

**Dr. Elaine's™ Soil Food Web Foundation
Courses**

Course Manual

**Foundation Course 3:
BioComplete™ Liquid Amendments**

Congratulations!

Having completed the second Dr. Elaine's™ Soil Food Web Foundation Course, *BioComplete™ Compost*, you should now have an understanding of the theory and principles of how to aerobically decompose organic material while creating the ideal environment for beneficial organisms to thrive in. This will allow you to successfully make the kinds of BioComplete™ Compost most appropriate for the plants you wish to grow. In this next Dr. Elaine's™ Soil Food Web Foundation Course, *BioComplete™ Liquid Amendments*, you will be guided through the practical skills needed in order to extract and multiply the microorganisms from a solid BioComplete™ Compost material into a liquid form. The various methods for applying the BioComplete™ Liquid Amendments will also be examined here.

Foundation Course 3 will also highlight the advantages of using BioComplete™ Liquid Amendments, rather than solid amendments. The distinctions between extracts and teas are clarified during this course.

We wish you all the best as you continue on with Foundation Course 3.

Dr. Elaine's™ Soil Food Web team!

HOW TO USE THIS MANUAL

Used in conjunction with the series of online lectures, Dr. Elaine's™ Soil Food Web Foundation Course Manual provides the following:

- Overview of the lecture
- Lecture Contents containing Key Points that clarify and/or support information delivered in each lecture. *Please make sure you read these before watching each lecture!*
- Glossary of key words, terms and abbreviations used in each lecture
- References and Further Reading

On-screen prompts: During the online video lectures you will occasionally see information popups. These on-screen prompts will refer you to:

- Other sections of this course
- Key Points that are found in this Course Manual

Time references: These appear in this Course Manual:

- After **Key Points**, for example, "**Key Points: [34:18]**" - this indicates the time in the online video at which Dr. Ingham mentions a particular topic or concept. The information in the Key Points sections of the Course Manual will help you better understand these topics and concepts.

BEFORE WATCHING EACH LECTURE YOU WILL NEED TO DO THE FOLLOWING:

- Read through the section of the Course Manual for that lecture.
- Review the Course Glossary for the terms that are listed in the lecture.
- Review the relevant Appendices for the lecture.

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LECTURE 1

Lecture 1: DEFINITIONS (PART 1) [51:05]

1.0 OVERVIEW

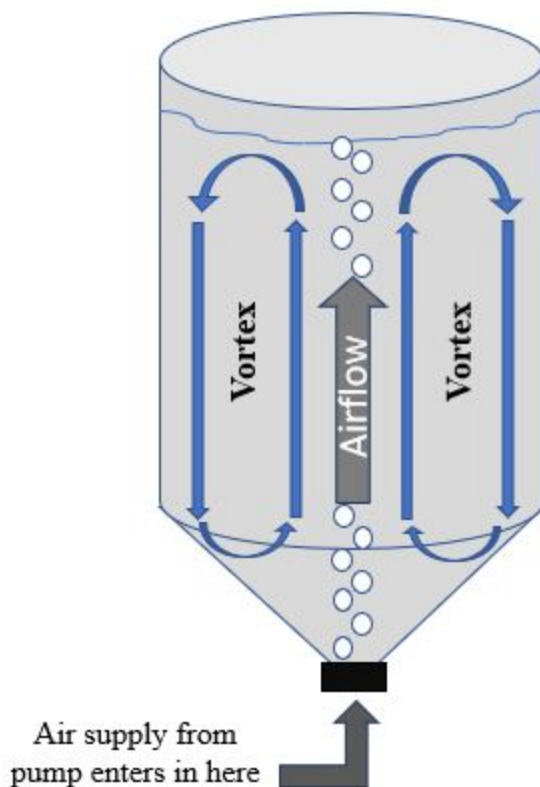
Lecture 1 covers the general overall concept defining BioComplete™ Extract and Tea, along with what the difference is between an extract versus a tea. Guidelines for the recommended requirements and functioning of your Brewer equipment are given, for when you are getting ready to purchase one or use one.

1.1 LECTURE CONTENTS

1.1.1 Definition of an Extractor/Brewer and the basic guideline requirements for using one to make a BioComplete™ Extract or Tea

1.1.2 **Key Point [6:04]** Description of a vortex created within a conical tank

Image 1



Air is pumped in through the bottom of a conical tank. The air bubbles travel up through the center of the tank pulling water along with it as it travels to the surface. Once reaching the top of the water's surface, the air bubbles pop and the water gets pushed away from the center and moves towards the sides of the tank. After the water hits the sides of the tank, it flows down the tank wall and gets pulled back up through the center with the air bubbles again repeating the cycle. This movement is called a vortex and is efficient at oxygenizing the water and is gentle on the microorganisms.

1.1.3 *BioComplete™ Trademark Defined*

BioComplete™ – This is a trademark term that we use to describe soil amendments that meet the minimum biological requirements as defined by Dr. Ingham (See Tables 1-3 below). You will hear Dr. Ingham referring frequently throughout the lectures to the terms in the table below:

Table 1

<i>BioComplete™ Compost</i>	Organic matter that has been aerobically composted, and meets the minimum biological requirements as defined by Dr. Ingham.
<i>BioComplete™ Extract</i>	A liquid extraction that has been made using <i>BioComplete™ Compost</i> , and that meets the minimum biological requirements as defined by Dr. Ingham.
<i>BioComplete™ Tea</i>	<i>BioComplete™ Extract</i> that has been through the brewing process, and meets the minimum biological requirements as defined by Dr. Ingham.
<i>BioComplete™ Vermicompost</i>	Organic matter that has been aerobically composted using vermiculture, and meets the minimum biological requirements as defined by Dr. Ingham.
<i>BioComplete™ Amendments</i>	A collective term used to refer to <i>BioComplete™ Composts, Extracts & Teas</i> .
<i>BioComplete™ Liquids</i>	A collective term used to refer to <i>BioComplete™ Extracts & Teas</i> .

Table 2 - Minimum Biological requirements for *BioComplete™ Compost*

Bacterial Biomass	300 µg/g compost
Fungal biomass	300 µg/g compost
F:B ratio	Equal to or greater than 0.3:1
Protozoa	10,000/g compost
Beneficial Nematodes	100/g compost

Ciliates	must be less than 5/drop at 1:5 dilution
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Table 3 - Minimum Biological requirements for BioComplete™ Liquids

Bacterial Biomass	300 µg/ml liquid
Fungal biomass	300 µg/ml liquid
F:B ratio	in <i>BioComplete™ Tea</i> : equal to or greater than 0.3:1 (lower for <i>BioComplete™ Extract</i>)
Protozoa	10,000/ml liquid
Beneficial Nematodes	100/ml liquid
Ciliates	must be less than 5/drop at 1:5 dilution

1.1.4 BioComplete™ Extracts and Teas MUST BE AEROBIC throughout the entire production process

1.1.5 Brief overview of the process for making a BioComplete™ Extract

1.1.6 Brief overview of the process for making a BioComplete™ Tea

1.2 GLOSSARY TERMS *(Please refer to the glossary on page 21)*

The following glossary terms are used in this lecture: **Aquifer; Neutralize; Phosphoric Acid; Vortex**(singular)/**Vortices**(plural).

1.3 REFERENCES & FURTHER READING

Green Pro Solutions, LLC - Dirt Simple™ Compost Tea Brewer

<http://www.greenprosolutions.co>

LECTURE 2

Lecture 2: DEFINITIONS (PART 2) [33:25]

2.0 OVERVIEW

Lecture 2 gives the definitions of liquid form materials that are often compared to and confused with BioComplete™ Extracts and Teas. Dr. Ingham goes into great depth in this lecture to give you a better understanding of the differences between these materials and BioComplete™ Extracts and Teas.

2.1 LECTURE CONTENTS

- 2.1.1 Definition of a Leachate and how it compares to a BioComplete™ Extract or Tea
- 2.1.2 Definition of a Plant Tea and how it compares to a BioComplete™ Extract or Tea
- 2.1.3 Definition of a Fermented Tea and how it compares to a BioComplete™ Extract or Tea
- 2.1.4 Definition of a Manure Tea and how it compares to a BioComplete™ Extract or Tea
- 2.1.5 Definition of a Put-to-Sleep Tea and how it compares to a BioComplete™ Extract or Tea
- 2.1.6 Explanation of why and how BioComplete™ Extracts and Teas are applied differently from each other
- 2.1.7 Assurance of success when using biology to alter the soil or plant's health

2.2 GLOSSARY TERMS *(Please refer to the glossary on page 21)*

The following glossary terms are used in this lecture: **Biodynamic; Hydroponics; Hydroponic System.**

LECTURE 3

Lecture 3: GENERAL CONCEPTS (PART 1) [53:06]

3.0 OVERVIEW

Lecture 3 explains that, when making a BioComplete™ Tea, the addition of foods is necessary in order to increase the populations of aerobic microorganisms effectively. The foods to be used must be carefully selected based on the desired effect on the Fungal:Bacterial ratio and several other factors.

3.1 LECTURE CONTENTS

3.1.1 Quick review of bacterial and fungal foods

3.1.2 Testing bacterial and fungal foods for use in BioComplete™ Teas

3.1.3 Visual assessment and comparison of different compost that may be used to produce an extract or tea

3.1.4 Checking and diluting salt levels and preservatives in bacterial and fungal foods

3.1.5 Understanding the F:B ratio in bacterial and fungal foods

3.1.6 Development of BioComplete™ Tea recipes

3.1.7 Understanding the effects of biology biomass levels in the compost that is used to make BioComplete™ Extracts and Teas

3.2 GLOSSARY TERMS *(Please refer to the glossary on page 21)*

The following glossary terms are used in this lecture: **Blackstrap Molasses; Coffee Filter; Impinge; Molecular Weight; Surface Tension; Tertiary Structure; Waring Blender.**

LECTURE 4

Lecture 4: GENERAL CONCEPTS (PART 2) [42:43]

4.0 OVERVIEW

Lecture 4 covers more of the general concepts associated with producing a BioComplete™ Liquid Amendment, such as: existing soil conditions, environmental factors, microorganism diversity, water quality, and temperature. It is critically important to know this information before making a BioComplete™ Extract or Tea.

4.1 LECTURE CONTENTS

- 4.1.1 Review of the dynamic relationships between predators and prey in the soil food web
- 4.1.2 Understanding the conditions of the land you are working to regenerate
- 4.1.3 Microorganism diversity and its importance to the soil food web
- 4.1.4 Assessing water quality and how to deal with detrimental water issues
- 4.1.5 Guidelines for the quality of water used in making a BioComplete™ Extract or Tea
- 4.1.6 Temperature guidelines for both brewing and applying a BioComplete™ Tea

4.2 GLOSSARY TERMS *(Please refer to the glossary on page 21)*

The following glossary terms are used in this lecture: **Activated Charcoal; Diurnal; Morphological Identifications; Stone Fruit.**

LECTURE 5

Lecture 5: GENERAL CONCEPTS (PART 3) [53:38]

5.0 OVERVIEW

The first part of lecture 5 focuses on the critical importance of aeration. In the second half of the lecture, Dr Ingham discusses the use of certain microorganisms as biocontrol agents. These can be employed in certain circumstances to tackle particularly bad pest or disease problems.

5.1 LECTURE CONTENTS

- 5.1.1 Review of oxygen levels versus activity of beneficial/detrimental microorganisms
- 5.1.2 Aeration and the effects that it has on the type of microorganisms present
- 5.1.3 Biocontrol organisms that can be used when making extracts and teas

5.2 GLOSSARY TERMS *(Please refer to the glossary on page 21)*

The following glossary terms are used in this lecture: ***Bacillus thuringiensis***; ***Beauveria***; **Boll Weevil**; **Bromine**; **Carbon Dioxide Probe or Sensor**; **Entomopathogenic**; **Exoskeleton**; **Genera**; ***Gliocladium sp.***; **Glyphosate**; **Lepidopteran**; **Nicotinoid**; **Oxygen Probe or Sensor**; **Parasitize**; ***Pseudomonads***; **Root Grub**; ***Steinernema***; ***Trichoderma sp.***

LECTURE 6

Lecture 6: MAKING BIOCOMPLETE™ EXTRACTS & TEAS (PART 1) [59:54]

6.0 OVERVIEW

Lecture 6 is the first of 3 lectures covering the topic of how to make BioComplete™ Liquid Amendments. In this lecture, the main focus is on the extraction techniques used to obtain the best results, and how to manage situations when the starting compost doesn't meet the minimum biological requirements. The techniques in this lecture are relevant not only for extracts, but also for making teas as you will use these same techniques during the first steps of producing a batch of tea. These detailed demonstrations provide you with a lecture which you will want to refer back to and watch many times to become proficient in making extracts and teas.

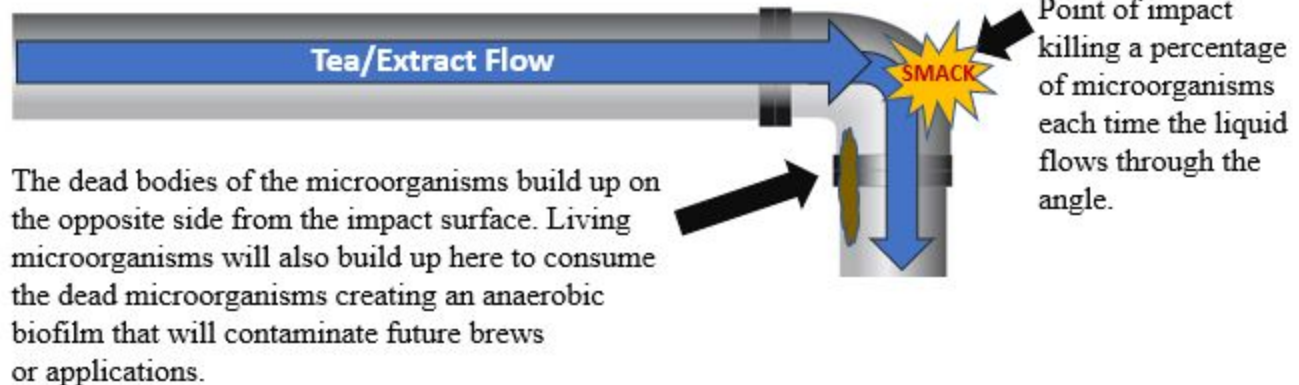
6.1 LECTURE CONTENTS

6.1.1 Overview of the extraction process of microorganisms from compost

6.1.2 **Key Point [4:16]**

Image 2

90 Degree Angle in a Brewer/Spray Equipment



6.1.3 Hand massage extraction technique

6.1.4 Brewer extraction technique

6.1.5 Demonstration of extraction using a brewer

6.1.6 **Key Point [38:23]** - Correction: Dr. Ingham is referring to the air valve on the top of the brewer and it allowing the exchange of oxygen between the tank and the atmosphere, and not to allow water out of the valve when extracting or brewing.

6.1.7 Demonstration of extraction using hand massage

6.2 GLOSSARY TERMS *(Please refer to the glossary on page 21)*

The following glossary terms are used in this lecture: **Auger; Weft.**

LECTURE 7

Lecture 7: MAKING BIOCOMPLETE™ EXTRACTS & TEAS (PART 2) [56:32]

7.0 OVERVIEW

Lecture 7 delves deeper into understanding the recommendations for your equipment, and pointers for what to avoid when buying a brewer. Here you will also see many examples of different types and styles of brewers for all sizes of scale of agriculture. The avoidance of the build-up of biofilm is an important factor to consider when selecting this equipment.

7.1 LECTURE CONTENTS

7.1.1 Additional recommendations and things to avoid when buying a brewer.

7.1.2 Biofilm - What is it? How to avoid it. And how to deal with it when it occurs in a brewer.

7.1.3 Examples of different types of brewers and set-ups

7.2 GLOSSARY TERMS *(Please refer to the glossary on page 21)*

The following glossary terms are used in this lecture: **Airstone; Disc Diffuser; Entrain Oxygen; Fusarium sp.; Neoprene; Torus Vortex; Venturi/Venturi Effect.**

7.3 REFERENCES & FURTHER READING

Biologic Crop Solutions

<http://livebiologic.com/>

Vital Garden Supply Tea Brewer

<https://vitallandscaping.com/product/vital-tea-brewers/>

Jolly Farmer

<https://www.jollyfarmer.com/>

LECTURE 8

Lecture 8: MAKING BIOCOMPLETE™ EXTRACTS & TEAS (PART 3) [1:03:08]

8.0 OVERVIEW

Lecture 8 is the 3rd lecture in this series on the subject of making BioComplete™ Liquid Amendments. The many variables to be taken into consideration when brewing tea are analysed. This lecture then concludes with demonstrations of making and brewing tea, a protozoan infusion, and cleaning a brewer after completing an extract or tea. Again, this is a lecture which you will want to re-watch several times in order to perfect your tea making techniques.

8.1 LECTURE CONTENTS

8.1.1 Guidelines on proper cleaning of your brewers

8.1.2 Consideration of the variations in aeration, food, and temperature when making a tea

8.1.3 Demonstration of making and brewing a tea

8.1.4 **Key Point [22:03]** Correction: Dr. Ingham accidentally said a 5 gallon brewer instead of a 500 gallon brewer. Please refer to the table below for examples of suggested amounts of compost to use in different brewer sizes. Remember: the quantity of compost used in the brewer will always be adjusted depending on the amount of biology in the compost you will be using to make the brew, and the specific biology in the area where you intend to apply the tea.

Table 4

Gallons	5	10	30	50	100	500	1000
Suggested Rate of BioComplete™ Compost (lbs.)	0.5-1	1-2	2-3	3	4-5	7-15	15-30

8.1.5 **Key Point [24:15]** Correction: Dr. Ingham accidentally said 10 pounds instead of 10 gallons at this point in the demonstration.

8.1.6 **Key Point [25:09]** - Additional foods to use in tea brews - See **Appendix 1**

8.1.7 Demonstration of a Protozoan Infusion

8.1.8 Demonstration of cleaning a brewer

8.2 GLOSSARY TERMS *(Please refer to the glossary on page 21)*

The following glossary terms are used in this lecture: **Barometric Pressure; Humate.**

8.3 REFERENCES & FURTHER READING

Merlin Organics

<http://gomerlinorganics.com/>

LECTURE 9

Lecture 9: APPLICATION METHODS (PART 1) [42:19]

9.0 OVERVIEW

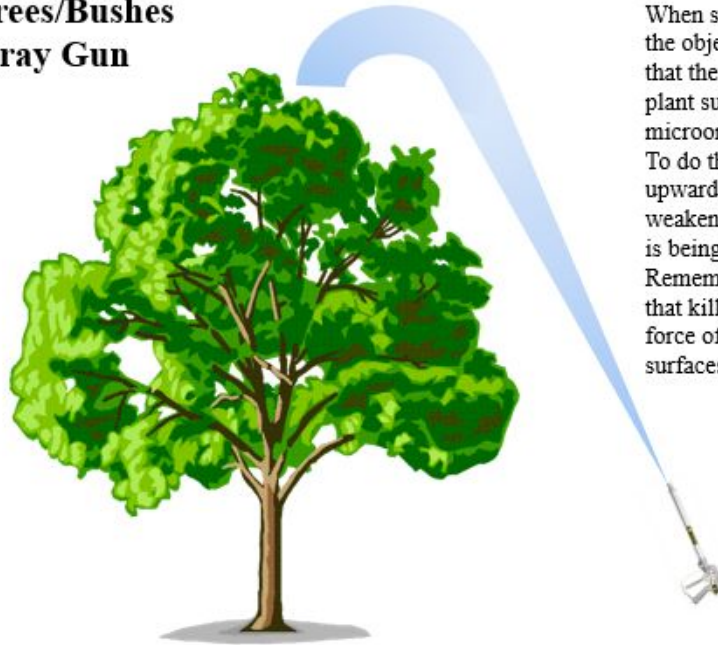
Lecture 9 is the beginning of a 3 part lecture series on the topic of BioComplete™ Liquid Amendment *application methods*. This lecture focuses on the many different ways to apply a BioComplete™ Tea along with the guidelines of a wide range of equipment options for various scales of operation.

9.1 LECTURE CONTENTS

- 9.1.1 Example of BioComplete™ Tea being used to treat needle cast on a Christmas tree farm
- 9.1.2 Benefits of BioComplete™ Liquid Amendment applications
- 9.1.3 Examples of different types of application methods for applying a BioComplete™ Tea
- 9.1.4 Examples of acceptable nozzles to use when spraying a BioComplete™ Tea
- 9.1.5 Time of day for spray applications
- 9.1.6 Water source considerations when making extracts and teas
- 9.1.7 Spray application pressure and coverage guidelines
- 9.1.8 Example of spraying large trees or bushes

Image 3

How to Spray Large Trees/Bushes with a Handheld Spray Gun



When spraying large trees or bushes, the object is to angle the spray gun so that the tea will gently land on the plant surfaces without killing the microorganisms from impact. To do this, you must aim the spray gun upwards to create an arching pattern to weaken the pressure of the tea while it is being projected through the air. Remember that it is not the pressure that kills the microorganisms but the force of the impact when it hits the surfaces.

9.2 GLOSSARY TERMS *(Please refer to the glossary on page 21)*

The following glossary terms are used in this lecture: **Antibody; Antigen; Antigen-Antibody Interactions; Attenuate; Chemical Drift; Fertigation; Ultraviolet.**

9.3 REFERENCES & FURTHER READING

Gro-King Garden Sprayers™

<https://www.gro-king-sprayers.com/>

LECTURE 10

Lecture 10: APPLICATION METHODS (PART 2) [55:17]

10.0 OVERVIEW

Lecture 10 starts off with a case study in a vineyard where a trial was held to assess the percentage foliar coverage required to protect plants from a serious and common fungal disease. Examples of different types of equipment that can be used for BioComplete™ applications are given. The lecture finishes with a demonstration of a mid-sized sprayer applying BioComplete™ Tea to trees and bushes.

10.1 LECTURE CONTENTS

10.1.1 Case study of BioComplete™ Tea application for the prevention of a serious fungal disease.

10.1.2 **Key Point [1:19]** The term “Field of View” (aka FoV) refers to the observable area a person can see using an optical device; in this case a microscope. In this example, Dr. Ingham is referencing calculation of the percentage of coverage of either of the *Botrytis cinerea* or BioComplete™ Tea by using the FoV method.

10.1.3 When to apply an extract versus a tea

10.1.4 **Key Point [12:50]** Correction: Dr. Ingham accidentally refers to using a tea as a soil drench. As discussed in previous lectures, teas contain active glue producing organisms that make them ideal for adhering onto surfaces upon contact, thus teas are recommended as foliar applications when you desire coverage on surfaces for protection. In extracts, the organisms are not reproducing actively so the glues are not being produced; this is why extracts are recommended for soil drenches or injections so that the organisms can seep further into the soil without sticking to the aggregates and organic matter.

10.1.5 General recommendations for application according to the seasons, for time of year, type of crop, and crop life cycle

10.1.6 Examples of equipment and different types of applications

10.1.7 Demonstration of a mid-size sprayer and application

10.2 GLOSSARY TERMS *(Please refer to the glossary on page 21)*

The following glossary terms are used in this lecture: **Apple Scab; Botrytis cinerea; Drip Emitter; Flange; Imbibe; Pivot.**

LECTURE 11

Lecture 11: APPLICATION METHODS (PART 3) [46:52]

11.0 OVERVIEW

Lecture 11 explores an in-depth case study of “the Biological versus the Conventional Approach” to soil management which was conducted at a dairy cow farm in New Zealand. Further information on the topic of perennial crops is given together with an explanation of why these plants are so important. This lecture finishes with a summary of the ways to achieve success using biology to grow healthier more productive plants.

11.1 LECTURE CONTENTS

11.1.1 Case Study on dairy cow pasture’s from New Zealand

11.1.2 Perennial cover plants and their importance

11.1.3 Summarizing ways to achieve success

11.2 GLOSSARY TERMS *(Please refer to the glossary on page 21)*

The following glossary terms are used in this lecture: **Boron; Cobalt; Facial Eczema; Herbage; Molybdenum; Selenium; Sul-Po-Mag; Sward; Switcher Nematode; Urea.**

11.3 REFERENCES & FURTHER READING

Hill Laboratories NZ

<https://www.hill-laboratories.com/>

AgFirst Consultants NZ Ltd

<https://www.agfirst.co.nz/about/>

COURSE GLOSSARY

Activated Carbon - charcoal that has been heated, or otherwise treated, to increase its adsorptive power and surface area.

Airstone - a type of air filtration commonly used in aquariums, aquaculture, and hydroponics (traditionally made of limewood or porous stone), used to diffuse oxygen gradually into the water, and thereby reducing the noise and size of bubbles in conventional air filtration systems.

Antibody - any of a large variety of proteins normally present in the body, or produced in response to an antigen which it neutralizes, thus producing an immune response.

Antigen - any substance (such as an immunogen or a hapten) foreign to the body that evokes an immune response either alone or after forming a complex with a larger molecule (such as a protein) and that is capable of binding with a product (such as an antibody or T cell) of the immune response.

Antigen-Antibody Interactions - are non-covalent and reversible interaction, formed by a combination of hydrogen bonds, hydrophobic interactions, electrostatic and van der Waals forces.

Apple Scab - a disease of apple trees caused by a fungus (*Venturia inaequalis*) which produces dark blotches or lesions on the leaves, fruit, and sometimes the young twigs.

Aquifer - a body of permeable rock which can contain or transmit groundwater.

Attenuate - to reduce or weaken the force, effect, or value of something.

Auger - various tools with a helical bit or shaft for boring holes, such as a drill bit in the ground, or for moving loose material.

Bacillus thuringiensis - a Gram-positive, soil-dwelling bacterium, often used as a biological pesticide. Commonly referred to as Bt.

Barometric Pressure - another term for atmospheric pressure; which is the pressure exerted by the earth's atmosphere at any given point.

Beauveria - a genus of imperfect fungi (order Moniliales) categorized as an entomopathogenic fungi species.

Biodynamic - a system of farming that follows a sustainable, holistic approach, which uses only organic, usually locally-sourced materials for fertilizing and soil conditioning; views the farm as a closed, diversified ecosystem, and often bases farming activities on lunar cycles.

Blackstrap Molasses - a dark, viscous liquid that is a byproduct of table sugar production from either beets or raw sugarcane.

Boll Weevil - a small gray or brown weevil (*Anthonomus grandis*) of southern North America and Central America that damages cotton crops by laying eggs in and feeding on buds and bolls.

Boron - a chemical element with the symbol B and atomic number 5, a nonmetallic solid found in nature.

Botrytis cinerea - called gray mold, this is a serious plant pathogen; an imperfect fungus forming botryoidal conidia.

Bromine - a non-metallic halogen element that is isolated as a deep red, corrosive, toxic, volatile liquid of disagreeable odor, with a chemical element symbol of Br and an atomic number of 35.

Carbon Dioxide Probe or **Sensor** - an instrument for the measurement of carbon dioxide gas.

Chemical Drift - the airborne movement of chemicals such as pesticides from an area of application to any unintended site.

Coffee Filter - a filter (usually paper) used to run water through ground coffee, while retaining the coffee grounds.

Cobalt - a chemical element with the symbol of Co and atomic number 27, a hard silvery-white magnetic metal.

Disc Diffuser - an aeration device (typically in the shape of a disc, tube, or plate) which is used to diffuse air and oxygenate a liquid. Also known as an air diffuser or membrane diffuser.

Diurnal - having to do with the day - night shift.

Drip Emitter - irrigation devices; that connect to a drip line or hose that deliver water to specific areas or plants at a very slow, consistent rate.

Entomopathogenic - (*Biology*) an organism that consumes or causes the death of insects, e.g. entomopathogenic nematodes or fungi.

Entrain Oxygen - to draw in and transport oxygen by the flow of a fluid.

Exoskeleton - (*Zoology*) a rigid external covering, or skeleton, of the body in invertebrate animals, especially arthropods, providing both support and protection.

Facial Eczema - a disease that mainly affects ruminants such as cattle, sheep, deer, goats and South American camelids.

Fertigation - the injection of fertilizers into an irrigation system to deliver soil amendments, water amendments, and other water-soluble products.

Flange - a projecting flat rim, collar, or rib on an object, serving to strengthen or attach or (as on a wheel) to maintain position on a rail.

Fusarium sp. - any of a genus (*Fusarium*) of ascomycetous fungi; having curved septate conidia, and which includes forms that are important agents of plant disease, and others that produce mycotoxins implicated in human and animal disease. Also can cause plant diseases such as wilt or dry rot.

Genera - plural of genus; a principal taxonomic category, ranking above species and below family; denoted by a capitalised Latin name, e.g. *Bacillus*.

Gliocladium sp. - a genus of fungi resembling those of the genus *Penicillium*, but with the conidia of a spore head surrounded by a slimy deposit that binds them into a rounded mass. *Gliocladium* colonizes living plants as an endophyte, digests material in soil as a saprophyte, and is also known as a parasite of other fungi and of some nematodes.

Glyphosate - a synthetic compound which is a non-selective systemic herbicide; particularly effective against perennial weeds.

Herbage - the succulent part of herbaceous vegetation, used as pasture.

Humate - synonym of humic acids, e.g., citric acid and citrate.

Hydroponics - a method of growing plants without soil, using water based mineral nutrient rich solutions.

Hydroponic System - the tools and equipment that operate together in order to grow plants hydroponically.

Imbibe - (Botany) (especially of seeds) absorb (water) into ultra-microscopic spaces or pores.

Impinge - have an effect or impact, especially a negative one.

Lepidopteran - (*Entomology*) an order of insects that comprises butterflies and moths.

Molecular Weight - the ratio of the average mass of one molecule of an element or compound to one twelfth of the mass of an atom of carbon-12.

Molybdenum - a chemical element with the symbol Mo and atomic number 42, a brittle silver-gray metal of the transition series, used in some alloy steels.

Morphological Identification - using the size, shape, and structure of an organism to assist in identification.

Neoprene - a synthetic polymer resembling rubber, resistant to oil, heat, and weathering.

Neutralize - to make (an acidic or alkaline substance) chemically neutral.

Nicotinoid - any of a class of systemic water-soluble insecticides (such as imidacloprid) that are chemically related to nicotine; used especially in agriculture to control destructive pests (such as aphids and mites) and that selectively bind to the postsynaptic nicotinic receptors of insects to produce paralysis and death.

Oxygen Probe or **Sensor** - an electronic device that measures the proportion of oxygen saturation or dissolved oxygen (DO) in a gas or liquid.

Parasitize - infest or exploit (an organism or part) as a parasite.

Phosphoric Acid - (*Chemistry*) a weak acid with the chemical formula H_3PO_4 .

Pivot - (*Agriculture*) a large overhead irrigation system with a mechanical drive to propel it around a central point, thereby watering crops in a circular pattern.

Pseudomonads - (*Microbiology*) any of a genus (*Pseudomonas*) of gram-negative, rod-shaped, motile bacteria; including some that produce a greenish fluorescent water-soluble pigment and some that are saprophytes or plant or animal pathogens.

Root Grub - a general term for a soft thick worm-like larva of an insect (such as a beetle) that is often found around the roots of a plant.

Selenium - a chemical element with the symbol Se and atomic number 34, a gray crystalline nonmetal with semiconducting properties.

Steinernema - an entomopathogenic nematode of the family *Steinernematidae*. It is a parasitic roundworm that has independently formed an insect-killing symbiosis with bacteria.

Stone Fruit - a fruit with flesh or pulp enclosing a stone, such as a peach, plum, or cherry.

Sul-Po-Mag - a soluble mineral commercial fertilizer of sulfate of potash-magnesia (langbeinite). Also known as K-Mag NATURAL.

Surface Tension - the tension of the surface film of a liquid; caused by the attraction of the particles in the surface layer by the bulk of the liquid, which tends to minimize surface area. A property of liquids arising from unbalanced molecular cohesive forces at or near the surface, as a result of which the surface tends to contract and has properties resembling those of a stretched elastic membrane.

Sward - an expanse of short grass or the upper layer of soil, especially when covered with grass.

Switcher Nematode - nematodes that can consume fungal hyphae or plant roots. Most of these species will mainly consume fungi as long as there is an adequate food supply, otherwise they may attack root systems causing detrimental effects to plants.

Tertiary Structure - a structure of a biological molecule (such as proteins and nucleic acids) with a specific three dimensional arrangement as defined by the atomic coordinates.

Torus Vortex - a vortex ring; a region formed in a fluid or gas where the fluid mostly spins around an axis line that forms a closed loop. Also known as a vortex ring or a toroidal vortex.

Trichoderma sp. - a genus of fungi that is present in all soils; in the family Hypocreaceae, and containing many species and strains, of which some are saprophytic, while others are parasites of other fungi.

Ultraviolet - of or relating to sunlight or a light bulb that emits ultraviolet radiation.

Urea - a soluble weakly basic nitrogenous compound $\text{CO}(\text{NH}_2)_2$ that is the chief solid component of mammalian urine and an end product of protein decomposition, is synthesized from carbon dioxide and ammonia, and is used especially in synthesis (as of resins and plastics) and in fertilizers and animal rations.

Venturi/Venturi Effect - the reduction in fluid pressure that results when a fluid flows through a constricted section of a pipe.

Vortex(singular)/**Vortices**(plural) - where the flow in a liquid or gas rotates around an axis line, which may be straight or curved.

Waring Blender - a common appliance used to chop/blend/mix substances for the home, foodservice and laboratory industries.

Weft - (*Mycology*) the crosswise entanglement of multiple strands of fungal hyphae forming the appearance of a netlike mass.

REFERENCES FURTHER READING & LINKS

AgFirst Consultants NZ Ltd

<https://www.agfirst.co.nz/about/>

Biologic Crop Solutions

<http://livebiologic.com/>

Green Pro Solutions, LLC - Dirt Simple™ Compost Tea Brewer

<http://www.greenprosolutions.co>

Gro-King Garden Sprayers™

<https://www.gro-king-sprayers.com/>

Hill Laboratories NZ

<https://www.hill-laboratories.com/>

Jolly Farmer

<https://www.jollyfarmer.com/>

Merlin Organics

<http://gomerlinorganics.com/>

Vital Garden Supply Tea Brewer

<https://vitallandscaping.com/product/vital-tea-brewers/>

APPENDIX 1 - Additional foods to use in tea brews

***These are suggested rates, always test foods in your brewer system and adjust for best results. ***

Product Name/Company	Group Fed	Application Rate per 50 gal (200 L) of water
Bacterial		
Simple Sugars	Bacteria at low concentrations, Fungi at high concentration (syrup)	60 ml (1 tablespoon) to 0.1 L (1 tsp.)
Kelp	Bacterial foods, Fungal surfaces	0.01 to 0.1
Fungi		
Fish Hydrolysate	Fungi, important to have bones, scales, and cartilage liquefied using enzymes, not heat or acid	0.01 % to 0.1 % add carefully, can drive teas anaerobic
Fruit Pulp	Fungi and Bacteria	0.01 to 0.1 %; test in your system to determine
Humic Acids - Dry	Fungi (as humics are broken down, then bacterial food is released)	1 to 15 oz, depending on product
Humic Acids - Liquid	Fungi (some bacteria)	600 ml (1 pint) to 0.1 gal (0.4 L)
Protein Meals / Soybean meal, Oatmeal, Barley Meal, Feather Meal, etc.	Fungi	Test in your system
Spices / Garlic, Orange Oil, Citrus, Cinnamon, Lemon	Inhibitors of specific microbial groups	Test in your system
Enzymes, e.g. break down chitin and cellulose	Fungi	See package for details for suggested rates
Yeast (brewers, bakers, wine)	Complex mix of proteins, minerals	Test in your system