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Management of Lawn Bowling Greens in Adverse Weather Conditions

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Turf Managers managing Lawn Bowling Greens are faced with more difficulties than any other discipline of turf management. Generally speaking the conditions are the toughest in that Lawn Bowling Greens are maintained under challenging conditions where heavy compaction and excessive wear are required to be dealt with, while having the restrictions of a tight budget.

In comparison to many other sports turf playing surfaces, Lawn Bowling Greens are very small and are constantly under pressure from over usage, moisture stress, low cutting heights, shade and lack of air flow. Along with a high requirement for green speed, eventually all of the above can lead to the greens showing signs of wear and becoming unsightly. The task of producing quality playing surfaces under these constraints requires the knowledge of the Bowling Green Turf Managers to be at an optimum. However, unfortunately Turf Managers managing bowling greens are not always remunerated well to match the knowledge base required to deal with the challenges involved.

Key to Managing Bowling Greens

There is no substitute for research and study in turf management. The more is done by the Turf Manager, the more prepared he is for either producing a top quality playing surface or to survive a playing surface during harsh times either through climatic

When considering maintaining bowling greens on an annual basis the maintenance can be broken down into two parts - Growing/improving the green, and Maintaining & protecting the green. Green improvements are usually carried out during the off season or any breaks that usually occur during the season, and the remainder of the year when the green is in use, time is generally spent in maintaining and protecting the green, generally ensuring that an even and consistent grass cover is maintained while producing optimum playing conditions.

Whilst the green is in play it is usually difficult to improve the condition of the turf, as the stresses of play only create issues particularly with the root system and turf quality and only improvements are possible to the green nutritionally whilst it is in play. Once the green is in play reliance is placed on all the good work that has been done either through renovations or pre-season work to ensure it plays to its potential.

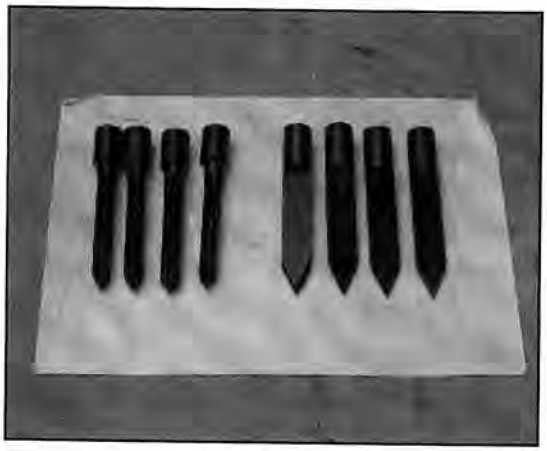
When considering improving a bowling green, there are normally two major factors that are the supporting reasons behind achieving this – dealing with the health of the soil, and developing a deep and vigorous root system, which in turn involves improving grass coverage/quality of the green. When the improvement of a bowling green surface is required, aeration is of extreme importance.

Aeration

Under normal circumstances the compaction issues that face Turf Managers are challenging and unfortunately more often than not Turf Managers are unable to do much about it as the greens are under heavy usage, or in many cases their budgets are too restrictive. In many scenarios, Clubs are limited to one or maximum two aerifications per green per year, and with the big compaction issues faced this is not enough. In an ideal scenario, bowling greens should be aerated on a regular basis, where around 10% of the surface should be removed each year through aeration, this allows not only the air to get down in the profile, but assists in reducing the thatch, allows nutrients to work into the profile, and of course keeps the root system going down through the profile in its efforts to 'chase water'

One of the main issues that Lawn Bowling Green Turf Managers face with aeration is the surface disruption that it causes. Club committees and bowlers are generally against any maintenance practice that will effect the speed of the green during the season, so aeration during the season is sometimes disallowed for this reason, however, the aeration of the green's ends on a regular basis, which is predominantly the major wear areas on a green and can be easily done during the season without too much disturbance to play, which can be a vital tool in maintaining grass coverage through the season. In recent years there has been some innovative aeration tine designs come onto the market that causes less

disruption to the green, and in particular the introduction of the hydroject has allowed Turf Managers to aerate their greens with virtually no disruption at all.



Tine Options

Coring

Thatch Management

A closely related issue to aeration is the management of thatch in bowling green surfaces. Thatch is basically the decomposed and undecomposed organic matter that lies in the turf surface. Thatch builds up in a green because the organic matter accumulates faster than it can be decomposed by either decomposition or mechanical means. The accumulation of thatch is a normal process, although us Turf Managers often contribute to the accumulation through high water and fertilizer inputs and not balancing the make up of our soils well. Keeping in mind that the production of turf in a bowling green situation is not natural and general speaking thatch is not a problem in a natural grass land, and it only becomes a problem once we start contributing large inputs into our turf.

Thatch has the potential to cause us many problems in our quest to producing quality playing surfaces. The most noticeable, particularly to the bowlers is the slow green speed, excessive thatch produces a spongy, soft surface that produces a slow surface. Excessive thatch will result in the turf having shallow roots, will reduce water infiltration, and generally provides a good habitat for insects to live in and harbors many disease issues.

As Turf Managers we then need to address how we are going prevent and/or control our thatch problems. The easy and simple answer to that is not to allow the thatch problems to occur in the first place. To ensure this happens, irrigation and fertilizer applications need to be monitored closely. The principal deep and infrequent watering needs to be adhere to closely, the basic fundamental of 'little and often' needs to apply when a fertilizer program is being considered.

Both of these principals have a large effect on the performance of the root system, which will be discussed later. For one reason or another, at some stage we will be faced with thatch problems, which will require us to put in place a program to control the thatch and preferably diffuse it. There are four main practices that are used to control thatch, the first being mechanical dethatching, the second involves hollow tine aeration, physically

removing a piece of thatch each and every time the green is aerated, the third is frequent sand topdressing, involving regular light applications of sand topdressing to dilute the thatch layer, and finally, increasing microbial activity in the soil, in other words increasing the activity of the good bacteria, fungi and worms. This is turn allows the thatch to be decomposed at a faster rate, particularly as soil temperatures rise.

In the event that the thatch layer on a green gets out of control and the maintenance practices mention above are ineffective, the Turf Manager is left with no real option but to take the top off the green, and re-leveling and re-sowing the surface. The key is to ensure the depth of the thatch does not get out of control as all on the maintenance practice that controls thatch generally deal with top 25mm – 50mm and in the event that the thatch gets deeper than this, taking the top off the green is the only real answer to controlling thatch.

Sand Topdressing

Nutrition

It is imperative to manage bowling greens efficiently it is done with the inclusion of an adequate nutrition program. When setting up a nutrition program for a bowling green, two major aspects should be looked at – what the plant requires, and secondly what the soil requires to support good plant growth. In many cases the requirements of the plant and soil are one in same and in other cases there are different requirements, this of course depends on the soil and grass types in use. For example some situations the plant might be in need of nutrients such as trace elements, but the soils might have adequate levels, in this situation foliar applications of nutrients is required to allow the plant to take up the nutrients, in other situations granular applications are more effective. These application methods are generally determined by the differentiating results between a soil and tissue test.

Generally speaking the approach with nutrition should be little and often, and only applying what is absolute necessary, where applications of fertilizer should only be committed for plant and soil health, and not plant color. Fertilizing our greens to generate an aesthetic pleasing appearance is common, however, can lead to many problems including thatch, disease, insect, and wear problems.

In relation to setting up a nutrition program, soil and tissue testing along with an evaluation on turf quality is always the best place to start. Without the inclusion of these tests and data, any fertilizer applications to the green will be predominately guess work, which can be inaccurate and costly.

When implementing a nutrition program there are many nutrients and soil amendments that are considered vital in balancing the soil and plant growth in order to produce a healthy green year around, however, evidently contributions to a nutrition program will be governed by a budget, and in many cases Lawn Bowling Clubs don't have a lot of extra funds to assign to a comprehensive nutrition program.

It is common knowledge the three most important nutrients that turf requires to function is Nitrogen, Phosphorous, and Potassium and should be the base for the development of a nutrition program. Fortunately there are many fertilizer blends on the market that are made of balanced ratios of these nutrients which makes easy application for the Turf Manager. The functions of each of these nutrients are vital and at the same time are complex and this paper will not be going through the in-depth functions of each.

Although phosphorous is important, it is required in smaller amounts when compared to Nitrogen and Potassium. In most situations, an even balance of Nitrogen and Potassium should be applied to the green on a monthly basis as generally speaking the plant requires both of these nutrients in approximately even quantities.

Nitrogen is generally considered the most important element in plant nutrition, where it is generally used for controlling the growth of the green. However, many Turf Managers are inclined to over apply nitrogen resulting in the problems already outlined.

The application of potassium, like nitrogen is considered important in maintaining quality turf on bowling greens, generally speaking potassium is used to harden and protect the plant against extreme weather variations and heavy usage. Potassium is also responsible for mobilizing other nutrients and maintaining healthy plant function.

Like Potassium the application of nitrogen should be applied monthly to your greens to regulate the growth and maintain plant resistance to wear and other stresses. The general rule of thumb when drawing up a nutrition program for the application of these two nutrients, they should be applied at a rate of 0.25kg of actual elemental nutrient per 100m2 per month. There is a calculation that allows this to be accurately calculated. These calculations are designed to take the guess work out of applying fertilizer.

The calculation is as follows...

In order to apply 0.25kg of Nitrogen (or Potassium) in one application, the below formula can be used. In this case we will use a common fertilizer such as Calcium Nitrate for a Nitrogen application, the calculation is as follows:

$$0.25 \text{ Actual Nitrogen} \times \frac{100}{N\%} = \text{Required Fertilizer rate/100m}^2$$

$$0.25 \text{ Actual Nitrogen} \times \frac{100}{19 \text{ (CN = 19\% Nitrogen)}} = \text{Required Fertilizer rate/ 100m}^2$$

0.25 Actual Nitrogen x 5.26 = 1.3kg of Calcium Nitrate application per $100m^2$ per month is required to achieve a standard Nitrogen application of 0.25 of actual Nitrogen.

This calculation can be done using any fertilizer that the Turf Manager intends to use.

In the event that a Turf Manger is already following an existing fertilizer program where nitrogen is being applied regularly, the following calculation is a reverse of the above calculation to see how much nitrogen is actually going down. In this case Calcium Nitrate is being applied at a rate of $3.5kg/100m^2$ on a monthly basis.

$$\text{Existing fertilizer rate (kg/100m}^2\text{)} \times \frac{N\%}{100} = \text{Actual Nitrogen/100m}^2 \text{ being applied}$$

$$3.5 \times \frac{19}{100} \text{ (CN is 19\%N)} = \text{Actual N/100m}^2 \text{ being applied}$$

3.5kg x 0.19 = 0.66 Actual $N/100m^2$ being applied per monthly application.

This calculation shows that the Turf Manager is applying Calcium Nitrate to his green on a monthly basis at $3.5kg/100m^2$ resulting in $0.66kg/100m^2$ of actual Nitrogen being applied each application, which is clearly an excessive rate, which will eventually lead to excessive growth along with all the associated problems that go with it.

Other Nutrients and Amendments

Outside of NPK nutrients, Calcium is viewed as being important in that it has numerous important functions in supporting healthy growth for the plant. It also has an import role in keeping the soil profile open and when present in the soil in good quantities it assists in balancing out other nutrients. Other nutrients that should also be considered when forming a nutrition program are as follows:

- Magnesium, Manganese, Iron and Zinc – when present aid the resistance to disease, insect and wear.
- Calcium – Magnesium ratios – when balanced provide a balanced soil for growth.
- Maintain high CEC – preferably above 5, assists in retaining nutrients in the soil, without being leached.
- Healthy humus levels – generally important in providing a healthy soil.
- Balance PH at around 6.5 – important in ensuring optimum growth occurs.

- Hormone products – can be important in manipulating plant growth, along with root development.

An important aspect in managing bowling greens that is often overlooked is the addition of Wetting Agents on a regular basis. Due to the excessive wear and compaction issues that are present with bowling greens wetting agents can go a long way to assisting in reducing some of the stresses the turf is placed under. The adding of wetting agents to the maintenance program assists in the uniform movement of water through the soil profile, and even distribution of moisture and availability throughout profile. Wetting Agents increase the resilience of the green, and generally assists in the green being healthier.

In relation to maintenance, adding wetting agent to the program restricts water repellency, therefore reduces dry patch and eventually leads to using less water during irrigation. One of the major complaints of bowlers is the inconsistent surface a green sometimes presents, the addition of wetting agents will help in keeping the greens performance even & consistent.

Irrigation Management

Undoubtedly one of the most important factors in maintaining quality Lawn Bowling Greens is the correct management and scheduling of irrigation. On bowling greens, learning the skills of irrigation management is more an art than a science. The major problem faced is Turf Managers are required to produce fast paced, consistent greens, but at the same time keep the turf on the green in a healthy condition, and this is predominately why Lawn Bowling Green Turf Managers have one toughest jobs in the turf industry.

The important factors in winning this battle is committing to an irrigation program that involves:

- Deep & infrequent applications of water (watering to field capacity).
- Minimize light frequent hand watering.
- Syringing during times of stress (ensuring it's a very fine spray).
- Know your irrigation system & how much it applies.
- Avoid hydrophobic conditions.
- Knowing your water quality, and having it analyzed.
- Using wetting agents.

Another debate relating to bowling green irrigation is the use of manual systems v's automatic systems. As time goes by more and more Clubs are going towards automatic systems due to their time and labor saving, along with the precision that automatic systems bring. However, they are more costly to install, and more expensive to maintain. On the other hand manual irrigation systems and still used by many Clubs effectively, they are maintained and operated for a minimum cost, they rarely break down, they can be more flexible in relation to dealing with localized dry spot, however can potentially use

more water, are more labor intensive, which generally doesn't allow watering at night therefore requires green closure to carry out irrigation.

Developing and Maintaining a Root System

The last three topics mentioned in this paper - aeration, thatch, and irrigation all combined together is the principal factors in maintaining and developing a deep and vigorous root system. In any turf situation the root system is the key in supporting the growth of healthy turf, and for providing the turf with the ability to deal with all the stresses that it comes in contact with on a day to day basis. Based on this, a simple conclusion can be made;

"Any green that has a deep and vigorous root system will have very little problems"

To maintain a deep and healthy root system in bowling greens, it is important to understand what a root system requires to develop and continue to grow. It is common knowledge turf grass roots chase water, however the reasons should be understood why it does this. Each and every time roots find water for the plant it is rewarded with a 'feed' of the plant hormone Auxin, so in other words the more water roots find for the plant the more they are rewarded, and the more the roots can grow and develop. Along with the reasons already outlined, this is another of the reasons that thatch is undesired in sports turf as it holds around 33% moisture, which is much more than any soil profile, as a result the roots will simply live in the thatch as it gets rewarded with all the Auxin it needs by living there, so there is no need for the roots to grow deep looking for water.

In order to develop a deep and vigorous root system, the following rules need to be adhered to:

- Minimize thatch at all costs, roots like to live in thatch as they are well accommodated there.
- Ensure Greens are irrigated deep and infrequently – this will ensure the roots will grow deep looking for the moisture for the plant, so in turn it is rewarded with a 'feed' of plant hormone Auxin.
- Ensure the green is on a regular aeration program – this will reduce the greens compaction, provide a good amount of air into the profile, reduce thatch, and provide a easy avenue for roots to grow deep chasing water.
- Impose a mild amount of moisture stress on the green on a regular basis – encouraging the roots to grow deep looking for water.
- Avoid excessive applications of Nitrogen - this leads to carbohydrate exhaustion, and the plant redirecting the nutrients from the root system to the leaf & stem of the plant.
- Balance soil nutrients, particularly Phosphorus, Potassium, and Auxin. Adding the plant hormone Auxin to the nutrition program can assist in the development & maintenance of the root system.
- Avoid regular amounts of shallow watering.
- Avoid stressing the turf with mechanical means (scalping, unnecessary mowing, observe1/3 rule) – these practices all stress the root system.

- Consider using Primo maxx in the maintenance program – it has the potential to redirect the plant nutrients into the root system to aid development.

Root System

Surface Preparation

The preparation of the surface of the green is the finishing of all the good maintenance and preparation work that has been done previously with the soil profile and root system. Mowing is the first thing that comes to mind when carrying out the final preparations of the green. Although mowing seems quite straight forward, there are some important factors to consider in ensuring a good mowing program compliments an already good maintenance program.

It should be understood that each and every time the green is cut, a small amount of damage is inflicted on the greens surface, with this, below are some points to keep in mind when setting up a mowing program:

- Only cut when necessary, remember each & every cut is damaging turf
- Cut a different direction each time, keeping the green even and consistent
- Always cut in different a direction than play avoid bowls 'tracking'
- Always cut at optimal cutting height for the turf species selected
- Always follow 1/3 rule, avoiding carbohydrate exhaustion
- Cut in morning, while the leaf is standing up, and during the coolest part of the day
- Limit 'clean up' or 'ring' cuts to avoid extra stress on green's edges
- Always ensure the mower is 100% sharp to avoid damaged turf and therefore providing avenues for disease and an unhealthy green in general
- Lay protection 'cloth' to turn the mower on at the greens edge each time the green is cut

Mower Turning

Grooming and Verticuting

Grooming and verticutting is an important maintenance practice that is applied to the surface of the green to ensure that standard of the surface meets the expectations of the Turf Manager, players, and committee alike. Like rolling, grooming & verticutting is the 'finishing touches' to be carried out in the preparation of a green for play. In short, these practices are aimed at:

- Controlling thatch & mat
- Improving green speed
- Encouraging a deeper root system
- Ensuring smooth playability
- Providing better surface consistency

Green Speed and Rolling

Finally in relation to surface preparation, rolling and the controlling of green speed is an important factor. It is easy to over commit the amount of rolling that is done on a green, as there is often a considerable amount of pressure placed on Turf Managers for excessive green speeds, which can lead to many problems including excessive wear, extreme compaction, and poor health of the green in general. Despite the requests that Turf Managers get from members to ensure green speeds are high, it is important that the greens are not pushed too hard for green speed too early in season.

As the season progresses, the greens will naturally firm up and speed will increase, without needing to over commit to rolling and low cutting heights. The cautious approach needs to be taken early season, not to over roll and pressure the green for speed, a wary approach will result in the greens being in good condition at the end of the season resulting in bowlers wanting to play on them greens because they are in good condition – remember, most greens are in good early in the season, however, it is only the well maintained, well managed greens that are in good condition by the end of the season, this

is a direct reflection of the Turf Managers skills and knowledge. The key factors in achieving and sustaining suitable green speed, is as follows;

- Manage irrigation correctly, watering to field capacity inflicting mild moisture stress by game day.
- Groom & verticut only when necessary.
- Regular cutting, regular cutting program will increase green speed, but remember not to over cut, and ensure the optimum cutting height is used for the species chosen.
- Roll in morning - keeps the plant lying down for whole day.
- Use of Primo Maxx – can be a powerful tool in increasing turf density, therefore increasing green speed.
- Remember green speed naturally progresses as through green usage.

Avoiding problems with wear and dealing with stresses turf

It is inevitable that at some point in time as a bowling green Turf Manager you will be required to deal with wear issues. As mention earlier in this paper the off season is generally spent improving the condition of the green, and the season is generally spent maintaining the green and attempting to prevent the green from deteriorating as much as possible. Maintaining the green in good condition is only possible if the pre-season work has been good and in particular the renovation work. It is crucial that that the off season green closure is made the most of, along with the good growing conditions of the spring is utilized well to ensure the green is in good condition the day the season starts.

In order to keep the green in good condition for the duration of the season, the following basics should be followed

- Rotate rinks on a daily basis.
- Rotate direction for play on a daily basis.
- Use of rink protectors where possible.
- Potassium silicate & Primo Maxx assists in hardening the plant.
- Syringe watering – to keep the plant function during times of stress.
- Machinery rotation – rotate access to the green & how the machines are used.
- Good maintenance program (aeration, irrigation, nutrition, cutting, rolling).

Rink Wear

In the event that turf on the green either thins out is lost, the following fundamentals should be observed;

- Raise cutting heights
- Avoid cutting stressed areas
- Additional aeration
- Additional fertilizer application, particularly Zinc & Manganese
- Syringe watering
- Ensure wear areas remain flat
- Turf doctoring
- Reseeding
- Turf replacement

Syringing

Record Keeping

The benefits involved with good record keeping are endless. Good records allow Turf Managers to refer to their past work to see what work for them previously, and to see what maintenance practices were not so successful. Good quality record keeping shows that a Turf Manager is well organized, particularly when it comes to dealing with Committees.

In the event that green conditions are not up to expectations, record keeping can show reasons for this, with particular reference to weather, over use of the green, or lack of material that has available to the Turf Manager. In other words good record keeping can be used as a tool to protect the Turf Manager's reputation in the event of criticism. Although time is a factor, the more records that can be kept the better. Listed below are some areas that record keeping is critical:

- Daily diary (record abnormal inputs , applications & observations).
- Daily records of rainfall, temperatures, sunlight, soil temperatures & soil moisture levels.
- Fertilizer application records.
- Chemical application records.
- Root depths – to be recorded on a monthly basis.

- Soil testing – showing effectiveness of nutrition program.
- Tissue analyses – shows what plant is actually taking up from the soil & foliar fertilizer applications.
- Record monthly photos of the greens – allows comparisons to be made from month to month or year to year.
- Machine maintenance records – showing to Committee good maintenance procedures and records, which can eventually assist in the approval of new machine purchases.

SUMMARY

The management and preparation of bowling greens is complex and challenging at the best of times. It is essential to have clear objectives, implement regular and systematic maintenance programs where all inputs are kept even and consistent, always remembering good programs produce good results.

It is important to have confidence in yourself and stick with what works for you, always remember there is never one method that works for everyone, with this in mind it is important to keep an open mind, and keep communication lines open with colleagues with the aim of sharing information and methodologies in the maintenance and preparation of your greens. Like managing most things, communication is the key, the more positive communication that goes on with staff and committees, the more effective the results will be and the easier it will be to achieve the optimum outcome.

Being observant is an import component of bowling green management, this used in conjunction with a generous amount of time spent on research and keeping records will reflect the quality of greens that is being produced. The better a Turf Manager knows his grasses, soils and environment the better he is prepared to deal with any problematic situation that may arise.