beauty. Upon such boards were placed the immediate responsibility of holding in trust these fast-disappearing reservations, scenic features, waterways, ponds, lakes, vista points, bridge approaches, large tracts for athletic fields, sites for stadiums, swimming pools, golf courses, and, more recently, community buildings. The park was the all-inclusive area for recreation, and from the earliest times there was no thought on the part of such men as Mr. Eliot that there should be any segregation of agencies concerned with public pleasure grounds. At that time, most of the men qualified to administer public open spaces had been trained and had had experience primarily in horticulture. Men professionally trained to construct and administer public recreation areas were not available. The supervision of activities was left to volunteer social workers, teacher, or willing parents during spare time. Playgrounds were barren areas adjacent to school buildings where gravel playing surfaces were regarded as sufficient for average sports activities. Turf and trees were considered unessential luxuries in connection with the school playground. The park board then assumed the responsibility of providing large turf areas as a welcome relief from the hot pavements and dust, but due to problems of maintenance, certain areas were set aside for unrestricted use by the public while others were designated for purely esthetic purposes with the customary "Keep off the Grass" signs. The results of this practice was the ultimate setting up of separate commissions for parks and for recreation, with the attendant duplication of facilities and services. Fortunately, many of these differences in the aims of park and recreation interests have resulved themselves, and cities which have been operating with the appointed park boards appear to have weathered the storms of change most successfully.

In cities of Washington, such as Seattle and Spokane, planning was done many years ago to provide for the acquisition of lands for future park requirements. The first requisite was the development the guaranteed maintenance

of a park system which provided all phases of recreation as it was known in those days. The playground associations were unorganized, and in most instances were unable properly to administer and maintain the areas assigned to their use. The park boards assumed the responsibility for continuing the work of these groups. Standards for the location and specification of playgrounds in terms of the individual neighborhoods led to the placing of recreation units within close walking distance of every home. Along with such standards arose public demands for equal benefits at budget time for new facilities in accordance with the new national standards. Emphasis was placed on greater consideration of the youth, more and more personal attention to each child using the playground. There was more talk on the part of civic organizations to the effect that "our young people are being neglected," and "I didn't have these things when I was a kid, but I'll see to it my own kids have every opportunity." With the increase in leisure time, park boards were confronted by the demands for extended hours of park and playground operation, the demands for indoor programs during the winter and year round indoor night activities for our citizens of all ages. Organizations clambored for more and more supervision, at the same time making equally insistant requests for additional facilities, and a higher degree of maintenance.

Although it is desirable to acceed to the requests of enthusiastic groups, there is a limit to which the maintenance dollar can be stretched. The problems related to the maintenance and operation of parks are unique. The park executive is called upon to consider a greater number of details such as services, engineering, public relations, horticulture, aesthetics, cultural activities, muscle building sports, hydraulics, and finance than any other municipal department. The budgeted dollar is divided any number of ways from construction of a swimming pool, laying out of a parkway, planting trees, constructing lawns and gardens, to supervision of an athletic event, conducting a square dance, or protecting the public's interest in an incomplete land acquisition program. The budgeted dollar is now spread so thinly that the physical park setup is suffering. The demands on the part of pressure groups for increased services must be met in one of these ways, by additional revenue from appropriations, by income from fees and charges, or through bond issues to relieve the annual capital outlay budget. It is even possible that present increase in vandalism might be reduced if the public is obliged to support more directly through modest charges the facilities which they patronize.

Park boards have assumed added responsibilities as a result of the changes in the standards and specifications for facilities. Even our youngest participants are insisting on facilities which are regulation. Lighted fields which are not scientifically correct from the standpoint of the lighting engineer are the source of complaints from the baseball and softball leagues. The texture of the playing surface must satisfy the most discriminating tennis player when he enters a court, even if that court is furnished to him without charge, net and all. No ball game or other athletic events are enjoyable anymore unless the area is turfed and unless the watering has been done in sufficient advance of the game to assure a dry field. Even the most modest park area must be furnished with tables and benches for a picnic free of charge, and there must be accommodations for all. We are obliged to meet the changes in health requirements as they pertain to swimming pools, although many times we have not been permitted to accumulate a reserve fund to meet the evil day when modernization is urgent. The bond issue idea is excellent for schools or when the life of the park system is threatened, but otherwise we are urged to put off the inevitable under the pressure of alloting revenues for so-called "essential services." National athletic organizations change from year to year the dimensions of use areas, although this practice has been almost negligible in the last few years.

Moreover, with the tremendous pressure brought to bear to provide more and more playgrounds in our rapidly growing communities, there arises a doubt as to the average city's ability to develop and maintain recreation grounds adjacent to schools at the same rate as the development of the school structures themselves. Where a bond issue comparable to that of the schools is not available for playgrounds, there seems to be no real reason why the schools should not undertake the entire responsibility.

Far too little emphasis has been placed on the park board's continued responsibility to exercise jurisdiction over the street trees of the city. It falls to these boards to acquire for future development such areas as bridge approaches, river banks, scenic drives, properties outstanding for their rich soil conditions, properties suitable for future golf courses, for park drives and boulevards, and properties which should be held merely to prevent encroachment on established or proposed public improvements. We must clarify in the minds of the citizens, and particularly of city commissioners, the point that parks and recreation are not separate functions and that there must be a proper balance in the distribution of public funds for new development and for maintenance. This proper balance is stressed in the following words of Ralph Cornell, consultant to the Park and Recreation Department of Los Angeles:

"No city can say that it has too much park area. Changing conditions will determine how far we shall go in plans already made, but is definitely a problem of planning and all aspects of park planning should be considered equally.

"Do not destroy the urban balance. Overdevelopment of one member of the urban body at the expense of any other member is inviting most serious consequences. No area set aside for a definite purpose should be altered, abandoned or sacrificed in any way at the expense of the facility, use of purpose for which it was originally set aside.

"We are in an age demanding more and more the benefits of attractive surroundings and whether we are aware of it or not, the beautification of a playground is as necessary as the facilities provided therein. We will continue to have purely park areas as well as those for multiple use and they are all essential in the properly planned city."

We have a challange before us to preserve the park systems which have been designed to provide recreation for all ages. The park board today must decide whether the public funds shall be used to maintain established facilities or whether greater emphasis shall be placed on more facilities less adequately maintained in order to furnish at the same time ever increasing supervisory services. Shall the cities spend funds for those things which the people should provide for themselves?

As the Milwaukee Journal most correctly stated some years ago: When you fail to keep up your plant or make public improvements that are becoming necessary, you are borrowing against the future as surely as if you floated bonds or went out and negotiated a cash loan.

"A city run down to the point where its very existence is threatened is not debt-free even though it may not owe a dollar. It has mortgaged its future and has to meet that mortgage."

There is truly a great challenge to the stewards of public park systems. We must endeavor to search for ways in which the public may assume some of

the responsibilities now thrust upon our municipal agencies. Through the schools, our churches, our programs of outdoor education in the parks, the people of our communities must soon realize their responsibilities in the use and protection of public recreation facilities. If they do not assume their rightful share of cooperation in our municipal parks, I am sure that all too soon the statement of Annette Richards which appeared in the Reader's Digest, regarding the abuse of our national heritage in parks, will result in admission costs for all forms of recreation in the country. "Let's put an end to it!" says Miss Richards. "Americans can learn not only to improve their outdoor manners but to take pride in their recreation lands. They can learn to use and not abuse, to enjoy and not destroy. They can take to heart the forest-fire slogan: 'This is God's Country - Don't Make It Look Like Hell!'"

TECHNIQUES OF GROUND SPRAYING

George Mock
President, Washington Ground Sprayers

The need of spraying for control of insects, plant diseases, weeds, brush, or soil-borne organisms is a problem which confronts almost every person here. During this period of extreme rapid advancement, none of us can achieve the degree of proficiency we desire. Many of you here find yourselves in the position of needing to become good general practitioners in the field of applying chemicals and chemically treated materials. We are most fortunate to have within our State University, specialists who are constantly working on almost all phases of a number of our most difficult problems. The ever-increasing amount of co-operation among tesearch, extension, and the people who must use this new-found information must not be overlooked. Continuation of this fine program will lead to more satisfactory results for each of us in his own particular field. Test data are no more valuable than the organization's or individual's ability to use the proper techniques of application.

Let us attempt to discuss a near-normal year in a park, golf course, or cemetery. Before we evaluate the chemicals to be used and the method of their application, let us note that nothing takes the place of good cultural practices. By this we refer to (1) proper soil structure with adequate drainage; (2) selection of grasses and other plant materials suited to soil and climatic conditions; (3) irrigation requirements; (4) proper amounts of fertilizer; (5) the correct mowing, trimming, or pruning schedule as the case may be.

Proper spray equipment is necessary if good results are to be forthcoming. Separate units should be used for the application of weed materials. Only too often timing and rate of application are not carefully observed. Without a thorough and even application on the plant, tree, or turf area being treated, the finest chemical cannot do its job.

Let us begin with some of the controls that can be effected in the fall. In turf, weed control can be enacted very successfully at this time. For the control of broadleaf weeds and clover, the use of 2,4-D amine and some good wetting agent is recommended. If you have a buttercup problem, add MCP. Combinations of 2,4-D and 2,4,5-T amine will give good results on mouse-ear checkweed and ajuga. Endothal, a product of Penn Salt, is looking very good to us on Varonica. Treatment for weeds should be applied about the time when you would normally mow. Do not cut the grass first -- allow three to five days after spraying before you mow. Best results will be noted if spraying is done by the twice-over method. Reduce the recommended dosage by one-half and spray turf twice, using a 90 ft. spray pattern (north to south and then east to west).

In the event Fusarium in a problem for you at this time, Phenyl-mercury-acetate has been doing a good job for us. Crabgrass treatment is probably too late as most seed is ripe. Care must be taken to control crabgrass as it has made great inroads into our area in the last two seasons. Disodiummethol-arsenate does control (with some grass damage) in the post-emergence treatment (two to three sprays Fairy ring treatment appears to be limited to Methol Bromide. All other methods have shown very little results.

A general fall spray on ornamentals for control of sucking and chewing insects as well as a number of fungus diseases, is certainly in order. The spider mite population was slow to build up in western Washington this year. Counts on hemlock, spruce, juniper, and many other conifers indicate the need of a good acaricide. Aphis and the larva of many chewing insects are much in evidence. Combinations of an organic parathion phosphate and a DDT chlorinated hydrocarbon will control both types of insects. Adult weevil control will be satisfactory if generous amounts of this spray are applied to the ground as well as on the plants. Careful handling of systox can be an unparalleled aid in this type of work. Mildew, scab, arborvitae blight, corinium blight, and many other fungi should be treated at this time. Bulbs that are dug and stored should be protected from insects and disease. Those of you who have greenhouses or other types of indoor plantings should check them and enact necessary control measures. A great number of other topics could be noted for fall projects, but let us move now to the next season.

Winter in Washington will require slight variations in timing of some of our projects. Seasonal aspects and geographical location will dictate the month of your first fertilization, and if you are from western Washington, we would strongly recommend if you have moss that you try Ferrous Amonium Sulphate. Results of the past three years on turf we maintain indicate real value from this material on cement, grave markers, or border plants. Crabgrass pre-emergence sprays will be timely any time after our freezing weather is over. Do not overlook this portion of your spray program if you have observed crabgrass in any area of your turf at any time in the past.

Winter may allow the time to apply materials for growth control. The growing season usually is so packed with other pressing projects that few of us are putting to good use the advantages of some of our better soil sterilants. Simizan is a good one for gravel paths and gravel driveways (20 to 40 lbs. per acre). Simizan also is showing fine results as a weed and grass control in permanent plantings in which annuals are not being planted (4-8 lbs. per acre). Care should be taken to insure extremely close calibration and even distribution of this material.

If you have a brush or blackberry problem which has been on the border line because of the safety factor due to potential hazards of volitility, why not spray during the dormat season? 2,4,5-T and diesel oil used as a basel spray will do the job. Dormant spraying of trees, plants, shrubs, and hedges is basic. Need for control of the eggs of aphids, spider mites, and scale along with fungi, lichen, moss, and algae designate this as one of our most important control periods. Combinations of oil and fungicides are very practical. Peach leaf curl in Western Washington requires two sprays with a good fungicide before the leaf buds open. The extensive damage by apple scab this year to almost all of our ornamental crab trees indicates definite need for a carefully planned scab-control program. Some of you will prefer to apply a delayed-dormant spray. This is effective in most cases and in a few cases far more effective than a full-dormant application. Pine scale, juniper scale, camelia scale, spruce aphids, and some spider mites that emerge from the soil respond favorably.

Spring brings new life, and with it come slugs, bugs, cutworms, leaf minors, sod webworm, caterpillars, more weeds, and fungi. Our state is blessed with soils and climate allowing for the growth of numerous species of plant material. Each has its own specific problems, and it is our responsibility to know what they are and how best to treat them.

Cover sprays should be started as early as is practical. Care should be exercised in the preservation of insect and predator balance. Too little is being written on the practical aspects of this subject. In general, long-term controls have their drawbacks if they do not provide some safeguards against upsetting nature's balance. Spring sprays are the key to how serious many of your summer problems will be. Do not create the need for additional spraying by the use of ill-advised combinations of materials. Cost of materials are not a very large factor when we take a long-range look at the results. Control of leaf minors must be a preventative measure. Holly, lilacs, privit, and boxwood all require treatment. Although aphids are not too serious a problem in early spring, success of your over-all program depends on not allowing a major build-up to occur. We have as of the last year incorporated an araracide in all cover sprays with excellent results. The addition of this material helps us to prevent an unbalanced picture between predators and spider mites. Control of cut worms, weevil, and slugs can be accomplished simultaneously. Apply Aldrin or Toxaphene and Slug-Fest in an over-all ground application. Scab and mildew control are a must, and start before the infection is too deep-seated.

As we move on into the summer months, our program remains very similar. If turf sprays are being applied, try adding rather large amounts of surface-tension reducing agents. This will help to reduce the problem of getting water to penetrate evenly. Aphids will always become a serious pest by about the first week in June. Five years of fairly general use of systemic sprays for sucking insect control leads me to believe that the time has arrived when people such as yourselves can be readily assisted by the incorporation by systemic sprays in your program. Systox as a cover spray at the rate of one pint to 100 gallons of water will give aphid control for four to five weeks under most conditions and on most plants. Soil drenches are of practical value if extreme care is taken not to overdo them. Caution is the byword to anyone who toys with the idea of systemic injection. After three years on this type of work I suggest that until further research is done, <u>don't try to do any of it</u>!

As a closing word let me say, there is no substitute for good research work.

The need for proper techniques by the applicator has made ground spraying a practical science.

NEW TURFGRASS RESEARCH CENTER AT WESTERN WASHINGTON EXPERIMENT STATION

Roy L. Goss
Turf Specialist, Puyallup, Washington

A turfgrass research center was established at farm No. 5 of the Western Washington Experiment Station this summer. Much research can be accomplished on contributed or loaned areas by parks, golf courses, cemeteries, etc., but true research from the basic approach can only be accomplished under conditions where absolute control of the area can be maintained. Also, it is often the case where previous practices are not known or cannot be remembered in sufficient detail to be reliable for experimental work. And, perhaps one of the most important reasons for establishing this center is to have plenty of room at home which greatly reduces travel time between experimental areas. Actually, this alone will pay for the area in a very short time. And last, but not least in importance, is the possibility and probability in many cases that turf will be injured or killed due to certain treatments.

Since an irrigation system had to be installed, it was decided that an automatic system would be the most desirable unit as this will allow better water control and better utilization of the available irrigation water. Mr. Don Hogan, Civil Engineer, designed the system in accordance with the type of control that we wanted. This system is presently installed and is operating as planned.

An area covering 1 1/2 acres was designed to accommodate experiments on both lawn type and putting green turf. For the putting green area, Astoria (Colonial) bent was chosen to represent that type since that is the prevalent type in this area and because Penncross was too expensive for planting an area of 30,000 square feet. This was planted at the rate of 3 pounds per 1,000 square feet. The lawn area was seeded to a mixture of 2 pounds of creeping red fescue (Pennlawn variety) and 1 pound of Colonial bent.

Before planting the putting green area, it was sterilized with methyl bromide. This was accomplished in four days by using four tarps 20 feet x 100 feet. Only 1 pound of methyl bromide per 100 square feet was used since temperatures were ranging over 85°F. and soil moisture was adequate. Excellent results were achieved, and according to nematode counts made by Dr. Walter J. Apt, there were none living from samples down to one foot. The grasses were seeded on July 28, with the most appreciated help of several golf course superintendents (Henry Land, Sr. and Jr., Glen Proctor, Bernie Higgins, George Lawton, and John Jaslowski). In fact, 30,000 feet of putting turf was seeded, mulched with peatmoss, and rolled in two hours.

Irrigation and fertility experiments will be conducted for the first two-three years and possibly longer. Determination will be made on turf quality as it is affected by various fertility levels and sources of nutrients. Different amounts of irrigation water will be applied to four separately controlled areas. From this, some information will be gained as to the effect of frequency, rate, and amount of application on turf quality. The effect of irrigation on root development will also be studied, and correlations will be made between irrigation level, nutrient level, and root and top growth. Later, compaction studies will also be made.

A soil sterilization study is still in progress to determine the optimum rates and efficiency of methyl bromide, bapam, cyanamid, and mylone in the control of weeds prior to planting. These sterilants have been applied at the manufacturer's specifications, 1/2 rate, and double rate. All treatments have been replicated four times.

An area for a turf nursery has been set aside for selecting and propagating new or better adapted species, or selections for Pacific Northwest conditions. It is the belief of the writer that the best place to select turf grasses which are best adapted to the Northwest is under our own particular conditions.

With this point in mind, Johnny Harrison of the Hayden Lake Golf and Country Club sent in a plug (four inches in diameter) of a bent that was vigorous and had a very good texture. We then took plugs from vigorous bent strains on two of Milt Bauman's Overlake Golf and Country Club greens. Boyd Gourley sent in a bent and Poa selection from his Everett Club. With these three, we clonally divided and planted them in flats in the greenhouse last winter. The number of flats were increased by stolonizing, and at the present time, we have several hundred feet of stolons in production. Next spring, these stolons will be used for establishing turf plots for mowing to evaluate further the selections for quality, vigor, and disease resistance.

While these selections are being vegetatively propagated, a parallel line will be carried for seed production. If these selections will reproduce true to type by seed and set a good crop of seed, they should be well adapted for this region.

Many other experiments will be conducted on this farm as time goes on, but for the present, herbicide investigations will be confined to the areas where the problem exists, that is, on outlying areas.

TURFGRASS WEED CONTROL -- CURRENT RECOMMENDATIONS

John Gallagher - Agr. Chem. Div.
Amchem Products - Ambler, Pennsylvania

The total volume of turf grass weed-control information is large. In some instances, such as for crabgrass control, it could and does fill books. In others it is very limited -- perhaps a single observation of secondary nature. But taken in its entirety, we have available answers to many turf grass weed-control problems.

Availability and common usage often are several years apart. Those of us who work with weed-control chemicals often have three or more years' testing before the material becomes common knowledge to the ultimate consumer. What I plan to do here is to discuss the chemicals now being recommended for weed-control problems in turf. They may not all have reached the stage of common usage, but all have research work to support recommendations.

Phenoxy Compounds

Phenoxy compounds make up the basic chemical for broadleaf weed control. They are generally available as amine salts or esters and are formulated for spraying or spreading.

Certain cautions must be observed when using phenoxy compounds. Spray to avoid drift to desirable ornamentals, use half rates when treating bentgrass, and thoroughly clean spray equipment if it is to be used for other purposes than turf spraying. Phenoxy compounds are most efficiently sprayed with low volumes.

2,4-D

Weeds easily controlled at rates of 1/2 - 1 1/2 lb. acid equivalent per acre.

Dandelion (Taraxacum officinale), narrow leaf plantain (Plantago lanceolata), broad leaf plantain (Plantago major), self heal (Prunella vulgaris), ground ivy (Nepeta hederacea), and many other common regional broadleaf weeds.

Weeds hard to control require specific formulations or repeat treatments.

Wild garlic and onion - 2,4-D ester formulations. Eradication covers a three-season spray program. Knotweed (Polygonum aviculare), curled dock (Rumex crispus), and wild carrot (Daucus carota) require repeat treatment at three-week intervals.

2,4,5-T

Weeds easily controlled at rates of 1/2 - 1 lb./A

Most clover species, white dutch (Trifolium repens), hop clover (Trifolium procumbens), and black medic (Medicago lupulina).

Weeds hard to control require repeat treatments.

Oxalis (Oxalis stricta), young knotweed (Polygonum aviculare), and veronica species.

2,4,5-T Propionic

Weeds easily controlled at 1-1/2 lb. acid equivalent per acre.

Common chickweed (Stellaria media), field chickweed (Cerastium arvense), henbit (Lamium amplexicaule), spotted spurge (Euphorbia supina), oxalis (Oxalis stricta), and clover.

Weeds hard to control require at least two treatments at the 1-1/2 lb. per acre rate.

Yarrow (Achillea millefolium) and mouse-ear chickweed (Cerastium vulvatum).

For weeds other than spotted spurge make applications during the cooler seasons of the year.

Materials Other Than Phenoxy Compounds

Neburon

(1) For chickweed species and pearlwort, 4 lb. 50 per cent material per acre at temperatures no higher than 85°.

Endothal

Knotweed (Polygonum aviculare), veronica filiformis, poa annua - 1/2 - 2 lb. per acre. Spring application two applications may be needed.

Grass Killing Chemicals--Selective

Organic arsenicals - DMA - disodium monomethyl arsonate, AMA amine (dodecyl) methyl arsonate available as liquids, soluble powders and dry vermiculite formulations.

Weeds controlled--Pose-emergent applications.

Crabgrass (Digitaria sp.), witchgrass (Panicum capillare), barnyard grass (Echivochloa crusgall), foxtail (Setaria sp.), and dallis grass (Paspalum dilatatum). In most cases multiple applications at rates of 2.1 - 3.5 lb. for young plants. 7-10 lb. for mature and hard to kill species such as dallis grass. Treatment number and interval varies -- 2 - 3 at 5-7 day intervals most common.

Caution--Turfgrasses can be injured. Fineleaf fescue species extremely susceptible. Applications made at temperatures of 85° or higher will cause discoloration.

Phenyl mercuric acetate--PMA

For crabgrass and seteria species 0.75 lb./A or 5-7 pints of a 10 per

cent material. Three applications at seven-day intervals on seedling plants needed.

Contact Chemicals

Potassium cyanate, kocn, and sodium arsenite. Na Aa_2O_3. Contact killers relatively non-selective, producing burn on most turfgrasses. Control is achieved by repeat treatments on annual species.

Weeds controlled - Pre-emergent

Sam species except dallis grass

Arsenicals - Arsenic toxicity factor of 3-5 lb. metallic arsenic per 1,000 sq. ft. (2)

Calcium arsenate - 10 lb. 85 per cent or 12 lb. 73 per cent arsenic trioxide.

Lead arsenate - 24 lb./1,000 sq. ft.

The above materials prevent Poa annua vigor and survival. Fall to spring applications.

Chlordane

60-100 lb. technical per acre. Spring application most satisfactory. Vermiculite formulations show advantage.

Dow M-1329, 1481 and Diamond Alkali Chemical Company DAC 893 field tested this year show excellent control of Digitaria species with a high degree of selectivity.

Dow 1329 is a 2 lb./gallon liquid formulation, Dow 1481 is an per cent vermiculite formulation and DAC 893 is a wettable powder formulation.

Grass Killers - Non-selective

Dalapon - amino triazole, TCA - Specific chemicals for the nonselective removal of grasses around trees, sand traps, driveways, and other areas where complete kill of grasses is desired.

Dalapon - 10-20 lb./A

Amino triazole - 16-24 lb./A

TCA - 60-100 lb./A

The range of rates is given to cover different conditions of grass species and density.

Soil fumigants and short-term sterilants. Sometimes the best weed-control practice is to start fresh with a weed-free seed bed. The following materials will provide such a condition. Each has its advantages and disadvantages. The choice depends on the situation.

Vapam - 100 gallons/A

Methyl bromide - 435 lb./A (poison gas)

Mylone - 327 lb./A

Calcium cyanamid - 4,860 lb./A

This is a brief summary of the current turf grass weed-control picture; it is constantly changing at the research level. Now uses are being found for old chemicals, and solutions are being found for problem weeds.

PRODUCING BETTER TURFS

C. B. Wilson, Agronomist
Milwaukee Sewerage Commission

To produce better turf one must first understand the eight basic factors that govern plant growth. In fact, when the "big eight" are in balance one does not have better turf, he has perfect turf.

The first is the right grass suited to the local climate and weather. Obviously bermuda or zoysia has no place in the land of the northern lights. Conversely, cool-season grasses in the tropics are equally out of place except, perhaps, as an overseeding for winter cover. The point overlooked by the layman is the tremendous variation in weather in a restricted area. Dr. Keen, Kansas State University, tells us a plant transplanted from the north to the south side of a home in his zone can be the equivalent of a 500- to 600-mile journey due south!

Secondly, grass must have light to thrive. Kentucky blue grass and bermuda are good examples of sun-loving plants. Where shade is a factor, one's choice should be red or chewings fescue in drouthy soils, or Poa trivialis under moist, shaded conditions in cool, humid area. In the south, zoysias and St. Augustine are noted for their ability to do well under partial shade. If light is extremely limited, ground covers must be used instead of grass.

The third factor is favorable air temperature. This might be likened to the oppressive heat experienced in many metropolitan centers on a hot summer day as compared with the relative comfort of a suburb in the same area. On golf courses the trouble greens invariably lie in a pocketed area. Often, the clearing of underbrush and trees in the line of prevailing breezes will correct the bad condition becuase air movement lowers the temperature.

We have listed enough water as factor number four, although in this list each factor is as important as any other. None can stand by itself in attaining out goal of perfect turf. About 80 per cent of growing grass is water. It has been estimated that it takes 1,000 pounds of water to produce one pound of dry matter on a bent grass putting green. Yet most turf ills relate to the improper use of water. When the voids between soil particles are saturated with water, vital oxygen is exluded. Grass roots must have air as well as water. In fact, grass can wilt when standing in water. All of this emphasizes the importance of deep, infrequent watering. Frequent, shallow irrigations encourage disease, compaction, and weeds.

Factor number five is a favorable soil environment. To be truly productive, soils must be uniform and as deep as grass roots are capable of growing. Grass will grow on any textured soil. Excellent turf is maintained on the peats of Minnesota, the sands of Florida, and the adobe clays of California. Man errs in attempting but seldom succeeding in his efforts to modify soil. Topping an area composed of any of the aforementioned with two or three inches of garden loam before planting is a criminal practice in our opinion. Roots will be restricted during periods of stress because layers of any kind hamper drainage.

This does not mean to imply that clay, sand, or peat is a better medium for growing grass, or that modification is never necessary. Ideally, grass grows best on a medium sandy loam. When properly mixed it will contain about 50 per cent solids of which from 10 to 15 per cent is organic matter. This leaves 25 per cent for water storage and 25 per cent for air. Such a soil drains readily, yet still acts as a storehouse for needed plant food elements. On intensively used areas like putting greens and play fields every attempt should be made to approach this goal. Preferably, the ingredients of this soil should be mixed "off site" and allowed to compost or weather before use. Again it must be uniformly deep. Some may be satisfied with a rooting depth of one-foot. However, it is interesting to note that research at the University of California's Davis Campus indicates Kentucky blue grass is capable of sending out live roots to a depth of almost four feet. Bent and fescue will root to two feet, and bermuda feeds below six feet on uniform soil. This, by the way, is on turf plots mowed between 1/2 and 1-1/2 inches depending on the grass.

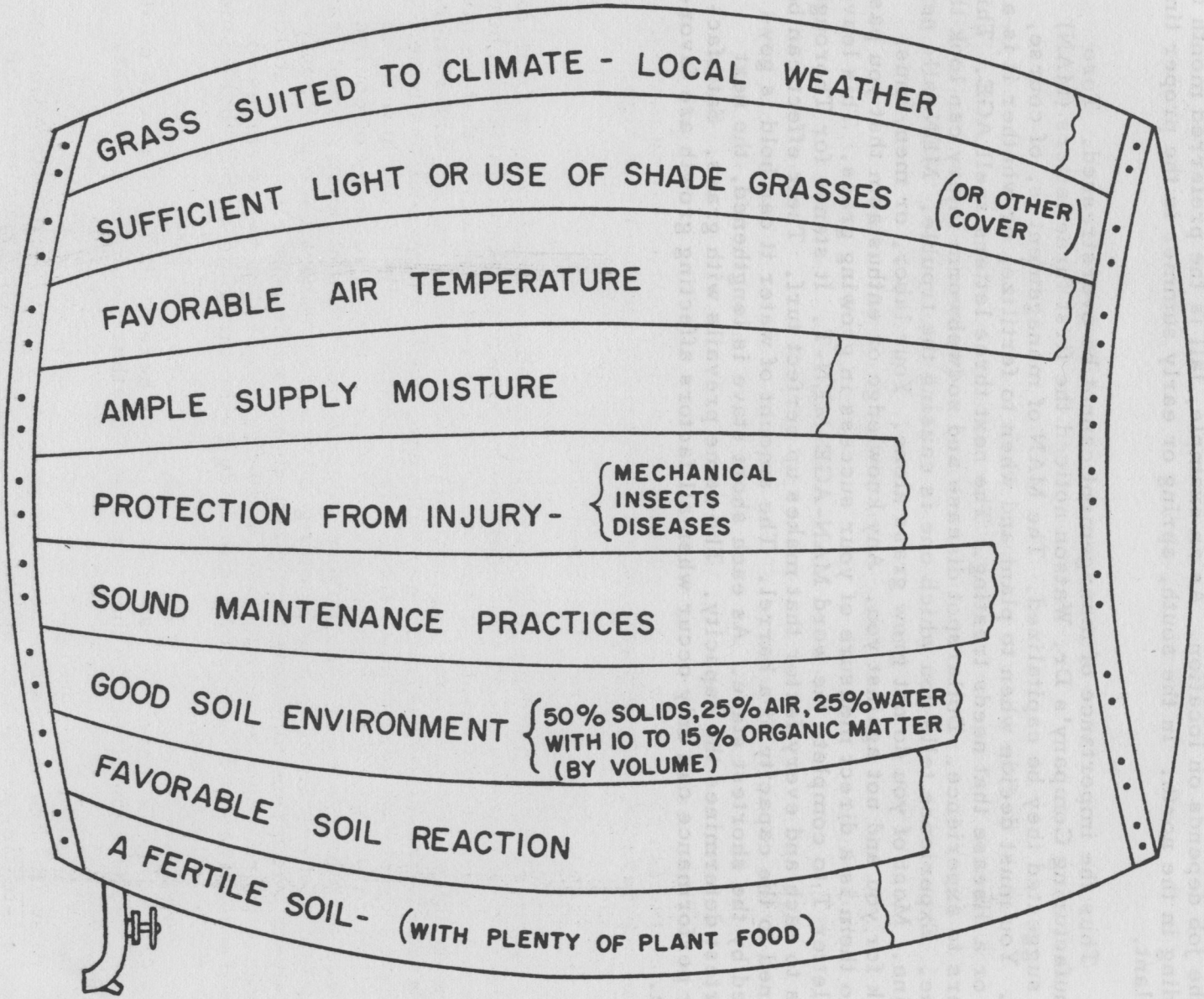
Number six is favorable soil reaction. Soils can be too acid or too alkalike to support good growth. A pH range of slightly acid 6.0 to slightly alkaline 7.5 (7.0 is neutral) is considered ideal by turf experts. The professional turf grower should have a soil analysis made periodically by a competent laboratory. Sampling depth should never vary (we specify exactly two inches), and the results must be interpreted by a turf authority to be meaningful. When soils are too acid, trace element toxicity can occur, and one lowers the efficiency of nitrogen use by the grass. Under alkaline conditions sodium, carbonates, and soluble sulphates and chlorides can prevent growth. Only a chemical soil analysis will provide this information along with corrective procedures.

The seventh factor is a fertile soil. Nitrogen is considered the key element in growing grass since it is required in greater amounts than any of the others. Actually, some 14 or 15 elements are needed. The plant manufactures three of these--carbon, hydrogen, and oxygen. The remainder must be supplied. Needs for phosphorus and potash are determined by soil analysis as are those for calcium and magnesium. Overlooked by some is the fact that turf requires as much sulphur as phosphorus. The so-called minor elements are present in most soils or are provided as a fringe benefit in a few of the natural organic fertilizers used. Iron is probably the most important minor element, although copper, zinc, molybdnum, manganese, and boron are also needed in trace amounts. Most of these are subject to "tie-ups" in the soil that make them unavailable to the plant. This is another reason to have soil tests made periodically, and adjust soil reaction to prevent this from happening.

Our final factor is protection from injury. Even the best-maintained turf is subject to attacks from insects and diseases, and an improperly adjusted mower can ruin excellent grass in a matter of hours. When idsease, or an insect, or traffic, or a poor mowing job thins out the turf, weeds invariably enter. Prevention, then, is the best approach to the protection from injury factor. There are several good fungicides and insecticides available, and the use of aeration tools to alleviate compaction is commonplace today. Mower manufacturers and their distributors furnish operating manuals with each piece of equipment. It is foolish when one doesn't follow their suggestions on equipment maintainance to the letter. And last but not least, when weeds invade there are many selective weed killers at your disposal.

In our "barrel diagram" we mention another factor--sound maintenance practices. Actually, this involves all of the others. The factors never change whether one lives in Alaska or Alabama. However, timing or knowing when to do the job depends on location. As an example, fall is the preferred month for seeding in the north. In the south, spring or early summer is the proper time to plant.

Thus the importance of management cannot be overstressed. Toro Manufacturing Company's Dr. Watson noticed the first three letters (MAN) and suggested they be capitalized. The MAN of management is, of course, you. You must decide when to plant and when to fertilize, or whether it is a bug or a disease that needs treating. The next three letters spell AGE. This refers to experience. Dollarspot disease and sodwebworm injury can look the same. Experience tells you which one is causing the trouble. MEN falls next in line. Most of you do not grow grass alone. Your labor, or men, must work for you and not against you. Any knowledge or enthusiasm that you pass on to them is a direct measure of your success in growing grass. This leaves the letter T to complete the word MAN-AGE-MEN-T. It stands for Thoroughness to each and every factor that makes up perfect turf. Their effect can be likened to the capacity of a barrel. The amount of water it can hold is governed by the shortest stave. As each short stave is lengthened, the next shortest determines the capacity. The same prevails with grass. Satisfactory performance can only occur when all factors affecting growth are favorable.


GRASS SUITED TO CLIMATE - LOCAL WEATHER
SUFFICIENT LIGHT OR USE OF SHADE GRASSES (OR OTHER COVER)
FAVORABLE AIR TEMPERATURE
AMPLE SUPPLY MOISTURE
PROTECTION FROM INJURY - MECHANICAL INSECTS DISEASES
SOUND MAINTENANCE PRACTICES
GOOD SOIL ENVIRONMENT 50% SOLIDS, 25% AIR, 25% WATER WITH 10 TO 15% ORGANIC MATTER (BY VOLUME)
FAVORABLE SOIL REACTION
A FERTILE SOIL - (WITH PLENTY OF PLANT FOOD)

SOIL TESTING PANEL

A. R. Halvorson, Moderator; Roy Goss, Henry Land Sr., and Sam Zook

Halvorson:

Question: Roy, you mentioned something Sam brought up this morning; were you referring to these other tests?

Answer: Yes, from other areas. There are quite a number of commercial laboratories, of course, or tests from other states, and I would like to point this out first that many of these commercial laboratories are doing a good job of testing, and I would like to state that if you get test results from a commercial laboratory and from us be careful in comparing them. I mean, for instance our tests reports may show 24 lbs. of phosphorus per acre and a commercial laboratory may show 125 lbs. That doesn't mean that one is wrong and one is right. There are many different soil-testing methods. The important thing is: compare to see if it is low, medium, or high. The numbers don't mean anything in themselves, only as they relate to the low, medium, or high level. I would like to stress that. I have had test results brought to me from a commercial laboratory, and this thing has come up. It is said that one tested 25 and another tested 160. I looked at the ratings, and fortunately both of us had rated them high but with different testing methods. Those numbers are only a means of rating them low, medium, or high.

Question: How are reports interpreted?

Answer: Well, our interpretations are based on actual results from experiments, of course. Roy is conducting experiments, Al and Patterson here have been conducting work for a number of years, and the ratings that we give on the results are based upon actual trials in the field. Roy, Al, and Patterson will take these results, and they will write the recommendations based on their experience with results from this research work. Now, how these other laboratories operate I do not know. That is their problem, of course, whether they have specialists or their salesmen do it I don't know. I will say this, that many of them do a perfectly good job of running a chemical analysis--their interpretation, how they do it, that is something else. You fellows may have more experience with that than I do. I feel it is better for us to have the services of Roy Goss or somebody in the turf field rather than somebody in the selling field.

Question: Is there any way that Roy Goss here at this college can do it the same as Oregon State, or they could get together and make their tests identical?

Answer: Norm, you can help me out on this, but Oregon State College has a soil-testing service about like ours. In some cases their tests are a little bit different, and I wouldn't worry about that. There are many different testing methods, and even if they use a different method it would evaluate the soil the same way that ours does. In other words, it would rate it low, medium, or high. The number may be 16 in the case of Oregon, and it might be 30 in our case. It doesn't make any difference. The important thing is the low, medium, or high.

Norm Goetze:

I think it is being done at the Central Station but please don't quote me on this. One change we might make is to run the soil samples through a turf specialist. This has been done at Purdue for about five or six years and has worked out very well.

In our station here Norm, Roy takes care of it on the west side, and Pat and Al take care of here on the east side. Standardizing laboratory techniques between the two states might be a little difficult. I believe Glen's question was that we could maintain a little harmony between the recommendations so that I'm not up here shouting one thing and you're not down there shouting another thing and we are at odds on it. I don't see how that could happen if we are basing our recommendations on soil-testing results. There are bound to be different recommendations in Washington and in Oregon because there are differences in nitrogen now, But next spring you could readily go at it and also if your phosphates are down or your potash is down go right ahead, in one case you might recommend 2 lbs. of potassium sulphate or 1-3/4 lbs. murate of potash applied at every two-week intervals. If I get a soil test from Al here and it says potash is very low, why I'd just as soon recommend to you that every time you put on nitrogen then to put on 3/4 lb. actual potash K_2O with each application of nitrogen so you can achieve balance, then we can taper off, and that is the way we recommend to you and that's the reason recommendation might vary from one person to another. We won't make possibly the same recommendations to anybody in all cases. It is based upon the need and the time of year the recommendation is being made.

Question: Are there any tests for some of the minor elements?

Answer: There are many factors that affect how well turf will do, and one of them is the fertility level in the soil, the balance of nutrients in the soil. But there are other factors that will affect this such as moisture, and before I get into that we want to turn that over to Roy. But we do run special little tests occasionally on problems on alkali. I've had some samples from Moses Lake, Pasco, Richland, and that area. A lot of these areas are high in alkali.

We test the soil to see if it has an alkali problem or if it is a salt problem which at times is hard to tell without a test. Then we also have the problem of arsenic. We get samples from the Wenatchee area, an old orchard area, and maybe somebody wants to put in a lawn. We can test for that and give the rating of low, medium, or high of the arsenic levels in the soil. We have had some samples in from these turf areas where arsenical weed killers have been used or the level was high enough so that nothing would grow. The soil was sterile, and believe me when you get a soil sterile from arsenic it is going to stay sterile for a long time. Arsenic does not move in the soil. It has fixed itself to the soil, and it is going to stay there.

There are these special tests. If you do run into problems and fertility is not the problem, there is a chance that it could be alkali, high salts, or occasionally we will run into these high arsenic soils. I mentioned that we test for phosphorus, potassium, calcium, and the only minor element we test for is boron. Later on I want to get into the reason we do not test for nitrogen and some of these other things. Roy, do you want to say anything at this point?

Roy:

Well, we run into quite a few of those problems that quite often you can have a disease condition that tends to indicate a fertility condition. You're getting very poor growth on your grasses, and, of course, it could be disease in some cases. Other times you could have dry spots, you could have clay spots, and pockets, organic layers, almost anything if you have an organic area. You know in lawn construction many people are putting in great amounts of sawdust. Well, there is a case where those things are going to have to be straightened out over time. Anyone is going to have a problem on his hands for quite a long time. He is doing a real good job of handling it. Incidentally, he realizes it, and therefore he's treating for it. But we have all of this organic matter in the soil, but you can have a deficiency appearing and have a reason for it if you get in there and find out. I get all sorts of calls on "I have a disease on this grass." You can't tell what it is on the phone. The only way you can tell is by going to look. You waste about four hours looking and find that there is a big sawdust pocket. Sure enough, it was just as dry as a bone. I think a person should know their area well, and you could much more intelligently tell what you were after.

That's right, Roy. I wanted that to be brought out very clearly, because we have had on occasion people who wonder why their soil test shows high. I'm sure it is a fertility problem, but it can be some of these other problems.

I wanted to mention at this point, too, some of the tests we do not run. The first one is nitrogen. Why don't we run a test for nitrogen? Let's suppose you irrigate your area thoroughly today, and you take the soil sample tonight or tomorrow morning. The available source of nitrogen is very soluble. You put on water, and it moves it right down so that when you take your sample the nitrogen may be just below where you sampled. The other thing is that you test the soil even if you don't do so right after an irrigation. You take a sample and test it, and you find very little nitrogen in the soil. Yet your turf may be doing perfectly well. There may be an adequate supply of nitrogen for that plant. The reason for that is that the source of nitrogen in the soil is from organic matter other than fertilizer. Organic matter liberates nitrogen as it rots.

Sam Zook:

I had soil samples taken last year. In the sample it showed a low pH, and I would hate to quote the exact pH because I am not positive. The recommendations were for an application of a ton and a half of lime to the acre so first I aerified and then applied, and whether it's true or not, I feel that I got some benefit out of it.

Roy:

Well, I think if there is some information on that it would be well to bring out.

Al:

We do know that lime moves very, very slowly. It is very highly insoluble, more or less. If you don't place it where the plant can get it, you are apt to wait 20 years, as Charlie says, for it to get there. It's folly to do any construction without knowing the nutrient level of the soil that you are using.

For example, if you are building your own lawn, any landscaper that doesn't know something about the soil he is working with (the pH level, the phosphorus-potassium levels) then he is in a pretty poor position because he is doing no more than guessing as to what he needs. If it is low in pH then he wants to raise it up a bit so he can incorporate this to the depth that he is working. If it is on established turf there is only one way you can get it down and that is by aerifying first and then attempting to get as much of it down the aerifying holes as possible. It isn't too hard to distribute it two to three inches deep.

Al:

I would like to bring out an important point here in connection with soil testing in testing for lime. In this case, Sam, if you took a soil sample next year and wanted to have that checked for lime you can see the problems you might run into. You might pick up a sample of soil and pick up a chunk of lime in the sample. That would come into the laboratory and be ground up and would bring the pH up, whereas the pH in the total soil might not be that high. So this relates to what I said about the information sheet. If you state on the information sheet that this was limed last year, we will watch and be careful to see that there are no lime chunks in this soil.

Henry, you've had some experience with soil testing. Do you have anything you would like to tell about how you got the sample and how it worked out for you and how long did you have to wait for the test results?

Henry:

It took about one month, and I received it back with a full report from Roy.

COMPARATIVE PERFORMANCES OF BLUEGRASSES FOR TURF PURPOSES

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Some years ago, the Plant Materials Center planted some bluegrass received from an introduction tracing back to seed received in 1934 from Denmark. After growing and replanting from seed through four generations, a space planting was made in 1952. In this space planting, there were several dwarf or short-type bluegrasses. During a tour of the various plantings and research plots, J. K. Patterson, A. G. Law, and John Schwendiman selected four of these plants for consideration as a turf grass. Richard Adlard saved seed from these plants, and a space planting was made adjoining some space-planted merion bluegrass.

These plants showed several desirable characteristics. They greened up somewhat earlier than the Merion bluegrass, remained green later into the summer (these were dry-land plantings and soil moisture was depleted by mid-July), and were almost entirely free of powdery mildew that attacked all of the Merion plants. Seed was harvested from these plantings and designated by the numbers 105, 205, 402, and 602 to keep the four original plants separate. This seed was used for turf trials at Pullman, and seed was also sent to other research people around the United States (Ohio, Indiana, Kansas, Oregon, Maryland); some to British Columbia, Canada; and to other research workers in our own state.

Research plots at Pullman proved that all strains 105, 205, 402, and 602 could "take" the clipping treatments required of a turf grass. Clippings were made once each week to the 1/2-inch height and to the one-inch height by Roy Goss, as a part of his research. These strains also proved to have excellent turf quality; they maintained an excellent, dark-green color, were low growing, and gave almost a complete ground cover. In 1958, when we had one of the warmest summers on record, leaf rust attacked many of our bluegrass. These strains suffered to some extent, but much less so than did Merion bluegrass and somewhat more so than the Newport bluegrass. Other tests in Indiana, Oregon, and Canada supported evidence of this and other diseases resistance.

Table 1. Performance of Bluegrass at Wooster, Ohio - (R. R. Davis)

Variety	Seedling/sq. ft. inch Oct. 1956	Weeds/sq.ft. Sept. 1957	Weeds/sq.ft. Oct. 1958	Helminthosporium Leaf Spot **
P.N.W.*	1.4	7.1	1.0	2.8
Merion	2.4	2.6	0.8	1.0
Park	3.2	5.0	2.8	5.5
Delta	2.1	8.4	4.3	4.2
Penn (K1)*	1.7	5.3	0.4	1.0
Minn Common	4.6	4.8	3.0	8.8
Iowa Common	2.2	7.5	5.5	6.0
LSD. 05	1.3	2.3	2.1	1.8

* Seeded at 1/2 lb/1000 sq. ft. (rest seeded at 1 lb./1000 sq. ft.)
** 1 = least disease. 9 = most disease.

In spite of a lower seeding rate, P.N.W. shows excellent establishment in 1956 and good resistance to weed invasion by the fall of 1958.

P.N.W. shows some less resistance to Helminthosporium than Merion and Penn (K1) but significantly more resistance to this disease than the other common bluegrass.

W.E.P. Davis at Agassiz, British Columbia, Canada, makes this statement concerning the bluegrasses under his conditions. "Merion and P.N.W. are difficult to separate on the basis of their response to conditions at Agassiz. Newport has only been tested this season. It appears to be more open and less resistant to weed invasion than Merion.

"Merion, P.N.W., and Newport are all susceptible to rust, close clipping reduces the infection, they have a very high demand for nutrients. This type of bluegrass is rated highly here."

J. M. Duich at Penn State University makes this statement concerning bluegrasses under test in Pennsylvania. "We have had Newport under test since 1954 and were quite pleased until the last two years. The displeasure is due to susceptibility to leafspot (Helminthosporium vagans). Also, under cool spring conditions it makes seed heads and the turf becomes stemmy for several weeks. We still rate it appreciable better than Delta, Park and Arboretum under our northeast conditions. We definitely feel that it rates above common Kentucky and above the named strains but not superior to Merion."

Tests on seedling vigor were run since one of the problems in turf is in its establishment. (Merion is notorious as a "weak sister" in this respect.) In all of our green house and field trials, these strains were outstanding in seedling vigor. We even treated some of these seeds with Gibberellin (a growth stimulator) to see what might happen. The new grass showed some response. Merion, however, responded much more, but still did not grow as fast or as well as the new strains under test.

Table 2. Bluegrass Emergence Test

RATE OF EMERGENCE
50 Seeds after 1 week, 1957

	0 trt.	Gibberellic Treated
402	30	37
602	28	37
205	34	36
Merion	11	19

P.N.W. seems to have its own built-in growth stimulator and doesn't need assistance from gibberellic acid to exhibit its vigor.

Grass seed trials are now under way at Pullman, Prosser, and Corvallis, Oregon. The P.N.W. strain outyielded other bluegrasses at Corvallis

last year but was below Merion and Delta bluegrass at Pullman. (Present indications would indicate that all seed yields will be higher in 1959 especially for the P.N.W. strain.)

Table 3. Seed Yield Bluegrass 1958 (Pound per acre)

Variety	Oregon 1958*	Washington	% shatter after 7 day Wash.
Merion	220	346	47
Troy	275	---	
Park	243	---	
PNW	294	211	6
Newport	265	---	
Delta	198	464	27
Common	237	---	
LSD. 05	77	66	
CV %	21	10	

* P.N.W. and Newport were practically free of rust while the others were heavily infested. (P.N.W. showed only a trace of leaf rust at Pullman. Delta and Merion were severely infested.)

H. H. Rampton makes these remarks concerning seed yield of bluegrasses in 1959. "Yields of our bluegrass varieties are low this year. We have had a tremendous infestation of stripe rust (Puccinia Striiformis) and it has really knocked the yield of bluegrass seed in the Willamette valley. The later maturing varieties such as Merion and P.N.W. may not have been so severely damaged as were the early varieties, but all were hit hard." Merion has been one of the most susceptible of the bluegrasses to stripe smut in the eastern United States. This Smut (Ustilago Striiformus) reduced Merion by 32 per cent in a mixture with red fescue during a one-year period and thinned stands of turf planted to Merion only.

Seed yields will be secured at Prosser for the first time this year. One new bit of information on seed habit was discovered, however; the P.N.W. strain withstands seed shattering very well, in fact it's one of the best of the grasses in this respect. It held its seed about one month after ripening.

The seed characteristics are somewhat different than the other bluegrasses; they are about 20 per cent larger and have much less of the fuzz or silks at the base. This makes the seed easier to thresh and mill, which should be of benefit to the seed grower and processor

One of the problems encountered in handling some of the bluegrasses is the difficulty of getting proper germination within the first few months after harvest (the seeds seem to have a definite dormancy period). Seed of three of the new strains along with Merion, Delta, and Newport bluegrass was secured

from plantings at Pullman in 1958. Official germination tests were run, at the seed laboratory at Pullman, beginning in August until the present time (28-day testing period for each test). Please note the results:

Table 4. Germination of Bluegrass Varieties

	Test ending on: Sept. 15	Oct. 12	Nov. 11	Dec. 10	Jan. 6	May 5	June 12	July 23	Av.
205	72	77	67	86	91	83	81	87	81
402	72	79	86	84	88	79	83	87	82
602	72	86	81	82	88	78	86	89	83
Merion	3	5	2	3	1	14	31	55	15
Delta	23	32	35	29	29	35	4	59	31
Newport	1	0	0	0	0	1	0	24	3

The P.N.W. strains germinated quite readily immediately after harvest, but the other varieties did not begin to break dormancy until almost 10 months after harvest -- much after the normal turf-grass use time of March and April of the spring following harvest.

In an effort to break the dormancy, the seed was placed in cold storage for seven days; this definitely helped Merion, Newport, and Delta. In three tests, February 6, March 13, and April 17, Delta averaged 51 per cent germination, Newport 37 per cent, and Merion 23 per cent. This was appreciable above their performance without the cold storage treatment, but hardly satisfactory. The new strains were not changed or improved in germination by the cold treatment.

It is interesting to note that regardless of treatment, the new selections started off germinating well shortly after harvest and were performing better than the other varieties into the spring and summer of 1959.