Guide to Using Turf Colourants (with thanks to North Carolina State University)

Image showing the impact of various pigments on root growth. Vertmax® Duo is 2nd from the RHS showing increased root volume and lateral branching

Turf managers in the Australian Turf Industry have increasingly turned to the use of pigments and colourants for improving the aesthetics of their turf areas. This approach offers a low-cost alternative to overseeding without the issues associate with removing a cool season grass from the underlying warm season turf. The use of pigments has also become commonplace in conjunction with fungicides for promoting plant health benefits for example by Bayer with their Stressgard® technology.

Over this period there have been a number of new products introduced to the Australian marketplace such as Vertmax®, Vertmax Duo®, Green Pig®, Sensi-Pro® and probably the first pigment on the market in this country being BASF 's Vision Pro®. To better understand how these products perform, numerous studies have been carried out at North Carolina State University and more recently in Sydney, Australia by Gilba Solutions.

The knowledge related to the products and their application is limited. North Carolina first carried out detailed studies on putting greens in 2008. Sydney work has been carried out since 2013. Subsequent trials have included product evaluations on bent and couch at an assortment of mowing heights.

Although our research has focused on evaluating turf colourants during dormancy, we have also been looking at these as tank mix partners for commonly used fungicides.

What are you trying to actually do?

Prior to selecting a product, a turfgrass manager should ask the following pertinent questions:

- Will it be applied to dormant or actively growing turf?
- How much drying time is needed as these can stain clothing?
- Does the colour blend in well with the existing turf colour?
- Are turf health benefits an important consideration?
- What cost is acceptable?

During these research trials, it has been apparent that product formulation varies greatly among colourants with application costs for example ranging from $31-100 plus/Ha.

Why use turf colourants?

These are the current leading alternative to overseeding warm-season grasses.

Cool, wet springs and drought-resistant cool-season grass varieties used for overseeding have made spring transition more difficult.

“Touching up” requires minimum turfgrass preparation and provides an attractive surface.

It is comparably cheaper than overseeding.

Products such as pigments increases surface temperature, which may aid plant growth.

In the case of Vertmax® Duo it offers a secondary benefit of incorporating plant health additives into its formulation that stimulate root growth and increase stress tolerance.

Types of Product for Specific Uses

The major difference between dyes and pigments is the particle size. Dyes are much finer than pigments. Also dyes are not UV stable in contrast to pigments which are. Dyes, also known as colourants in which the coloring matter is dissolved in liquid, are absorbed into the material to which they are applied. Pigments, on the other hand, consist of extremely fine particles of ground coloring matter suspended in liquid which forms a paint film that actually bonds to the surface it is applied to

Colourant Influence on Turfgrass Colour

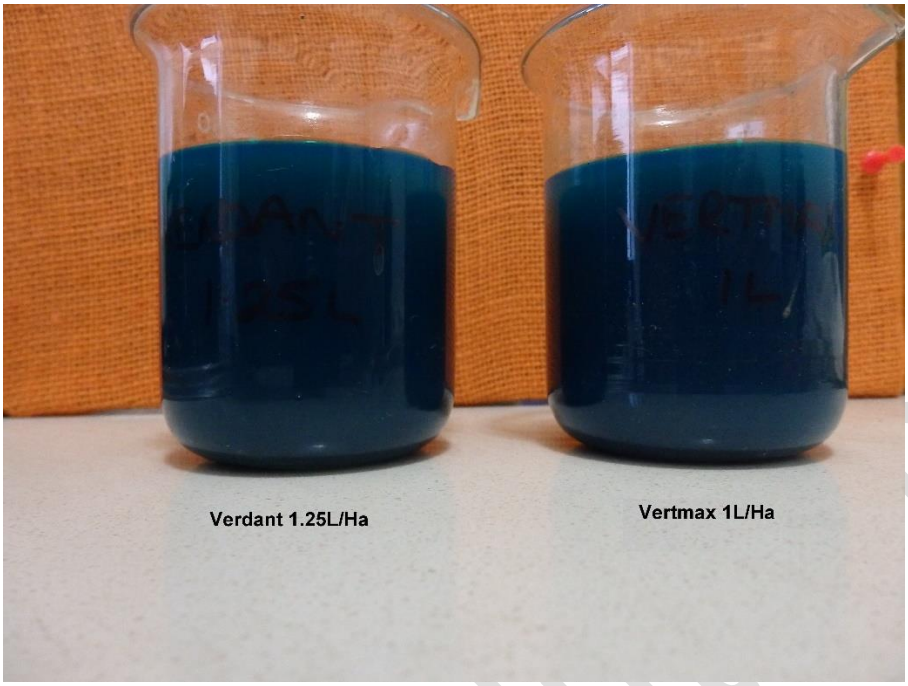
Pigment products tend to be darker in colour, which often is more towards a green or blue hue (especially when applied to dormant turf). One of the reasons application rates vary so much is the percentage content of binder. The higher binder content the higher the rate of application. Innovations such as incorporating stickers has led to significantly increased longevity and rainfastness as is the case with Vertmax®. When applied to dormant couch, a sequential application should be expected in around a month to maintain visual quality. On golf greens pigment colour will last 7 to 14 days, whereas on fairways/sportsgrounds you can probably get around 3-4 weeks.

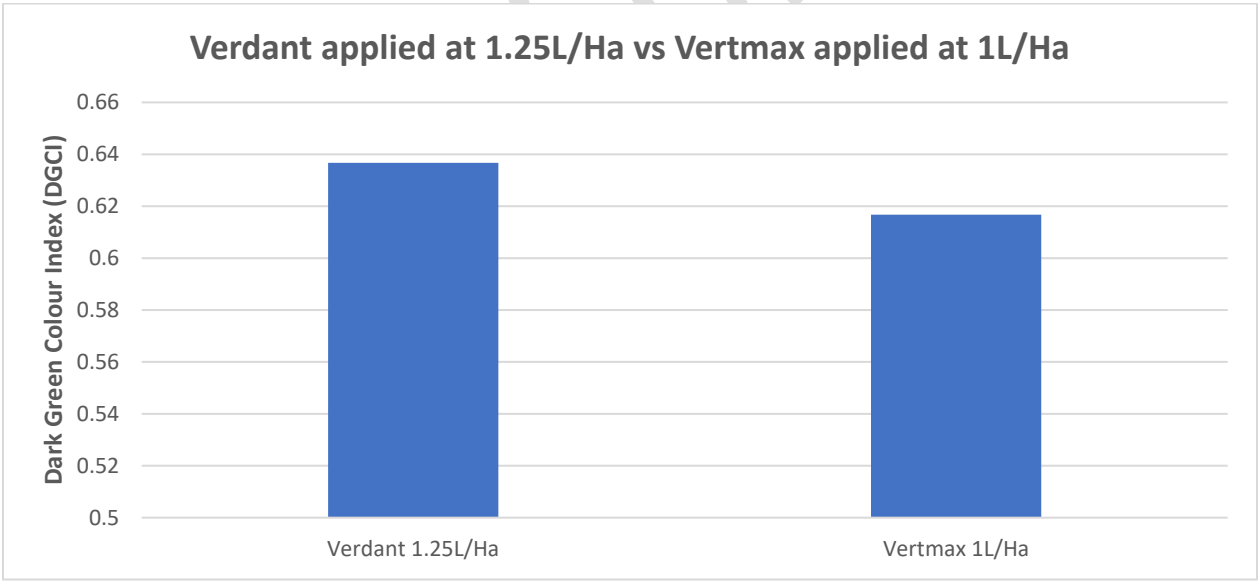
We have carried out work looking at the colour response based on label rates.

Examples of these products can be found in Table 1.

Table 1. Products that have been tested, their label dilution rate ranges, and approximate product application rate.

Product Name (Manufacturer)	**Label dilution rate (colourant:water)**	**Approximate product rate L/Ha**
Foursome® Pigment (Adama)	300-350	1.1– 1.5
Green Lawnger® (BASF)	1:9-20	34-100
Green Pig® Ultra (Globe Australia)	-	0.66 – 1
Sensi-Pro® (Various)	350:500	0.9-1.4
Vertmax® (Gilba Solutions)	250:1200	0.3-1.2
Vertmax® Duo (Gilba Solutions)	1:400	1
Verdant® (Living Turf)	1:400	1.25
Vision Pro® (BASF)	1:250-200	1.2





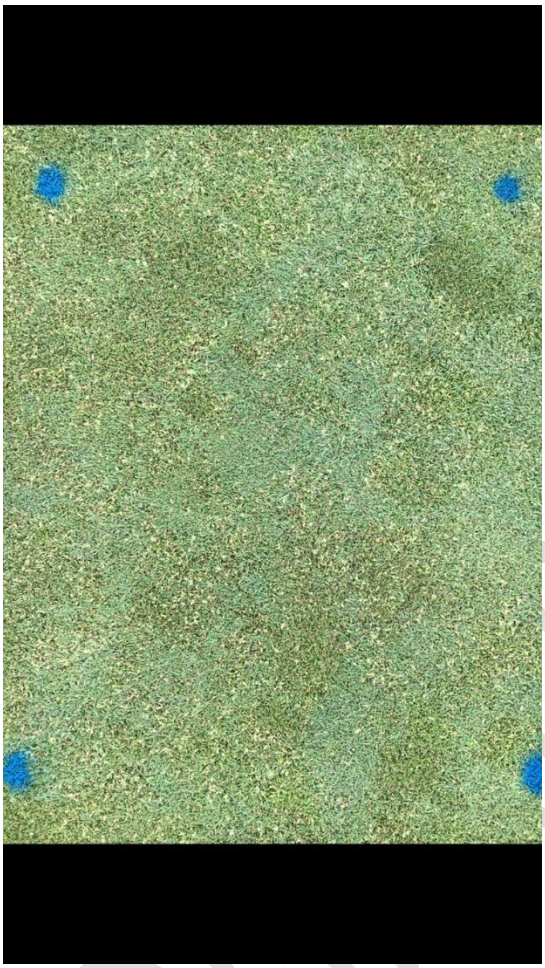
How to Apply

The application process simply involves adding water plus colourant to your sprayer, and spraying the mixture onto the area where colour is desired. If the colour is not applied evenly or dark enough, additional passes (ideally perpendicular) can be made to satisfy aesthetic desires. It is really important to

target your application as you do not want to get pigments on anything you do not want stained. Structures such as fences, tee markers and concrete will absorb the colourant and it may become

permanently stained. Having a decent tank cleaner available such as “mower restorer” is also advisable.

Image below is of Vertmax on greens height Agrostis/Poa annua and couchgrass cut at 25mm.



Application Conditions

When you apply these to the turf surface prevailing conditions can have a massive effect on the results gained. Amongst these the underlying turf colour, the presence of surface moisture i.e. a dew and the prevailing air temperature, can all have an impact.

Turfgrass colour at time of application greatly influences the appearance of a colourant application. If the turf is dormant i.e. couch in winter, applying a colourant will make the turf look better. Best results will be gained if you apply prior to it going into dormancy as the green colour of actively growing turf will greatly enhance any colourant application.

The presence of moisture can be beneficial, especially if the turfgrass is dormant or nearly dormant. As the turfgrass becomes more dormant, the leaf tissue becomes dryer, so adding supplemental water

(irrigation) will increase leaf moisture. The added moisture will help protect the applied colourant from potential absorption into the leaf tissue, which can dramatically increase the colourant's coverage and improve colour. Furthermore, products that are higher in viscosity benefit more from leaf wetness compared to products of lower viscosity.

While this wetness is usually accomplished with a quick syringe cycle from the irrigation, some people have waited to apply the colourant after a light rainfall or even early in the morning with the presence of dew. Be aware that too much irrigation that causes puddling can also dilute the application and result in an undesirable appearance. Many of the colourants do not dry or adhere very well when applied at low temperatures unless, as is the case with Vertmax® they have a sticker (QDT – Quick Dry Technology) incorporated into the formulation. This is worth considering when applying to potentially avoid staining of shoes etc. The other key difference about Vertmax® is it has a spreader incorporated within the formulation which means a much more even coverage.

The air temperature at the time of application has been found to be important for performance. North Carolina State University research has shown that when pigments are applied the air temperature plays a major role as it can significantly influence the product's ability to adhere to the turf foliage.

Over winter in colder regions such as ACT, Victoria and country NSW, when these are applied at low temperatures, pigment transfer from leaf tissue onto absorbent material more than doubles compared to when colourant is applied at 8°C. The end result can be the playing teams clothing becoming badly stained. If transfer is a concern, a turf manager may not want to apply these products when frost is present or air temperature is less than 8°C, and from personal experience I would suggest this minimum is better being around the 11°C level. Conversely, this is less of a concern on golf courses as participants are not likely to have direct contact with colourant-treated turf, although we have heard of issues occurring with players shoes becoming stained.

Product coverage is directly related to the dilution and calibration used when these are applied. Higher volumes of water will result in a lighter colour being achieved.

Application Rates and Methods

A general recommendation for application volume for high binder products is to apply the product and water mixture between 160 and 1000 Litres/Ha but we have found that 400-600L/Ha is ideal as it is a commonly used sprayer calibration set up in Australia. North Carolina State University research suggests that good results for the products could be achieved with application rates between 800 to 1100 L/Ha using flat fan nozzles from a multi-nozzle boom sprayer. Some turf managers use air-induction nozzles, and some have had great success using dual-fan nozzles.

Other potential colourant shortcomings

There are a few potential drawbacks when using a colourant, with the key one being it only improves the aesthetics and has no effect on the durability or wear tolerance of a surface unlike an oversowing. Once the dormant tissue is worn or torn away, no regeneration occurs until spring. It behaves the same way as an untreated surface.

Product Similarities

A common question is, “What is the best colourant?” In one series of trials at North Carolina State University, statistical analysis was used to group colourants based on similarity of attributes, which included colourant intensity, colour, and hue over two years. Results indicated that the colourants with the best natural-looking green colour **generally** did not last as long as some of the others. This group included Green Lawnger.

To have a natural-looking green colour for the duration of the dormant period, their data suggested reapplication will generally be necessary. A longer-lasting colour, although it may have a bluish or lime-green hue, can be achieved with minimum to no reapplication. As we later report in discussing the pigment products, these bluish or lime-green products may have application in situations when the turf's natural green colour is being accentuated rather than when trying to cover tan to brown dormant turfgrasses.

Product Development

As with most markets there are constant changes. At Gilba Solutions we have been looking at the combination of pigments with plant health elicitors and recently introduced Vertmax® Duo which can be applied as a stand-alone product or tank mixed with a number of spray partners due to its high degree of compatibility.

Cool season turf species are only able to utilize a certain amount of light which is around 400-500 µmols m2 s-1. Beyond this level plants are said to become photosynthetically saturated (Sharkey et al, 2010). When under heat stress, drought stress or cold stress turf susceptibility to damage increases. Under these conditions the saturation point can drop to 100 micromoles. So even in autumn or spring the turf can suffer light stress. Light intensities can reach 1000 micromoles on a sunny winter day (10x the

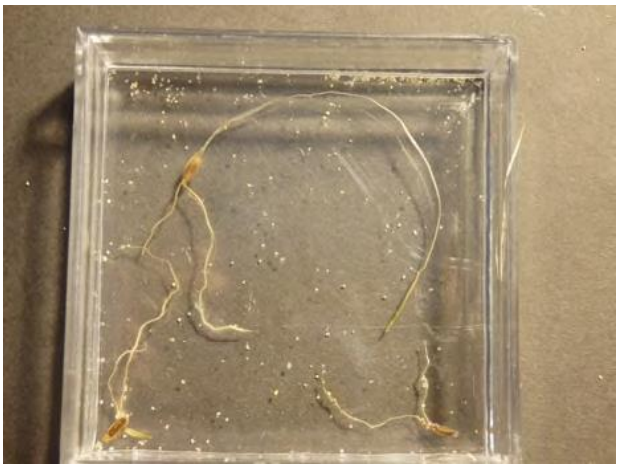
light saturation point). When these levels of PAR light are exceeded there is a likelihood of proteins, enzymes, membranes, and other molecules being degraded (Hakala-Yatkin et al., 2010). By relieving this lightstress, we can potentially reduce physiological stress.

On this basis Vertmax Duo was developed to act not only to improve turf aesthetics but to also act as a physical barrier or screen to UV and PAR light. When applied to the turf leaf, the pigment layer allows the transmission of PAR light but its intensity is decreased and UV light is absorbed or reflected.

Apart from the aesthetical benefits of Vertmax Duo use of this results in:

- Radiation absorbance increasing
- Reflectance decreasing
- Supplementary anti-oxidants become available to counter these free radicals, leading to Increased photosynthesis
- Increased root growth and lateral branching

LHS is untreated; RHS is Vertmax Duo applied at 1L/Ha showing the increase in lateral branching on Agrostis sp



Turf Colourant Transfer

As discussed previously In North Carolina State University's most recent trial, they identified that air temperature during colourant application can greatly influence colourant transfer. Seven turf colourants were applied at -4C°C, 7°C, and 16°C and sampled four times over the course of a week to quantify colourant transfer. When applied at -4°C, they found that colourant transfer was dramatically increased. They also found that three of the seven products tested performed much better than others.

In warmer areas temperatures will generally be high enough to maintain couch growth through the winter. If turf growth occurs, mowing may remove the colourant. When couch just begins to turn off-colour, an application of a pigment is an inexpensive way to improve colour, and also helps to promote sustained growth.

We also looked at this on both bentgrass and couch in relation to temperature using a temperature-controlled growth chamber. Product was **applied to dry foliage**.

The results at 15C showed no difference between these in regard to the potential for transfer as both of these dried within 1 hour.

Table 2. Trial examining pigment transfer following application at various temperatures

Grass type	Temperature °C	Product	Rate L/Ha	Drying time (hours)	Transfer
Bent	15	Verdant®	1.25	1	No
Bent	15	Verdant®	1.25	2	No
Bent	15	Vertmax®	1	1	No
Bent	15	Vertmax®	1	2	No
Non dormant couch	15	Verdant®	1.25	1	No
Non dormant couch	15	Vertmax®	1	1	No

We then looked at replicating a real-time situation where pigment is applied to **dry foliage** late in the day to dormant couch and a frost occurred. Product was applied to **dry foliage** and allowed to dry for an

hour on dormant couch before being subjected to temperatures of -2°C for two hours. The results showed that even after the low temperature period neither product transferred given the 1 hour drying time.

Table 3. Trial examining pigment transfer following sub zero temperatures					
Grass type	**Temperature °C**	**Product**	**Rate L/Ha**	**Drying time (hours)**	**Transfer**
Dormant couch	-2	Verdant®	1.25	1	No
Dormant couch	-2	Vertmax®	1	1	No

The results showed that as long as the pigments are allowed a minimum of 1 hour drying time at their respective rates neither of the tested products went back into solution.

Summary

Colourants and related products offer an alternative to overseeding that may be more cost-effective while still providing an aesthetically pleasing turfgrass surface during dormancy of warm-season turfgrasses. These products do not provide a wearable surface like a growing turfgrass. But under moderate wear, using such a product may result in healthier bermudagrass due to less competition during the spring and summer months. The products vary in colour, longevity, and ease of application (among other attributes), so turfgrass managers have options that they may consider.

Turf managers can pick from several spray-on products to keep their turfgrass green regardless of the turf's condition. These products can accentuate light-green grass, mask blemishes, or cover the tan colour of dormant turfgrass. They can be used on warm-season or cool-season turfgrass and may be applied on lawns, sports fields, or golf courses. There are several products currently on the market, so picking the best one for a situation may require some experimenting. Because there are two significant product categories, one may want to begin their decision process by deciding how they will use the product based on selected use characteristics (Table 2).

Table 4. Summary of product category and selected use characteristics.		
	Paint Products	**Pigment Products**
Applied on active growth		X
Applied on dormant turf	X	X
Colour duration > 2 weeks	X	X
Lowest cost per application		X
Reduced transfer potential	X	X*
Easiest to mix		X

- If sticker incorporated into formulation