

The Synergistic Effect

If plants are made up of 75% water then 25% is dry matter. This dry matter can be subdivided into 20% hydrocarbons produced by the plant itself through photosynthesis and a further 5% of trace minerals and nitrogen. Given adequate rainfall and sunlight, it becomes clear that no more than 5% of a plant's nutritional needs derive from the soil.

In conventional agriculture this 5% is lost to the soil at harvest with the removal of the crop and subsequent plowing can bury the roots so deep as to be practically unavailable to next years crop. Therefore nitrogen and trace minerals must be artificially added by means of fertilizer or another of the panoply of modern amendments.

However, by the expedient of returning all crop residues to the field as mulch – mulch should never be turned under – and by the addition of either an intercropped or winter-grown nitrogen fixing cover crop, which can provide all plant available nitrogen needs for the following seasons crop, this 5% system loss can almost be closed. Yet there will always be some loss, with the resultant long-term decline in fertility. While soil fertility is perceived as a linear, consisting of crop out - amendment in, closing the loop will remain impossible.

But soil fertility is not a static linear process. Inorganic or dead organic matter can never replace the dynamic autonomy of life. It is because plants and soil microorganisms represent a living system, complete unto itself, that Synergistic Agriculture is possible. Such an understanding is not new, neither is it a matter of belief, but a clearly expressed scientific principle:

“The principal property of soil fertility is determined by biological factors, mainly by microorganisms. The development of life in soil endows it with the property of fertility. “The notion of soil is inseparable from the notion of the development of living organisms in it.” Soil is created by microorganisms. “Were this life dead or stopped, the former soil would become an object of geology” (Vi'lyams, 1950).”

With these words NA Krasil'nikov (1958) transfers the study of soil science from Geology to Biology and announces the scientific understanding of soil's self-fertility. It is the 'Synergistic Effect' of this ecosystem that provides fertility to soil and it is only by mimicking these natural processes that farmers can enjoy sustainable benefits. Yet, 45 years later, conventional, science-based farming, supposedly involved with the growing of living organisms, has still to integrate 'life' into its cultural practices.

Work by Dr Alan Smith and Dr Elaine Ingham, have helped explain scientifically why plowing and synthetic chemical use are just so devastating to soil life and therefore fertility. As far back as 1977, reprinted in International Permaculture Journal, 1981, Dr Smith outlined the intimate connections between soil life and healthy plant growth, explaining the unique position of plants within an ecosystem transforming solar energy and making it available for other living things. However, plants as part of a complete cycle have needs that they are unable to produce themselves, he writes:

“For example, they require various elements. . . The soil is the reservoir of these elements, but to obtain adequate supplies plants must alter the environment around their roots to mobilize these nutrients.”

The main way that plants can gain access to these nutrients is by stimulating the activity of microorganisms in the rhizosphere. It is no surprise then to discover estimates of up to 25% (Dr Smith) to 50% (Dr Ingham) of total photosynthesized products from plants directed to the rhizosphere. Dr Elaine Ingham, AcresUSA (Vol.30, no.4), set out her understanding of the 'soil food web' (see www.soilfoodweb.com), expressing the dynamic relationship and what happens when conventional agricultural practices are used:

“These microbes retain large amounts of nitrogen, phosphorus, potassium, sulfur, calcium, iron and many micronutrients from being leached or removed by water runoff. Ideally, they out-compete pathogenic species and form a protective layer on the surface of living plant roots. It is usually only when the beneficial species of bacteria and fungi are killed by continuous soil disturbance and toxic chemicals that pathogenic species have an advantage.”

Because conventional agriculture does continuously disturb the soil and/or resort to 'toxic chemicals', Synergistic Agriculture recognizes the absolute importance of maintaining the soil/plant ecosystem in its entirety. Because any disturbance or imbalance will adversely affect the soil, Synergistic Agriculture rejects not only the use of inorganic chemicals and synthetic herbicides and pesticides but manures and composts too. Through concentrating on green manures and cover crops that maintain a mulch layer, and incorporating the additional beneficial effect of the commercial crop itself, Synergistic Agriculture relies on plants to feed the microorganisms, which in turn make available the nutrients that feed the plants.

If all conventional agricultural practices are dropped and a truly ecological, no-till, mulch system is established there will no longer be the need for fertilizer, pesticide or herbicides. But that is only the beginning. The rebuilding of depleted soils and their maintenance through plant succession and rotation will become the necessary focus of this new, soil-centred agriculture and a new science will have to develop alongside it because, as Dr Ingham says;

“Scientists don't fully understand the effect of any individual ingredient on soil life, much less the **synergistic effects** of the ingredients...The types of molecules released are specific for a variety of plants grown under certain conditions, forming in effect a unique chemical signature. As these molecules are released into the rhizosphere, they serve as food and growth stimulants for a certain mix of microbes...for each plant species, this characteristic chemical soup stimulates the development of a select, beneficial company of root-dwelling microbes. This microbial population colonizes the root zone, producing certain chemicals that inhibit the growth of pathogenic species. These organisms are also instrumental in supplying the plant's unique nutritional needs. The residual effects of this unique microbial population in subsequent years may also help explain why certain crop rotations work better than others.” (Emphasis added).

Emilia Hazelip was not alone in her attempts at agronomic reform, Masanobu Fukuoka began long before her and continues to this day, but as part of her agricultural legacy, Emilia has left behind her contribution to this ecological zero-till agriculture in the form of intricate rotational schemes for home and market garden vegetable growing. We would like to link up with others who recognize the importance of this work to share resources and help the adoption of these techniques founded on the principle of care of natural soil. For Emilia the connection between soil care and people care was profoundly interwoven, for, as she asked, *"How can we ever have peace on earth if we don't even have peace within the earth?"*