



Groundswell® Continuous Fermentation Process Manual

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Groundswell® Overview



VRM has developed a simple and effective organics processing methodology for solid and semi-dry organic material that allows stability, predictability and consistency and manages odour at every stage of the process.

The Groundswell® Continuous Fermentation process

- Uses low cost, readily available materials and processing techniques
- Requires minimal infrastructure
- Is able to use existing landfill or farm machinery (e.g. small tractor with blade or front-end loader).
- Operates in exposed sites with no power and minimal water.
- Has a minimal labour and machinery requirement.
- Is a simple process that can be managed by existing waste management or farm labour without expert composting knowledge.
- Operates consistently with seasonally variable feedstocks.
- Effectively manages concerns about putrescibles including odour, vermin and flies.
- Produces the highest quality biologically active compost possible with zero physical contamination that meets all regulatory and agricultural market requirements.
- Ensures pasteurisation is able to occur (i.e. temperatures are reached and maintained to destroy seeds, spores and diseases).
- Enables the conversion of organic waste previously disposed to landfill into a resource.

The Groundswell® Continuous Fermentation process was used exclusively to process food scraps and garden waste in the \$2 million Groundswell® project in NSW, Australia. (www.groundswellproject.blogspot.com). It has since been adopted by organics processors and farmers in Australia and Internationally.

The magic of Bacterial Photosynthesis: Managing Odour and Energy Requirements.

One of the great benefits of adopting the Groundswell® Continuous Fermentation process is the capacity to consistently manage odour at every stage of the process and still promote the conversion of difficult organic substances without additional energy inputs.

The Groundswell® process facilitates and accentuates the activity of special groups of photosynthetic bacteria which are able to manage the production and consumption of odour substances and promote the digestion of organic material using energy from the sun (including UV and infra-red radiation).

Creating the conditions for these photosynthetic bacteria to flourish during composting simultaneously breaks down odour producing compounds such as hydrogen sulphide and allows other organisms to flourish which help generate oxygen within the pile.

The result is a complex interdependency of biological families which each create favourable conditions for others and protect against the dominant biological process in the pile becoming putrefactive or odourous. The process is perhaps more easily understood as akin to a silage process but also stimulates the production of humus. In fact, the symbiotic reactions fostered in the Groundswell® process takes the normal “breakdown” of organic material for which compost is known into a completely different realm, with the output product after screening being described by some as being closer to an organic soil than a compost.

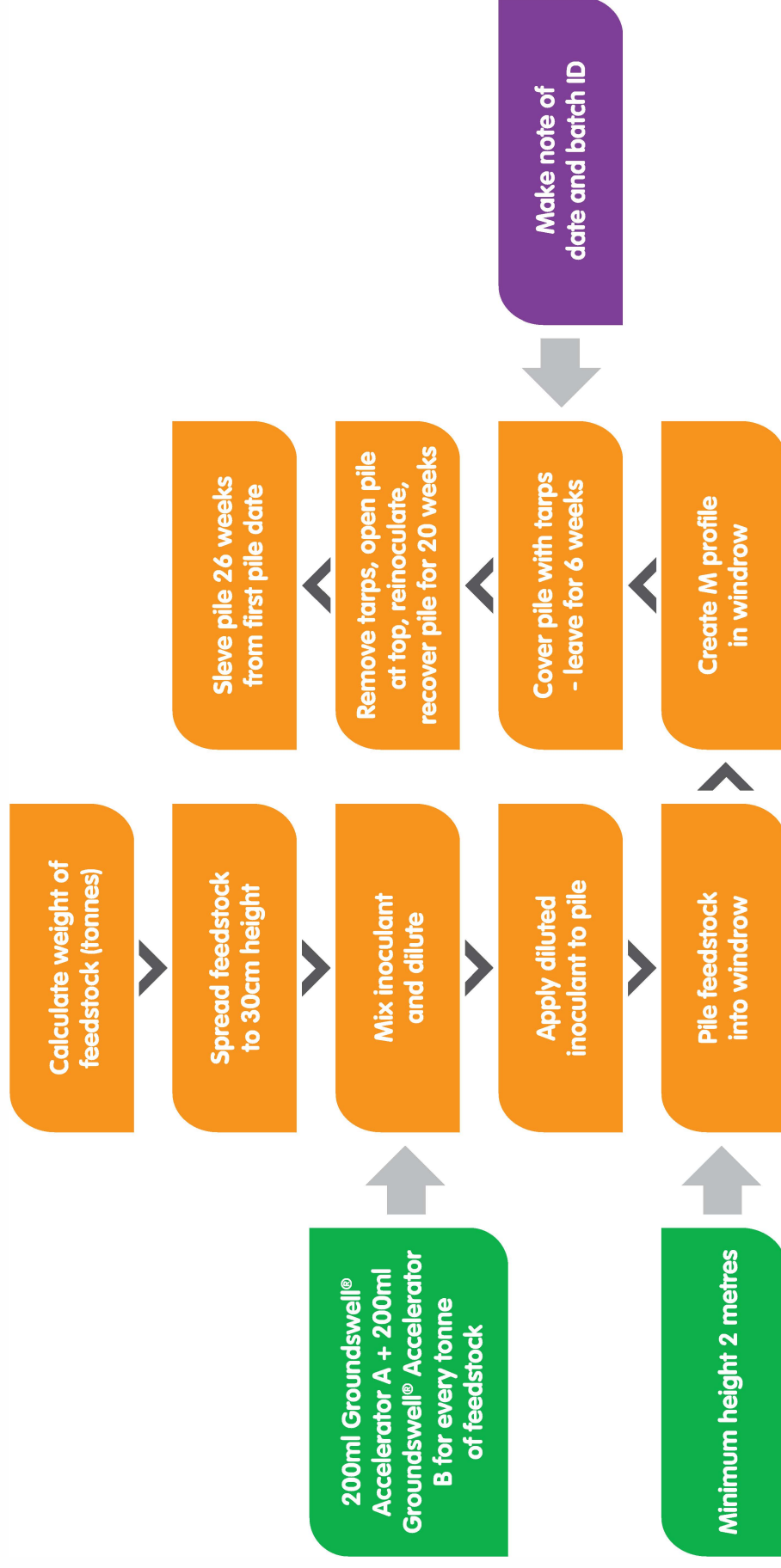
Process Description – Groundswell® Multi-Feed



- 1 Calculate the volume of feedstock you have in tonnes.
- 2 Spread feedstock to about 30cm thick.
- 3 Mix 200ml of Groundswell® Accelerator A and 200ml Groundswell® Accelerator B in 1L of water for every tonne of feedstock. (Tip: Mixed inoculants must be used on the day – do not mix and store!)
- 4 Apply diluted inoculant evenly to your spread feedstock using a fine spray.
- 5 After inoculation, wet the feedstock up to 50 to 70% moisture.
- 6 Pile feedstock into a windrow such that the height of the pile in the centre is a minimum of 2 metres. (Tip: There is no maximum height – pile as high as you can!)
- 7 Form a dip in the top centre of the pile lengthways. This will mean a cross-section of the pile will appear to form an M shape. (Tip: Run a perforated poly pipe on top of the pile in the dip. This will help you wet up the pile while covered)
- 8 Cover the pile completely with tarpaulins. Ensure there is at least a 30 cm overlap at each edge.
- 9 Weigh the tarps down where they touch the ground with lay flat pipe filled with water. Run a filled lay-flat pipe all along the centre of the pile to maintain the M Shape. This will help prevent the pile from drying out. (Tip: the pile must stay wet in order for Groundswell® to work!)
- 10 Leave this pile for 6 weeks.
- 11 At the 6 week mark, remove the tarps, spread or open the pile, reapply the inoculant, re-pile and re-cover.
- 12 Leave the pile covered for a further 20 weeks.
- 13 After the full 26 weeks, sieve the material. (Tip: Oversized material should return to help your next pile.)



Process Flowchart – Groundswell® Multi-Feed



To understand how HumiSoil® works for you, it is useful to have an understanding of the role of Humus in soil.

What is Humus?

Humus is a complex and persistent mixture of brown or dark brown organic substances which results from microbial decomposition and a synthesis of plant and animal matter. Humus can also be generally used to describe an upper layer of topsoil which contains organic matter. The process in which raw organic matter is converted into Humus supports the maintenance of beneficial microbes and helps store high levels of nutrients and organic acids in the soil. Humus also possesses extremely high absorption capability and can hold and release water and nutrients as needed. Where humus is present, soil structure is usually better and the chemical and biochemical reactions which allow plants to take up nutrients (the cation exchange capacity of the soil) is improved.

Humus is synonymous with good nutrition in soil and acts as a nutrient and energy storage facility. In nature, humus takes many years to form and soils which are rich in humus are normally very old. Unfortunately many of the processes employed in farming rapidly draw down on the nutrient and energy stores of humus in soil, resulting in a loss of humus.

What is Humisoil®?

As its name suggests, HumiSoil® is an organically based product in which the biological reactions which result in the formation of humus have already been started. This pre-fostering of humus allows you to speed up the natural process of humus formation in your soil. HumiSoil® is a fully matured top-soil enhancer made from totally organic inputs which contains high levels of humic materials together with a range of beneficial microbial activity.



A Revolutionary Breakthrough

Carbon is a key ingredient in the formation of humus. Carbon in soil is generally understood to come primarily from organic matter and is converted into humus by microbes. It is important to note that this process is not the same as what happens when organic matter is composted. When material is composted, most of the carbon in the material is released back into the atmosphere as CO₂. During HumiSoil® manufacture very little carbon is lost. In fact, the Groundswell® process in which HumiSoil® is made has been shown to foster some carbon sequestration – meaning more CO₂ can be captured along the way as HumiSoil® is made than was there to start with!

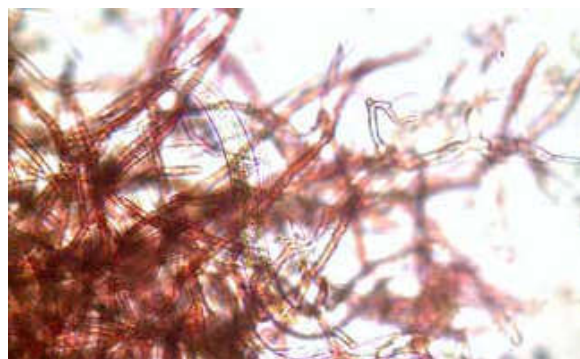
This unique effect – the preservation of carbon and energy stores and the formation of humus in organic material – results from the actions of special microbes which are able to complete photosynthesis deep within a pile of organic matter. These special microbes are incubated in HumiSoil® and are able to use infra-red and UV radiation to complete photosynthesis and re-capture CO₂ which would otherwise be lost as organic matter decays. These very important microbes are then carried to the soil in large numbers wherever HumiSoil® is used.

How is it made?

HumiSoil® is made using the Groundswell® continuous fermentation process pioneered by VRM®. In this process a range of microbes work to convert raw organic matter of many types into a product which has many of the characteristics of topsoil. An important part of this conversion activity is Bacterial Photosynthesis. Microbes responsible for bacterial photosynthesis thrive in the Groundswell® process and foster the fixation and mobilisation of additional carbon, nitrogen, phosphorus and numerous trace elements from their environment.

Soil benefits of HumiSoil®

A Microbial Incubator – HumiSoil® acts as a cossetting media which allows the establishment of important soil cultures in otherwise difficult circumstances. These organisms are responsible for fixing carbon and feeding energy, nutrients and water into the soil profile.



Promoting beneficial fungi – HumiSoil® assists in the development of a range of beneficial fungi species which provide an antibiotic support to plants as well as performing important functions in the formation of soil particles and in the development of nutrient transfer cultures around the roots of plants.

A water reservoir – HumiSoil® contains bacteria which manufacture water. Additionally, HumiSoil® fosters humus development in soil which in turn helps to absorb and store moisture.

How does it benefit my crops?

HumiSoil® supports the development of naturally healthy soil. Healthy soil microbes have been linked with reduced incidence of disease outbreak as well as with much more efficient nutrient transfer to plants.

Specific functions of the beneficial microbial cultures fostered by HumiSoil® include:

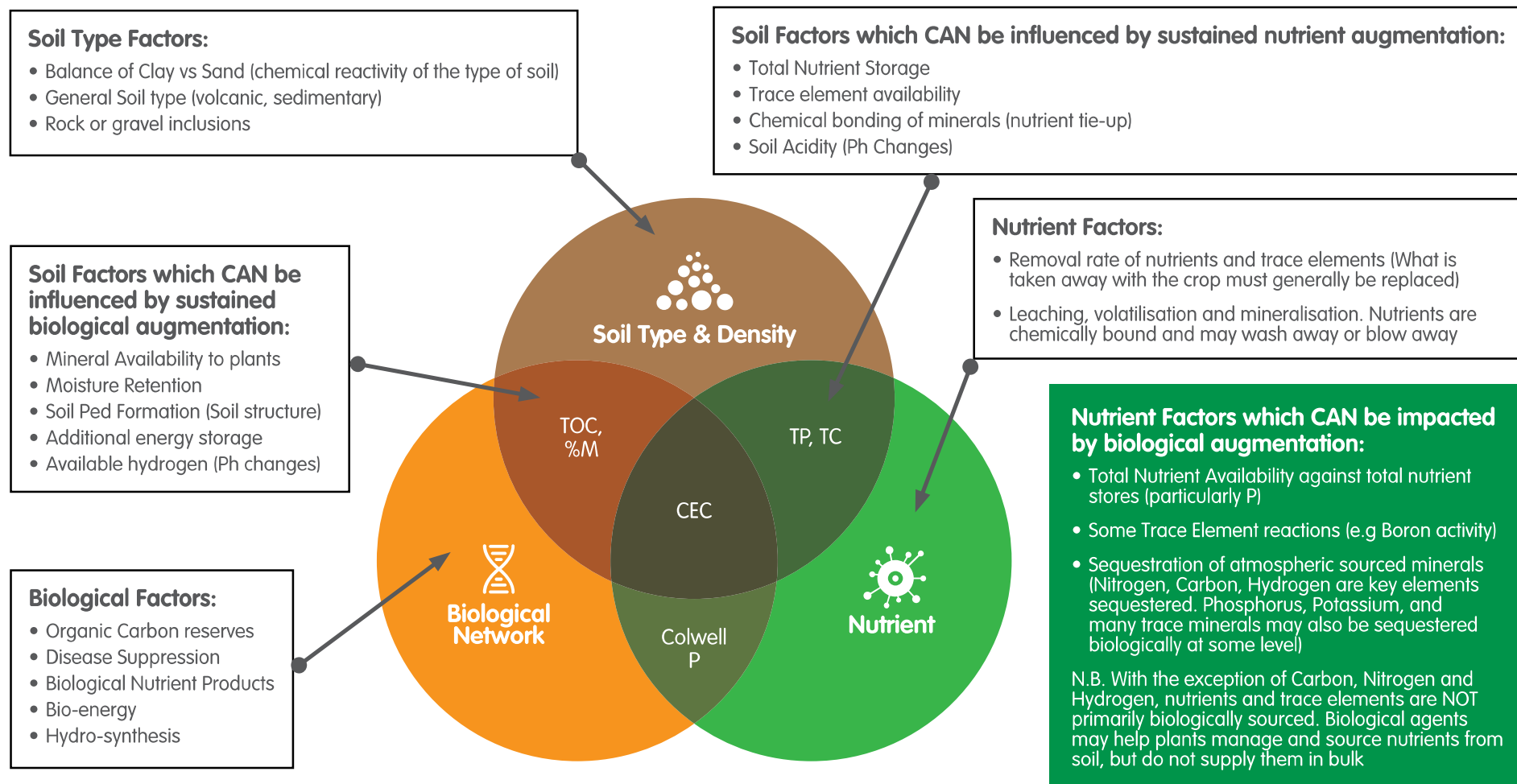
- Manufacture of water in the soil
- Fixation of Nitrogen from the air
- Mobilisation of Phosphorus reserves in soil
- Capture of CO₂ from the air and use of it to make sugars
- Manufacture of energy storage compounds like ATP
- Manufacture of antibiotic substances which help protect against disease

All of these functions help build a healthy soil and can assist plant growth.

General Principles of biological augmentation.

The simple addition of organic matter will not necessarily provide these benefits.

HumiSoil® specifically targets the hosting, incubation and deployment of the microbial agents responsible for the benefits listed below.



The table below compares and contrasts traditional Compost with HumiSoil® (product of the Groundswell® process) for their capability to provide a range of desired benefits.

Desired Benefit	Compost	HumiSoil®
Inclusion of Diverse Biological Populations	No Compost typically contains low levels of biological activity at end of process	Yes HumiSoil® typically contains high levels of a wide range of biological activity at end of process
Dominant inclusion of Specific cultures beneficial to soil	No Compost is typically populated by organisms whose function is the degradation of organic matter rather by those whose function is the production of beneficial substrates	Yes HumiSoil® is characterised by the appearance and proliferation of specific cultures of actinomycetes, bacteria and other organisms which are known to be beneficial in a soil environment.
Water retention	Yes (while it is in place as a mat on the surface of soil)	Yes (while it is in or on the soil and after a program of addition to soil surface)
Humus Addition	No Typically fosters very low on-going humification capacity when placed on soil surface	Yes Very high levels of humus pre-cursor materials and nutrient retention for humus manufacture in soil are present in HumiSoil®
In-Soil Moisture Addition	No	Yes Specific Bacterial agents of hydro-synthesis flourish in HumiSoil®
In-soil Carbon Sequestration	No Fosters Carbon digestion and release. May act as an agent of carbon reduction in soil	Yes Specific biological agents of carbon sequestration flourish in HumiSoil®
Nutrient Addition to Soil	No Nutrients are generally released to atmosphere by surface added compost	Yes Biological Nitrogen and Carbon Fixation activity is fostered by HumiSoil® addition
Soil Health and fungal disease suppression	No / Yes Very few fungal hyphae survive the composting process or are fostered by surface addition of compost in isolation. Over time, a blanket of composted material may be inhabited by beneficial fungi.	Yes A range of fungi species readily colonise HumiSoil® and are fostered wherever HumiSoil® is added to soil. HumiSoil® has a far greater retention and generation of moisture than compost which promotes diverse fungal activity.
Capacity to influence CEC	Yes / No Incorporating organic matter into the soil can help improve CEC. Compost left on the soil surface will not necessarily improve CEC	Yes HumiSoil® typically has a much higher intrinsic CEC than compost and contains a number of solubilised elements which contribute to improved CEC