Economics of 'Green' Compost Utilised as a Turf Topdressing

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When assessing the value of compost in some applications, we must consider not only the physical chemical and biological benefits in general, but also the value it can lend to reduced chemical fertiliser, pesticide and irrigation costs. In some cases, these benefits are simply the "icing on the cake," an extra benefit which helps with the sale-closer that gets compost in the door with new potential end users. In other cases, specific economic values can be assigned, and thus factored into the sale price of the compost. Obviously though, the value of some of these benefits are difficult to quantify (e.g., irrigation reduction).

The examples that follow begin a dialogue on how to value the fertilizing and pesticidal benefits of compost, as well as how this can act to increase the baseline value (price), of compost products.

Fertilizer

Most composters have avoided comparing their compost products to chemical fertilizer, since the cost of pure chemically-based nutrients are almost always cheaper on a weight for weight basis than those found in compost (remember, compost is sold for its physical, chemical and biological benefits, not just its fertilizing properties). Further, the nutrient content of composts can vary to some degree, thereby making it difficult for the composter to guarantee the 'minimum content' of nutrients (NPK) in order to assure the volume that they have identified to their customer. Providing minimum or average nutrient content data to end users and then working hard to create consistent products, may however, help composters raise the value of their compost products, especially if they are trying to service the turf management industry which often seeks slow release nitrogen sources — *a feature that all composts possess*.

Modern agricultural production, favours quick release nutrient sources (e.g., nitrogen in the form of sulfate of ammonia) that are typically much less expensive than their slow/controlled release counterparts (e.g., methylene urea) used in higher value turf management. The turf industry may spend two to two and a half times more money to purchase compound fertilizers that contain slow release forms of nitrogen, which feed the turf over time. This makes compost a possible viable alternative to certain slow release fertilizers, due to its ability to do the same. Although the composting industry is not going to sell compost into the turf market as a direct replacement for fertilizers, it could help composters gain additional value from compost sold for its innate content of slow release nutrients (nitrogen). So there's additional intrinsic value that can be attained from compost, if we can explain how it compares to slow release fertilizers.

Fertilizers can contain macronutrients and/or micronutrients. There are three nutrients typically conidered to be macronutrients, namely nitrogen, phosphorus and potassium.

These nutreints are needed by plants in larger quantities than are the micronutirents (e.g. Boron, Copper, Iron). Most chemical fertilizers contain primarily ‘N:P:K’, and are categorized as ‘compound’ fertilisers, whereas compost contains these three nutrients plus all of the micronutrients too.

Artificial fertiliser formulations vary depending on the end use of the product. Nitrogen (N) is reported as the percent Total Nitrogen, and the percent of the Phosphorus (P) and Potasium (K) is reported as diphosporous pentoxide (P_2O_5) and potassium oxide (K_2O)). A formulation with 12% N, 3% P_2O_5, and 24% K_2O for example, has a N:P:K ratio of 12:3:24. Nutrient content in fertilizers is reported on an ‘as is’ (wet) basis, but this is somwehat misleading, since granular fertilizers contain little if any water. The remainder of the fertilizer product is usually inert material, but may also contain one or more of the micronutrients.

Comparison of Compost with a Fertilizer

Fertilizers on the market today are usually sold with a guaranteed N:P:K value (Nitrogen:Potasium:Phospohorus). For example, two newer fertilizer formulations used on sports pitches are 12-3-24 and 3-3-32 (and many others) and contain high quality controlled slow release nitrogen sources. These products are often applied at a rate of 300 kg per hectare. At these rates, the 12-3-24 product provides:

- 36 kg/hectare of nitrogen*
- 9 kg/hectare of phosphorous
- 72 kg/hectare of potassium

**Calculation example: 300 kg/hectare fertilizer x 12% nitrogen fertilizer = 36 kg/hectare of nitrogen*

The 3-3-32 product provides:

- 9 kg/hectare of nitrogen
- 9 kg/hectare of phosphorous
- 96 kg/hectare of potassium

Perhaps more common fertilizers used within the sports turf industry include a 12-6-6 or 12-3-9, used in the spring/summer, and 3-12-12, used in the autumn. These products contain quick release forms of nitrogen, and therefore, are much less expensive than the controlled release products (costing as little as £0.50 per kg). These products would also be applied at a 300kg per hectare application rate.

A compost possessing a typical nutrient ratio of 0.8-0.3-0.6 (percent nitrogen to phosphorous to potassium, on a wet weight basis) with a 37% moisture content (remember that most dry fertilizers are near zero percent moisture), and applied at 62 cubic metres per hectare (a typical 6mm topdressing rate), will provide:

- 210 kg/hectare of total nitrogen - approximately 21 kg/hectare of available nitrogen (typically estimated at 10% availability the first year)
- 79 kg/hectare of total phosphorous - approximately 12 kg/hectare of available phosphorous (typically estimated at 15% availability the first year)
- 157 kg/hectare of total potassium - approximately 126 kg/hectare of available potassium (typically estimated at 80% availability the first year) during the first year of application.

Using this example, you can see that using compost at a common topdressing application rate can often provide enough nutrients to replace a typical application of chemical fertilizer!

Fungicide

Research has shown that many composts possess disease (fungal) suppressive properties. Various Ohio State University (USA) research studies completed throughout the 1980's and 1990's (various references), primarily spearheaded by Dr. Harry Hoitink, has even identified the specific modes in which suppression occurs. Commercial labs in the US are now testing compost for microbial populations in order to help predict disease suppression.

It is also important to understand that compost provides "preventative" disease control, and not "curative" control.

Biological controls are also often less predictable than chemical products. Chemical fungicides, however, are not always effective either. All pesticides sold in the UK must be registered through DEFRA. Although specific disease suppression claims cannot be made by compost producers, without proper registration, DEFRA allows the following to be stated ''*This product is not a pesticide. However, it contains low levels of naturally-occurring soil micro-organisms which may help to suppress soil-borne populations of some plant diseases.'* Although specific claims cannot be made, the use of disease suppressive composts could replace, or reduce, the use of fungicides in many turf maintenance scenarios.

With so many fungicides available on the market today, controlling any number of diseases, turf managers have to take special care in evaluating the products that they utilise. Further, specific chemical fungicides can work as either preventatives or curative, and some possess both properties.

Fungicides can be costly to apply, with preventative fungicides such as Myclobutonil and Fenaramol costing £450 to £750 per hectare (we are using £600 per hectare in the example below as a realistic average price). There is a huge variation in the cost of different fungicides, based on application rate, product type, mode of action, etc. However, the cost figures above, estimate the two fungicides used at a 6 to 8 litre per hectare application rate, at a price of £75 to £100 per litre.

It should further be noted that all fungicides have a specific period of time in which they are effective 'in control', typically being a two to four week period, whereas compost may provide its preventative disease control for months at a time, under the proper conditions.

Topdressing

Many composters market their end products as turf topdressings which physically 'open up' the soil structure and incorporate organic matter improving drainage and aeration, for golf course fairways, sports pitches and even home lawns. This application has developed into an excellent niche market for compost, especially since there is little competition against compost in these markets (except for more expensive sand-based topdressings developed for golf tees and greens). It should be understood that neat compost (unblended) is not a true replacement for the sand-based topdressings used on golf course greens, or in applications where the topdressing will be used to physically (structurally) fill in deep divots. However, compost can be an ideal topdressing for large area applications (golf fairways and sports pitches) where the cost of sand-based topdressings may preclude its usage. Furthermore, many composters are now blending their composts with industry standard sands to create high value topdressings that possess fertilizing and disease suppressive properties from the compost. Green composts can be considered as alternatives to peat and topsoil in standard sand-based topdressings.

In the golf industry, sand-based topdressings cost approximately £25 to £32 per tonne, delivered, and similar products used to construct tees and greens (using less expensive sand) costs approximately £15 to £20 per tonne, delivered. Compost may be sold at a price of say £16 to £17 per cubic metre, delivered. One tonne of sand-based topdressing is the same approximate volume as one cubic metre of compost, since compost possesses approximately half the bulk density of a sand-based topdressing. Typically, in sports pitch topdressing applications, sand-based topdressings are applied at a 3, 6 or 12mm application rate, depending upon the requirements of the project and available funds.

Replacement Values

The cost to use compost as a topdressing might be £1023 per hectare, or £102.30 per 1,000 square metres, when applied at an approximate 6mm application rate (or 62 cubic metres per hectare). When considering the potential fertilizer and fungicidal benefits of compost, and its value as a replacement for sand-based topdressing (actually using a less expensive tee/green construction mix as the topdressing), the cost is only 50% of a typical sand-based topdressing.

Relevant product costs are found in Table 1. They represent products used by many turf managers, and those which may be replaced if compost is used as a topdressing.

Table 1 - Relevant Product Costs

Product	**General Costs**	**Area Costs**
Sand-Based Topdressing[a]	£25 to £32 per tonne (estimated as £28.50 per tonne for economics)	£1767/hectare or £176.70/1,000m^2
Sand-Based Tee/Green Construction Mixes	£15 to £20 per tonne (estimated as £17.50 per tonne for economics)	£1085/hectare or £108.50/1,000m^2
Compost (used as Topdressing)[a]	£16 to £17 per cubic metre (estimated as £16.50 per metre for economics)	£1023/hectare, or £102.30/1,000m^2
Fertiliser[b] (controlled release nitrogen)	£1.25 to £1.30 per kg (estimated as £1.27 per kg for economics)	£381/hectare, or £38.10/1,000m^2
Alternate Fertiliser (quick release nitrogen)	£0.50 per kg	£150/hectare, or £15.00/1,000m^2
Fungicide[c]	£75 to £100 per litre (estimated as £75 per litre for economics)	£600/hectare, or £60/1,000m^2
Seed	£5 per kg (Dwarf Perennial Ryegrass)	£833/hectare, or £83.30/1,000m^2

		£83.30/1,000m^2

[a]Applied at 6mm, or 62 metres/hectare)
[b]Using earlier example, compost with a nutrient ratio of 0.8-0.3-0.6 applied at 6mm layer and an Autumn 3-3-32 fertilser applied at 300kg/hectare
[c]Using *Myclobutonil (at 8 litres/hectare) or Fenaramol (at 6 litres/hectare)*

A detailed cost comparison can be developed (Table 2) using these estimated cost figures. This comparison illustrates that a compost topdressing can fulfill the function of three products normally used in the management of high quality turf (a physical topdressing, with fertilizing and disease suppressive properties). These figures illustrate that compost used in a turf topdressing application may be able to fulfill a cultural and economic niche within the sports turf industry.

Going one step further, and using football pitch experience from the Northeastern region of the USA, the use of compost on sports pitches allowed the managers of the largest sports pitch venue in New England to reduce the amount of grass seed it used by two-thirds *(Compost for turfgrass: multifaceted organic ally, Sports Turf Magazine, August 2005).*
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Dwarf Perennial Ryegrass is commonly used on sports pitches in the UK. At an application rate of 167 kg per hectare, the cost of treating a hectare would be £833. Even if the use of compost would decrease the application rate of grass seed by only fifty percent, that would further save the sports turf manager an additional £400 per hectare.

Table 2 - Cost Comparison on a 1000m$_2$ Basis

Product Costs	**Sand-Based Topdressing**	**Compost used as Topdressing**
Topdressing (tee/green construction mix as the topdressing)	£108.50	£102.30
Autumn Fertiliser (controlled release nitrogen)	£38.10	£0
Fungicide	£60	£0
Total Costs	**£206.60**	**£102.30**
Grass Seed	£83.30	£41.65
Total Costs (with grass seed)	**£289.90**	**£143.95**

Obviously, different cost figures and application rates could be used within the economic comparison within this paper, based on specific project requirements. That said, it is obvious that significant cost savings can be obtained through the use of compost in the management of sports turf.

To determine how much money you or your customers could potentially save using compost, use the difference between the ‘per 1000m$_2$’ cost figures (for example in the *example shown within this report, £358.10 - £143.95 = £214.15) and multiply it with the size of the turf area to be treated in 1000m_2 increments (e.g., for a 6,000 m_2 pitch, for the example used one would simply multiply 6 x £214.15, for a 8,000 m_2 pitch, multiply 8 x £214.15). Also, where appropriate, you can substitute the cost of the controlled release fertilizer products, with the quick release ones.*

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