



BY DR. ELAINE INGHAM

FINDING THE RIGHT BALANCE

WHAT DO YOU MEAN, HEALTHY?

Health claims for chemical additives misrepresent how tests work

Bacteria, fungi, protozoa, nematodes and microarthropods need to be balanced in the soil to make different plant species thrive. These balances have been observed in soils all over the world where plants grow without pesticides or inorganic fertilizers.

As one might expect, chemical companies take exception to the work that the “non-toxic-chemical world” is doing, most likely because these companies stand to lose a great deal of money. A recent development in this on-going interaction is that certain scientists have written articles claiming that toxic chemicals and synthetic fertilizers do not kill organisms in the soil. They even claim that there is an increase in numbers of individuals of bacteria in the soil following pesticide use.

These statements are based on a lack of understanding of what these microbiological methods actually measure. Also, if pesticides don't actually reduce the number of individuals of at least some species of microorganisms in soil, then what is the point of using them?

What is the real question that is being addressed?

Do pesticides and inorganic fertilizers decrease bacteria, fungi, protozoa, nematodes or microarthropods in the soil? Remember, ALL the parts of the system are important. Not just bacteria, or just fungi. If bacterial numbers are increased, that is not adequate assessment of the full food web.

Reducing one part of a system may not immediately lead to a clear problem, but

sooner or later the problem will become apparent if the missing part is significant enough. A single application of a toxic material may not kill you. It may be the second, third or fourth. Maybe it needs to be in conjunction with some other chemical before the damage really begins to occur.

Therefore, the more we can maintain the whole healthy set of organisms in a system, the more likely it is that the system will remain sustainable.

When a pesticide is used, it has to reduce the number of individuals organisms in the soil that it's supposed to kill, or else why use the pesticide? So, the statement that increases in organism numbers by these scientists has to be called into question.

Then again, the method they used to support their statement cannot possibly address the question that is being asked.

Problems with the 'plate count'

The method they are relying on to measure the effect of pesticides and inorganic fertilizers on “soil organisms” is the “plate count” method. This method was developed by early microbiologists – Louis Pasteur, to be specific – to grow human pathogens. That is what plate methods do very, very well. Plate methods are very good at answering “what is the effect of a pesticide or inorganic fertilizer on disease-causing organisms.”

Just a brief summary of the plate method then so we are all on the same page.

The food resources in any plate method

are limited. A defined medium is used. Defined media such as blood, tomato juice, boiled potato, extracts from soy beans plants, or cellulose from wood.

But wait, how defined is blood exactly anyway? Or the cellulose ground up and dried from a mix of trees? These materials are only “defined” based on a consistent supply that we all recognize. There is huge inconsistency between batches of these prepared media. Why does that matter? Because the growth of bacterial species is very much determined by exactly which foods are present, in what concentrations and in combination with other materials. A slight variation from batch to batch means all sorts of different bacteria or fungi could grow or not grow.

So is the increase or decrease in “all soil bacteria” touted by these authors really dependent on the effect of the pesticide, or just variation in batch to batch of the plate medium?

Do all soil bacterial species grow on media that consist of blood as the food resource? Or media that are made of boiled potato with a little sugar in addition (PDA agar, for example, the medium used for “total fungal numbers”). It might work if the question were “what are the bacteria that grow in potato soup”, but certainly not acceptable to answer the question “what fungi are present in soil”.

Re-thinking the question

Anyone using plate methods needs to re-think the scope of what they can actually state from the data collected.

The media used for any of the several

thousand recipes for plate methods are limited in the kind of food present in the dish. Pasteur used media that were meant to mimic the habitat in which diseases grow in human or animal bodies. We still use those media today. But in no way does any medium that we use mimic all the foods, all the conditions, all temperatures, oxygen levels or chemical availabilities that can occur in any soil you want to point at, much less all soils everywhere.

Consider that plate methods incubate the sample at ONE temperature, one moisture, one humidity, and limit oxygen diffusion into the plate. When you consider that, you begin to realize how silly any use of plate methods are to answer the question about “do pesticides or inorganic fertilizers affect soil organisms”.

The media used in most plate methods are extremely rich, and mimic the human body. To what purpose? To grow human pathogens, in fact.

Antibiotics are often used to limit the growth of competitors and often dyes are used to indicate the pH change brought about by facultative anaerobic bacterial growth. The majority of the species that grow on plates are organisms that require reduced oxygen in order to grow, because we put lids on the tops of these plates, which restricts oxygen diffusion into the plate. Especially as the organisms in these plates begin to grow on the very rich foods, uptake and use of oxygen, with the concomitant release of carbon dioxide, means that the majority of bacterial species that grow in the habitat set up will be pathogens, not beneficial organisms.

Just think about all that for a minute – we use one or two extremely rich food resources – how is that similar to soil? We incubate at one temperature – how is that like soil, or likely to give a good value for all the species that only grow at very limited ranges of temperature, moisture or oxygen? The mineral forms in these plates are completely un-like what the organisms in soil require. Why would most soil organisms grow on a plate in the lab?

The truth is that they do not. Less than 0.001% of all the organisms in soil will grow in lab media.

And these people claim that pesticides cause increases in soil organism numbers based on plate counts?

Which organisms are growing?

So, which organisms are being increased following application of the pesticides and inorganic fertilizers?

Plate methods grow pathogens, diseases. That is what plate methods tend to select for, although some okay species can grow in these conditions. But 99.999 percent of the actual sets of organisms in soils are “missed” by using plate methods.

Once you understand the methods being used, you can understand what actually happens when you constantly use pesticides and synthetic chemicals. A one-time use of a toxic material might not damage things too much. But how do you know?

Would plate counts give you the information you want to know? Only if you are concerned with what is happening with the organisms that grow in the specific conditions you have set up on the plate.

Plate methods tell you that toxic chemicals enhance disease organisms.

Use of pesticides and inorganic fertilizers do not leave you better off when it comes to growing plants, except for possibly a very short term reduction in one or two or ten species of disease-causing organisms. The good guys are being killed as well, but that doesn't show up on a plate.

The truth is finally coming out: the bad guys are being helped by the toxic chemicals being used. 🍀

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