WEEDS IN LAWNS AND PLAYING AREAS

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In pastoral farming, agriculture and cropping and in orcharding and market gardening we have many plants which are always weeds regardless of where they grow, but in turf culture or lawns, every plant, other than say four or five grasses, is a weed. Almost invariably we can recognise only two grasses at a time as being the desirable ones. Under another set of conditions, one additional species, (i.e., three altogether) may be regarded as valuable, but seldom could we consider a fourth as anything but a weed. Let this be explained this way. Normally, in most parts of New Zealand we require only two grasses, browntop and Chewing's fescue, to produce a good lawn. Where soil conditions are moister than those needed to maintain a dense turf of browntop and Chewing's fescue, we could perhaps improve the density of the lawn by including creeping bent. Should the soil be rather wet for long periods, it is almost certain that Chewing's fescue will gradually weaken and be replaced by creeping bent, thus giving a turf composed almost entirely of browntop and creeping bent. Now consider those habitats which are nearly too dry for browntop, and we find that Chewing's fescue will dominate the browntop and that the species known as "dryland" browntop will combine with the Chewing's fescue and together these two will be the main constituents of the turf. The browntop will persist and may make good growth in wet seasons, but under dry conditions it may disappear altogether. Then if we have still drier conditions, and especially if they are in warm districts, we expect Indian doubt to combine with Chewing's fescue so that these two become the dominant species or perhaps the only ones if "dryland" browntop has not been established also.

In Northern districts or places where temperatures are favourable to Paspalum, this grass often completely smothers browntop and Chewing's fescue, although not infrequently we have a combination of the three and sometimes Indian doubt as well. It is difficult to maintain a good fine-textured and dense lawn in districts where Paspalum grows easily, and usually it is regarded as a weed. There are places, however, where it simply takes charge and it is treated in such a manner as is appropriate to make a satisfactory turf of it.

One must not forget to mention too, that there are special types of lawns, for instance, the Buffalo grass lawns on sandy soils at the seaside. Also Kikuyu is being used quite extensively in similar habitats these days because it has a more pleasing colour and appearance than Buffalo grass. Both these grasses have been seen growing together and at times Indian doubt also combines with them.

Despite the extremely wide ranges of conditions under which lawns are maintained, it is surprising how simple it is to restrict the number of species to the two or three which provide the kind of turf which is wanted. Any plant other than the required grasses is therefore a weed in the eyes of the greenkeeper. It is obvious to everyone that, in the variety of places where lawns and sports greens are required, there must be very favourable conditions for the growth of numerous plants other than the two or three species of grass which the greenkeeper tries to cultivate.

We come, therefore, to the conclusion that every plant except the few chosen grasses is a lawn weed. Clovers and ryegrass, which constitute some of our best pastures, are weeds in lawns and playing greens, but for some sports fields, especially for football and hockey, both of these species are very useful.

Apart from any grasses which are weeds of lawns, there are three main groups which the greenkeeper must consider. Firstly, there are the annual weeds, many of which establish in new lawns, but rarely establish in old lawns. Some examples of these are sow thistle (*Sonchus* spp); chickweed (*Stellaria media*); hogcress (*Coronopus didymus*); small soldiers

button (*Cotula australis*). Secondly, we have the group which we call rosette weeds, and amongst these there are also some annuals and biennials. Rosette weeds are those which usually have wide leaves radiating from a central crown, although some species have segmented leaves. Several rosette weeds have a strong tap root, but others have mainly a fibrous root system. Common and well-known examples are dandelion (*Taraxacum officinalis*); catsear (*Hypochaeris radicata*); ribgrass (*Plantago lanceolata*); storksbill (*Erodium cicutarium*) and (*E. moschatum*). Thirdly, there are mat weeds which invariably creep across the surface and smother the turf grasses. Under this heading one might also include the numerous species of moss which are found in lawns. Common examples of mat weeds are pearlwort (*Sagina procumbens*); white clover (*Trifolium repens*); creeping chickweed (*Cerastium caespitosium*); selfheal (*Prunella vulgaris*); pennyroyal (*Mentha pulegium*).

It might be wondered why so many of the common weeds of pastures and arable land are not frequent invaders of lawns and sports greens. Similarly, one may wonder why some weeds are more prevalent in lawns than in pastures, but it is to be remembered that nearly all lawns are subjected to a type of management quite foreign to pastures. This management is that of mowing with the ordinary rotary mower. In pastures the grazing animals, particularly sheep, are very selective, i.e., they graze the foliage which is palatable to them and avoid the unpalatable. Sheep can graze close down to the crown of the plant and are able to completely defoliate many weeds which survive under mowing conditions in lawns. On the other hand, by virtue of the close cutting of the rotary mower, some weeds are severely pruned, and cannot attain the necessary height for their survival and they ultimately die out. This is quite an important point when considering lawn weeds as distinct from those found in pastures. Through this control of certain weeds, however, we create a set of conditions which is particularly favourable to others and to some extent not so favourable to grass as we sometimes think it might be. For instance, there are those weeds which have been specifically mentioned earlier, that cannot stand close defoliation, but which under normal cutting heights of the rotary mower are not severely pruned and are thus able to remain strong and vigorous. In the course of spreading laterally (as they do) they create a rather drastic smother on the grass plants and thereby inhibit the natural tillering process of the latter. It is this tillering which should be encouraged by allowing a certain amount of light into the crown of the plant so that it will spread slowly to mingle with the adjoining plants and form a dense turf. It will be realised that although turf grasses are tolerant of regular close defoliation, they are to some extent weakened by being mown as closely as is usual on bowling greens and golf greens. Such close mowing must of necessity deprive the plants of the very necessary leaf growth, and without this, carbon fixation and plant metabolism is impaired. To some extent, therefore, close mowing is not in the best interests of the turf grasses, but it definitely favours those weeds which have flat prostrate leaves and are not unduly pruned by the mower.

Perhaps this will explain why it is that the weed problem in lawns and sports greens is a real one which cannot be overcome except by employing still more artificial methods of maintaining the turf. Actually the growing of grass under turf conditions is quite artificial because normally grass plants make tall growth at some season and not infrequently do they attempt to run to seed. By preventing this from occurring, man creates some rather hard conditions for grass growth, but fortunately a few species are capable of existing under these treatments.

Up to now, I have dealt primarily with the main ecological reasons that affect grass and weed growth in lawns, but there are a few other factors which must be considered. For instance, just as the moisture factor determines very largely which grasses will become the dominants, so it is the moisture content of the soil which influences the types of weeds that will be present. Some weeds are tolerant of high temperatures but rarely grow in cold regions, while the reverse is the case with other weeds.

SOIL ACIDITY AND SOIL FERTILITY: Perhaps the greatest factors affecting the grass and weed population on a sports green or lawn are the fertility of the soil and its degree of acidity. It so happens that all the best turf grasses do not require highly fertile soil;

in fact, a soil of relatively low fertility seems more favourable to them. This might be instanced by the fact that Chewings fescue, browntop, dryland browntop and Indian doud, are grown for seed on land which is regarded as being of a very low standard for pastures and stock grazing. It is important, therefore, to have soil which is of a low fertility standard if good turf is to be produced. Highly fertile soils will grow a wide variety of grasses, clovers and weeds, but the lower the fertility up to a point, the more restricted will be the number of species which can thrive.

The amount of moisture in a soil is important too because soils containing all the necessary plants foods are barren if they are absolutely dry. However, under average conditions in New Zealand there is usually enough moisture to maintain turf grasses. Coming back to the soil fertility factor though, we must realise that soils suitable for high producing pastures are not by any means suitable for dense, fine texture and weed-free lawns. Only too often has the fertility of a soil on a bowling green or golf green been raised to too high a level for turf grasses, with the result that weeds, clovers and mosses have been encouraged.

We must realise that while a certain standard of fertility is necessary, that standard is really very low compared with what we want on farm lands and in gardens. From a good lawn free from weed and clover the total weight of grass clippings removed annually is low in relation to what would be removed by regularly mowing a highly productive sheep or cow pasture or by taking hay or ensilage crops. The loss of plant food by its removal in clippings from a lawn is not high nor is the removal of plant food from a good pasture very high either, because animals grazing that pasture return a large percentage of plant food to the sward in their dung and urine.

Whereas the grazing animal returns a large amount of nitrogen, especially if the pasture contains a good proportion of clover, there is a big nitrogen loss from a lawn in relation to the total amount of clippings removed. It is the nitrogen then that is one of the first plant foods to become deficient in most lawns. A small amount of phosphate, calcium and potash is lost also.

Experience from research and practice has proven beyond doubt that it is important to maintain the nitrogen status of lawns at a high level and to do this it obviously is necessary to apply nitrogenous fertilisers fairly liberally. Our choice of nitrogenous fertilisers is rather restricted and in general we have only sulphate of ammonia, nitrate of soda or dried blood to choose from. Sulphate of ammonia acidifies a soil, nitrate of soda reduces acidity and dried blood appears to have no effect whatsoever in this respect.

We must consider then the effects that these fertilisers have on the soil and how this in turn may affect the turf. To maintain a good pasture with a high proportion of clover we aim at getting the soil to a "sweet" state, that is, it will be only mildly acid, but for lawns we deliberately create strongly acid conditions. This is done for two reasons - (a) turf grasses grow quite well on acid soils and yet the rate of growth is not particularly rapid (b) most weeds, clovers and coarse grasses do not thrive on acid soils.

Up to a point this all seems very simple, we apply sulphate of ammonia to feed the grasses with nitrogen and at the same time we acidify the soil and suppress or control most of the plants we do not want. And apart from the need to supply a little phosphate from time to time, the process of producing and maintaining a good weed-free lawn appears to be easy. Unfortunately however, this is not so. Therefore, before dealing with some of the other complexities I should explain one of the theories underlying the acid theory of weed control. The theory is that when a soil is acidified beyond a certain degree, there will be little or no bacterial activity, and therefore ammoniacal nitrogen will not be converted to nitrate nitrogen because this action is dependent on soil bacteria. Furthermore, plants which belong to the grass family can take up their entire nitrogen requirement in ammoniacal form, whereas practically all other plants require their nitrogen in nitrate form. If, therefore, the soil is fairly acid and

there is little or no nitrate nitrogen produced, the plants must take up their nitrogen in ammoniacal form. Grasses store their carbohydrate as sugars, while most other plants store their carbohydrate as starch. After absorption by the plant the ammonia interacts with sugars in the grasses and is beneficial, but it does not interact with starch, and therefore it accumulates in the cell structure of plants other than grasses and so becomes toxic to them.

This theory fits in very well with actual practice; therefore, if we apply sulphate of ammonia we acidify the soil and supply nitrogen in a form suitable to grasses but toxic to weeds and clovers. If nitrate of soda is applied not only is soil acidity reduced but the nitrate nitrogen is immediately available to both grasses and weeds. Lime reduces soil acidity also, as we all know, and this in turn favours bacterial activity and so enables ammonia to be converted to a form which is non-toxic to weeds. That is one of the main reasons why lime is not applied to lawns unless abnormal soil conditions exist. Sulphate of ammonia also has a toxic or burning action on the foliage of weeds and clovers but is almost harmless to the grass leaves unless it is applied at exceptionally heavy rates. This "contact" burn of weed leaves is quite important in greenkeeping. In sulphate of ammonia then we have a very useful substance, it provides nitrogen to the grasses, acidifies the soil and kills weeds and clovers through an internal process as well as by the external burn. To add still greater toxic properties to sulphate of ammonia we sometimes recommend the addition of some sulphate of iron, (about 1 part of iron to 3 of ammonia) especially when dealing with moss.

A better idea of the value of sulphate of ammonia as a fertiliser for lawns will be gained if we study the following table which shows the results of some phases of our research. We see in this that the three plots on which sulphate of ammonia is used have a fairly acid soil and that the soils of the "control" plot and those which get lime and nitrate of soda respectively are about neutral. The percentage of turf grasses is high and the weed and clover content is low under acid conditions, but is the reverse on nearly neutral soils. (For Table - see p. 65 following)

The total weight of clippings removed rises from 7,233 lbs. per acre on the most acid plot to 25,358 lbs. on the lime plot, and to 27,658 lbs. per acre on the nitrate of soda plot. The total dry matter removed is important also because it is in this that the plant foods are taken from the soil. One might ask, however, why does it matter if we apply fertilisers that stimulate weeds as well as grasses provided we can control weeds by spraying them with some effective weedicide? The greenkeeper can answer this by asking "Why mow a green three times a week instead of only once?" There is another important factor too, and that is that worm casting on the non-acid plots is heavy; there are no worms on the very acid plots. Where worms are active they keep the surface of the soil in a rather loose-textured or unconsolidated condition and this, together with the opening of the turf through worm casts smothering the grasses, leads to the establishment of weeds. As a rule weeds and clovers rarely establish in a dense turf.

It would seem from these conclusions and remarks that there should be no weed problem on lawns and greens because if sulphate of ammonia is used properly it will stimulate grass growth and at the same time control weeds, clovers and worms. Actually this is fairly true in most instances, but there are always those exceptions, and in greenkeeping they are numerous. For instance the turf of both golf and bowling greens, and tennis courts especially, is damaged and worn out during the season of play. Droughts cause a weakness of the turf, and invasion by grass grub and porina invariably leads to an openness in the turf which is most favourable to the establishment of weeds. Despite all the good manurial treatments which a green receives, weed control by some chemical process seems imperative at some time or other. It is almost certain that some weed seeds will get into a green sooner or later, and then all they require is a short period of favourable conditions and they will establish quite readily.

SUMMARY OF HOKOTHEE PLOTS UNDER HERBAGE WEIGHT TRIAL (Pilot Trial Only)

March 49/50 - Twelve Months Production.

PLOT	P.H	(Point Analysis - Hits per 100 Points)				FERTILISER TREATMENTS *	GREEN WGT. LBS.	AVERAGE	
		TURF GRASSES	OTHER GRASSES	CLOVERS	WEEDS			% D.M.	D.M. LBS.
2	4.47	94	1	2	4	S/A 6 cwt.	7,233.2	31	2,333.3
8	4.55	88	3	9	TR.	S/A 6. P ₄ . S/I 2.	12,849.2	30.5	3,919
6	6.43	48	4	11	34	Control	9,911.2	30	2,973.3 +
26	6.96	52	2	89	7	P ₄ . K ₄ . Ca. 20	25,358.4	26.5	6,720 +
31	6.77	44	8	41	6	P ₄ . K ₄ . N/S 8	27,658.8	25.7	7,108.3 +
32	4.76	98	TR.	2	TR.	S/A 6 P ₄ . K ₄ .	12,225.2	32.3	3,948.7

* S/A = Sulphate of ammonia.
P = Superphosphate.
K = Potash.
Ca = Lime.
N/S = Nitrate of soda.
S/I = Sulphate of iron.

The figure following the symbol for fertilisers shows the number of hundredweights of that fertiliser applied per acre each year.
Fertiliser applications are made at three-monthly intervals.

+ . Worm Casting Heavy.

WEED CONTROL BY SPECIFIC TREATMENTS: Because the maintenance of balance of all ecological factors has not overcome the weed problem entirely, considerable thought and attention has been given to other ways and means of dealing with weeds.

One of the commonest weeds throughout New Zealand seems to be moss, and contrary to popular opinion moss is not an indicator of acid-soil conditions. The presence of moss in a green is usually a sure sign that the soil is by no means acid enough for browntop and Chewing's fescue. On the research plots the only ones which have moss in them are those which are only mildly acid. Lime, dried blood and blood and bone have all induced moss into turf.

If one studies the turf on tennis courts, it will be seen that moss comes quite quickly on the lines which are marked with lime and whiting to define the court boundaries. This is a point which is well worth observing, especially in the winter months, when it will be found that that if there is any worm activity it will be more pronounced on the limed strips than elsewhere.

Although it is relatively easy to eradicate moss slowly, by increasing soil-acidity it can be dealt with quickly by treating it with a mixture of 1 part Sulphate of iron to 3 parts Sulphate of ammonia at the rate of 1 oz. per square yard. Also arsenic pentoxide spray will kill moss within a few days.

Poa annua is another common weed of lawns and greens in New Zealand, and it thrives under conditions similar to those described for moss.

Onehunga-weed is a very bad weed in greens, lawns and public parks in the North Island. It is an annual weed, but it seeds prolifically even under close-mowing. Despite all the best manuring and management that may be given to a green Onehunga-weed will continue to spread unless it is killed by a contact poison. Naturally it spreads more rapidly in an open turf, but when it is one established it will not take long to open the turf still more. Of all the materials used so far for the control of Onehunga-weed, none seems effective or as economical as a dilute spray solution of arsenic pentoxide.

Pearlwort and creeping chickweed are two other weeds which cannot be controlled satisfactorily by maintaining the correct habitat conditions for turf grasses. These two weeds are perhaps the only common ones which seem to require almost identically the same soil and growing conditions as browntop and Chewing's fescue. On this account they must be killed out with a poison, and it is because they are much more susceptible to arsenic poisoning than grasses that they can be eradicated easily.

Practically all lawn weeds can be dealt with quite effectively by creating conditions which are unfavourable to their growth, and most of the others can be killed with a cheap and effective spray, namely arsenic pentoxide. However, this substance is a poison which must be used with some caution. It is poisonous to human beings and animals and will kill grass also if applied at a heavier rate than is specified for its use. Even when spray of the correct dilution is applied at the proper rate, the leaves of turf grasses are likely to be burnt to the extent that they will turn brown.

Until four or five years ago we seemed to have made very satisfactory progress, and it did not appear that there would be any new and startling developments in greenkeeping, but science brought a new aid to the greenkeeper when it produced hormone weedkillers; they fill a long-felt want very nicely and will be a boon to greenkeepers. No matter how good and effective these hormones are in killing weeds, they are not the end-all in greenkeeping. Many disappointments are in store for people who rely on them to kill all weeds and produce a good lawn. Hormones are relatively ineffective on some weeds and it seems too that several factors must be taken into consideration when deciding on a weed-killing programme with them. There is quite a bit of evidence that hormones have had very harmful effects on browntop.

The matters which have impressed me as being important are -
 (a) Air temperature, and perhaps ground temperature also. (b) The types or species of weeds to be killed. (c) The amount of moisture, from dew or rain, in the turf. (d) The stage and rate of growth of the weeds. (e) The concentration of the spray solution, and the rate of application, not to forget uniformity of spread or distribution. (f) Type of turf to be sprayed.

When more is known about these matters or when users are fully advised on them, much more effective weedkilling should result. This, however, will still not be sufficient because if hormone sprays do kill all the weeds successfully, then some lawns and greens will be left almost bare.

Good greenkeeping practice, and consideration of ecological factors, will still be a prerequisite to the production and maintenance of dense, fine-textured and weed-free lawns. Hormone sprays are like any other materials used in greenkeeping, they are merely aids to the attainment of the perfect lawn.

QUESTIONS AND DISCUSSION

MR. HARRIS: Giving the results of experiments with the control of clover by hormone sprays, Mr. Harris said that with a combined spray of hormones and arsenic pentoxide the clover was completely eliminated, with the exception of three small plants which were now coming back and which were obviously established from nodes which were covered with soil when the spray was applied.

THREE QUESTIONS put to Mr. Madden were: (1) Paspalum is a very serious weed in the New Plymouth Golf Course. What have you found out about it? (2) What application of arsenic pentoxide do you use on moss? (3) Have you done any work with 2,4-D on Onehunga-weed?

MR. MADDEN: (1) The only way is to dig it out. If it is run round with a sharp knife it is weakened and with the application of sulphate of ammonia and sulphate of iron it cannot grow strongly and becomes virtually smothered by browntop.

(2) Arsenic should be sprayed on moss in the Autumn when the moss is dry - 1 lb. to 8 gallons of water, and 1 gallon of spray to 20 square yards.

(3) I have had some experience of using hormones on Onehunga-weed and the experience has been rather disappointing. It seems that the weed is not very susceptible to hormones. At least, there has been much regrowth.

DR. YEATES: The greenkeeper at the Linton Street, Palmerston North, green told me he had successfully dealt with Onehunga-weed by using 3 lbs. per acre of MCPA. What part does the grass grub play in letting in moss?

MR. MADDEN: I believe there has been successful work at Linton Street, but the greenkeeper was able to get thorough coverage of the area under ideal conditions with a knapsack spray pump.

The grass grub opens up the turf to the extent that something will usually come in and cover the ground. It seems that moss is one of the early pioneers. It comes in and fills up the bare ground quickly. Whether the original bareness is caused by the grass grub or by the scraping of players' feet is sometimes hard to say.

MR. CONNOLLY: The Onehunga-weed is already quite prominent in Canterbury. Is there any practicable means of applying some satisfactory chemical preparation for controlling wireweed?

MR. MADDEN: Wireweed is not a problem in many places, and I have had little experience of it. I am interested to hear of Onehunga-weed, but there have been earlier reports of Onehunga-weed in Canterbury and other parts of the South Island, and the weed usually turns out to be anything but Onehunga-weed.

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