From the Soils Up

Do you know the difference between entropy and extropy? Entropy is the explanation of things going to their most disorderly state. Extropy is the life giving invisible force that organizes. Understanding how to put the life force back in your farm, garden, lawn, trees, flowers, and bodies is key to remediation and health. This paper is a brief look at how invisible subtle energies are assimilated and filtered through different life forms and how to assess and harness this power. Revolutionary Breakthru Technology goes beyond organic, beyond holistic to concepts that dramatically enhance food to Super Dense Nutrition and healthy robust growth.

Every organism requires its specific environment in which it can achieve optimal growth and unique reproduction. The universal invisible life force, is reflected in soils, continues in plants, to animals and humans. Unraveling the interactions has been the ultimate goal of professional scientists in the fields of agriculture, animal husbandry and human health.

This presence and power of the invisible subtle forces is that which is made manifest to us as the visible, the one inseparable of the other. Only through penetrating the reality of the invisible, this higher or multiple dimensions of life, do we begin to perceive the laws. To enter these dimensions, we must visualize the invisible forces of nature which operate to bring this phenomenon into a functioning organism. What a miracle of invisible activity has transformed a dry seed, a handful of earth, and a little water into a plant. The subtle life force, operating through the moisture in the ground, touched the seed, broke it open, and caused growth, unseen, unknown, and inexplicable. All that appears is the form and activity of that which is invisible, the visible is but the appearing in form of that which caused it and gave it life. To recognize this force of life is not separate from the organism but rather the anomaly of extropy.

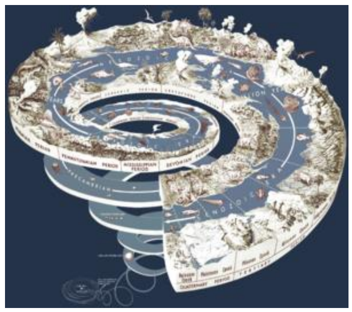
The advances in agriculture and renaissance thinking of many great men have made our present day society. A new concept is the Breakthru Technology for plants. The activity of nature is not something separate and apart from an organism, but rather a dynamic interchange of energy both visible and invisible in ever changing ecosystems. Today I wish to initiate an explanation of these factors. How this thinking will change your future, and how you can extrapolate the health and well being that is attainable.

Geological history has recorded the massive size of plants and animals in previous ages. How was this possible then and not today? Scientists tell us we have inherited these genetics yet many major corporate conglomerates are trying to manipulate the gene pool to get super plants and animals. Do we need to proceed down this path?

The short answer is, "No!" 30% of all yields are due to the genetics the other 70% is due to environmental or better yet environmental stress factors. 21st-century thinking is not the pigeon holed non-dynamic controlling thinking of a capitalist society. Are you ready to look at the alternatives?

Soil

Understanding life form relationships is the science of agronomy. Ecosystems that develop are dependant on several factors that originate on soils dependant upon longitude, latitude and altitude. The soil pedogenesis is directed further because of the influences of the parent geological material, weather, biological impacts, aspect and the natural hydrological factors of the land. In the development of a site all or a multitude of combinations of the above factors influence the changes in soil fertility and ultimately form ecosystem dynamics. Dynamics that change the ecosystem are disease resistance, plant type, macro/micro organisms and animal populations. Understanding this extropy that is being exerted on physical components is vital to success or failure of usage or remediation. Site pedogenesis or direction affects management procedures for developing uniform soil dynamics, plant and organism development.



The pre-pedogenic state determines the starting point from soil classification perspective and is only useful if significant landscaping has not occurred and the management controls the future pedogenic changes. This information of the natural fertility and soil dynamics of the site point of reference is imperative to determine next the chemical, pedogenic and agronomic changes relevant for the goals of an area.

Chemical analysis, defined by a current soil analysis, is correlated with plant tissue analysis that reflects the inherent specie transmutation of elements. The second extropy component of biochemistry.

From the Soils Up

THE MIGHTY EARTHWORM

The biologist Charles Darwin stated in his 1881 book about earthworms and humus:

"It may be doubted whether there are many other animals which have played so important a part in the history of the world as these lowly organized creatures."

Lumbricus terrestris (earthworms) have been the most neglected creatures on our earth; everywhere we hear the cries for help to save endangered species of flora and fauna, but our humble and silent earthworm has had only a handful of support. This is all slowly changing with the increased awareness of the benefits of consuming organic and bio-dynamic produce. The growers of these types of produce know that "man's best friend" does not have four legs, but is a loyal worker turning waste products into a usable fertilizer twenty-four hours a day seven days a week.

In the soil, there are two main types of earthworms. First, there are the shallow dwellers, generally living in the top six inches of the earth. These worms are your main composting ones – they devour any organic matter laying on the surface and take it below ground to the cool, moist environment where feeder roots from plants live so happily. Burrowing their way along they aerate the soil at the same time, also allowing roots to be deeper and more robust. These tunnels open the earth allowing deeper water penetration and the castings left behind act like sponges.

After these, we have the deeper burrowing ' nightcrawlers' – these sometimes rather large creatures burrow down some meters below the surface mixing soils, providing conduits reducing water-logging and overall enhancing soil fertility.

The efficiency of the earthworm lies entirely in its design. As Aristotle so rightly said, "worms are the intestines of the earth." With a few ingenious modifications, the earthworm is one long intestine. The differences include three pairs of calciferous glands, which are continually producing calcium carbonate, adding it to any food input and balancing any acidity of the food to a more neutral substance thus being able to lift pH in acidic soils, and the buffering action of carbonic acid reduces pH in alkaline soils. So, with whole armies of earthworms, a natural balance in the soil is achieved, reducing any need for limestone applications.

Through their constant burrowing into the sub-soil, earthworms gradually deepen the topsoil while also bringing essential minerals to the root zones.

The most severe problem facing modern agriculture has been the rapid decline in humus (organic carbon) levels in our soils. As reported in Appendix B Pt. l G, of the now infamous "agriculture lectures" delivered by Dr. Rudolph Steiner, that "humus and humus again should be given to the soil in every conceivable form (compost, leaf mold, etc.)". Anhydrous ammonia is the most significant threat to this humus formation, for, with even only one application of this potent substance, whole colonies of earthworms are destroyed. This practice must stop to rectify the inevitable result, which will be a completely unusable desert.

Our humble earthworm is the most efficient producer of humus, transforming up to its body weight per day of organic matter into humus.

Cover crops, manures, and compost must be added to the agricultural program. “Feed your soil, and your soil will feed your plants,” such is the cry of the organic farmer. Applying chemical fertilizer to your soil is not feeding it, but bypasses it, going directly to the plants making the soil nothing but a growing medium, destroying it and allowing pathogens and pests to proliferate.

From all this, we can say that the earthworm has an enormous impact on our soil with it’s burrowing and humus making activities, however, there are problems in re-establishing good earthworm populations in soils that have been subjected to heavy chemical treatment or those that have suffered from nutritional neglect. Merely sending in recruits to the battlefield is useless unless management practices are altered.

Zero tillage has become the norm more and more in agriculture providing a surface mulch. The use of tillage or mulching systems that leave surface waste is an important technique to increase earthworm populations. This residue protects the soil from drying out as well as protecting it from extreme temperatures, allowing the earthworms to feed and produce for longer in both spring and autumn.

Earthworms are prime indicators of soil health, but it has never been convincingly determined whether they are the instigators or merely contributors to high fertility. They positively contribute to higher levels of bacteria in the soil, but if given the opportunity to choose between an existing high beneficial microbe environment and a sterile situation, they will always gravitate to the former.

As Ehrenfried Pfeiffer, a bio-dynamic farmer who received the directions for this method of farming directly from Dr. Rudolph Steiner, states in Chapter 13 of Bio-Dynamic Gardening and Farming Vol. 2:

“Two processes are significant on the path of life which leads to the formation of organic matter. One is the reorganizing (extropy) process which all matter undergoes when it is organized by the living bodies of plants, animals, and man. The other is a breaking down which impairs and transforms “life” matter after it has been used up and fulfilled it’s task for the building up, growth and maintenance of the living organism. In nourishment, we have a special case, where outside matter (food) is broken down through digestive action and transformed into forms of matter to be used “inside” for the growth and maintenance of the body. This, however, is not a complete breaking down but fermentation. Fermentation is, therefore, a third process which stands in the middle of extropy and breaking down of organic matter (entropy) as a kind of “mediator’’.

We must think of our soil as in a constant process of evolution, fermenting, and continually transforming matter into nourishment for our living plants. To keep our soils in this mediating role requires specific numbers of beneficial bacteria and exudates. A decline in these bacteria also mean regression in pedogenesis (the mining of subsoil minerals into distinct taxonomic soil families) is ultimately changing the ecosystems and plant populations. Bacteria counts have not yet become a part of routine soil analyses, but it is hoped that in the future such vital contributions will not be overlooked.

Adding INSTAGrowth to soil creates an Eco-system for these beneficial bacteria, thus creating a worm friendly environment as well as instigating the right type of pedogenic fermentation while eliminating any putrefaction activity, which hinders healthy plant life. E. Pfeiffer goes on, “This is the secret of composting methods: to introduce such conditions of life (extropy) that no final decay or putrefaction can occur, but that the micro life of the soil resumes it’s activity, bringing about a complicated yet stable structure of organic matter. Humus is not so much a definite chemical formula but rather a state of existence of transmuted elements, transformed organic matter, and translocated nutrients connecting the soil with plant life. It is a balanced state of matter, a living organism or condition itself.”

Translocation or adding outside materials such as fertilizer to your soil is said to add elemental deficiencies or "soil food.” INSTAGrowth is a medium that allows soil food to be produced through the combined microbial fixation of elements like nitrogen from the air, the breaking down of organic matter as well as allowing for the proliferation of earthworms. INSTAGrowth is an ecosystem-balancing product providing plants and soil alike to have balanced micro and macro organisms that produce the nutritional benefits.

Encourage a large earthworm population.

- The tunnelling activity of earthworms prevents many of the conditions that weed seeds need to germinate;
- Worms often eat weed seeds and either destroy them or reduce their ability to germinate;
- Earthworms stimulate the growth of microorganisms in the soil, and microorganisms kill some weed seeds.

Some microorganisms (bacteria and fungus) live in a symbiotic relationship with plant roots and help plants grow better hence shading out weeds and out competing them for water and nutrients.

Keep soil pH near the ideal range for most plants and crops of 6.7 to 6.8 is helpful in fighting weeds. This range maximizes the nutrients available to plants and crops helping them stay healthy and outgrow and compete weeds (if a weed cannot get sunlight due to shading, it cannot make food, it will not grow well and will eventually die). This pH range also favours’ the growth of earthworms and microorganisms. Many weeds will grow well outside of this range whether alkaline or acidic.

From the Soils Up

THE EARTHWORM DIGESTIVE SYSTEM

The earthworm literally eats its way through the earth or organic material to form burrows. It goes around materials too large and hard to swallow. Small particles pass through the mouth and the cavity of the pharynx or throat, along the esophagus by the calciferous glands, which excrete chalk (calcium carbonate) thus marginally reducing acidity of the food material eventually assembling in the crop where the enzymes and bacteria controlled by the calcium carbonate solution break it down find in preparation to be treated in the gizzard, which is a sac surrounded by strong muscle where digestive juices, small grains of stone and mineral particles grind the food to enable it to pass through the intestine.

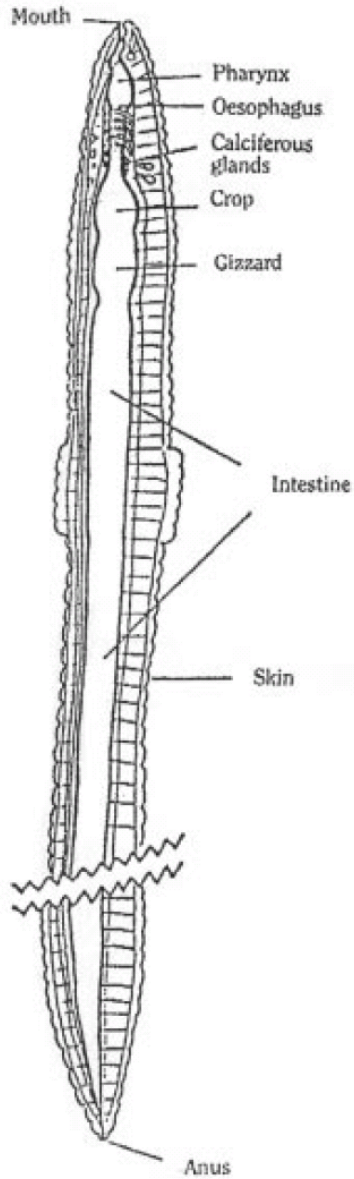
The smaller particles of food are absorbed through the intestine walls into blood capillaries and proteins and sugars are distributed to body cells while waste matter passes to the outside skin as mucous which lubricates the earthworms progress through the soil.

The undigested and larger particles of food pass through the intestines to the anus where they are excreted as nitrogen laden worm castings.

The whole process takes about 24 hours from eating to excretion. Some microorganisms from the worm's digestive tract pass out with the castings to continue the digestive process in the soil. Some of this material passes through the worm again as it repasses and repasses through the soil.

The digestive process of the earthworm is aided by bacterial action in the soil, which decays the food in a predigestion process.

Predigestion is best in slightly acid, but not strong acid, conditions.



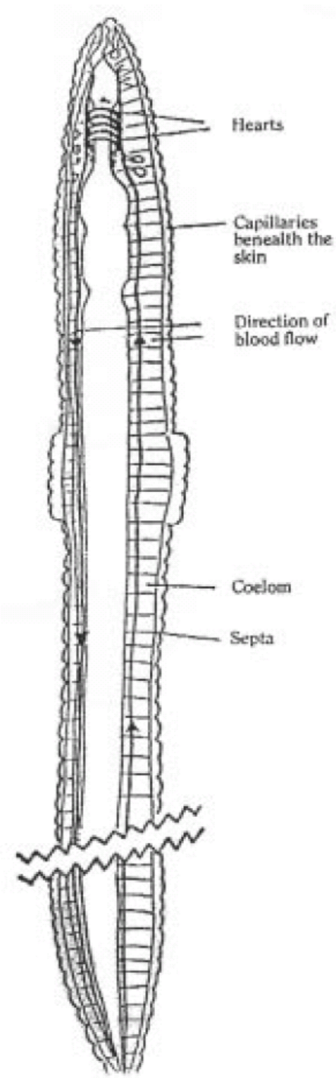
MANAGEMENT LESSON

Healthy worms require pH conditions between 6.8 and 7.2 for best digestion of food. Tiger worms will tolerate greater acidity. Worms will eat their own body weight in a day so food supply must be reliable.

WORM CIRCULATORY SYSTEMS

Earthworms have up to five hearts located at the anterior end, which pump blood to the posterior end through the main ventral blood vessel beneath the digestive tract. It returns through another larger dorsal blood vessel to the hearts. In the process the blood spreads to and from the organs and the skin through capillaries which exchange nutrition and water for waste matter.* The dorsal and ventral vessels are interconnected in most segments of the worm. The walls of the capillaries are extremely thin allowing for easy exchange of nutrition and oxygen for waste fluids and gases.

* This waste matter is a mucous secretion, which acts as a powerful wetter – sticker agent, so essential for foliar fertilizing.



MANAGEMENT LESSON

The worm circulatory system is extremely fragile so care should be exercised in handling them. Never use a spade and use forks with care.

[http://eap.mcgill.ca/Publications/eap_head.htm]

Weeds as Indicators Of Soil Conditions

by Stuart B. Hill and Jennifer Ramsay

Confronted with a weedy field or garden, one's instinctive reaction is to rush out and destroy the weeds before they take over. Perhaps we imagine them choking out our plants, or, at least, stealing the nutrients applied for our crop. This attitude towards weeds has predominated throughout history. In 110 AD Plutarch wrote "The richest soil if uncultivated produces the rankest weeds" (Lives: Coriolanus); and more recently Oscar Wilde wrote "The vilest deeds like poison weeds Bloom well in poison air" (The Ballad of Reading Gaol).

Only Lowell and Emerson have injected a ray of hope for the weed. Lowell I suggested that "A weed is no more than a flower in disguise" (A Fable for Critics); and Emerson asked, "What is a weed? A Plant whose virtues have not yet been discovered" (Fortunes of the Republic). Could weeds really have some virtues, a beneficial side to their character? It seems unlikely. Well, yes, actually weeds do have some points, in their favor. For example:

1. Many weeds protect our topsoil from the eroding forces of rain, wind, and sun, especially when the crop cover is poor.

2. By providing cover vegetation, weeds enable beneficial soil animals to be active at the surface, depositing their nutrient-rich feces and/or acting as biological control agents against various insect pests.

3. Many weeds, particularly perennials, possess extensive root systems that penetrate deep into the subsoil, breaking it up and enabling the less vigorous roots of some of our crop plants to penetrate further into the soil. Some roots, such as the leafy spurge, grow to depths of four to eight feet, whereas Canada thistle roots may penetrate to depths of 20 feet.

4. Breaking up the subsoil also improves drainage and creation.

5. Deep penetration by their roots often enables weeds to accumulate various elements from the subsoil, particularly trace elements, and transport them to the soil surface. Through the weed's subsequent death and decomposition, these elements become available to crop plants with less extensive root systems. Different "accumulator" plants concentrate different elements. Interestingly, the accumulated elements are often those in which the particular soil is deficient. Some farmers have utilized this property of certain weeds by employing them as green manure. For example, Rogers et al. (1939) found that a local case of Floridian disease in corn, called white bud, was associated with zinc deficiency and could be prevented by allowing zinc accumulator weeds to develop during fallow years.

6. Weeds that accumulate different elements have also been used by prospectors. By analyzing different parts of the plants for a high concentration of certain minerals, they have been able to determine the location of mineral deposits such as copper and selenium (Brooks, 1 9721.

7. Weeds have also been used as indicators of the presence and quality of groundwater (Chikishev, 1965).

8. In the past, weeds have often been used both as food and as pharmaceutical products. Interest in these uses and their development as resources for various industrial products is currently growing in the "developed world."

However, the primary value of weeds under consideration in this article is their ability to reveal information about the properties of our soils, particularly their nutritional status, pH, and presence of a hardpan. Frederick Clements (1920), the eminent U.S. botanist explained this property when he stated: "Each plant is an indicator. This is an inevitable conclusion from the fact that each plant is the product of the conditions under which it grows, and is thereby a measure of these conditions. As a consequence, any response made by a plant furnishes a clue to the factors at work upon it".

9. Since many weeds are "specialists" they are likely to be particularly useful as indicators. Different weeds are adapted to different ranges of environmental variables and can grow only where their particular needs are met. For example, certain species, such as knawel, are confined to acid soils, while others are limited to basic soils.

The use of weeds as soil indicators is not a new concept. In 50 AD, the great Roman scholar, Pliny the Elder observed that land supporting wild plum, elder, oak, and thimbleberry was also favorable for wheat production. Many North American immigrants chose land for their farms according to the vegetation it supported. They quickly recognized that White pine, Norway pine, Jack pine communities were characteristic of sandy soils of little agricultural value. The forests of birch, beech, maple, or hemlock indicate fertile soils.

10. It has been shown that the tall-grass prairies are suitable for orchards, cereals, hay, and fodder crops, while bunch grass regions are more suitable for wheat and grass production (Shantz 1911, Sampson 1939). Wiregrass areas are less productive and short grass communities least productive. Highly alkaline soils are unsuitable for arable use and are characterized by tussock grass, salt grass, and greasewood (Hilgard 1906).

The information on weed indicator species is poorly documented, much of it residing only in the minds of observant farmers and gardeners. In preparing the list of weeds in Table 1, numerous sources, some reliable and some undoubtedly less reliable, were consulted. Consequently, the information contained in it should be used as a basis for further observation and research rather than as a guarantee of what to expect from a soil. Before using such a table, there are several things to consider:

11. Some weeds have "ecotypes" which are nothing more than evidence of genetic ranges. Populations of a particular weed growing in different locations may differ slightly from each other in their appearance and requirements; they are referred to as "ecotypes." Thus, the ecotype of a particular weed in one area may be more tolerant of acid soil conditions than the ecotype of the same species in another area.

12. Limits of tolerance to environmental factors vary. Plants, including weeds, differ enormously in their degree of resistance to changes in soil pH, moisture content, etc.; and some have a narrow tolerance for one variable but a broad tolerance for others. The best indicators are those with small tolerances because they would only be found associated with specific conditions.

13. Plants may be sensitive to several environmental factors. When we look at Table 1, we notice that many of the plants are listed in more than one category of environmental factors. For instance, perennial sow thistle and docks are both indicators of wet areas; however, the thistle has a preference for more acid soils whereas docks are found in soils with a high lime content. Thus, when interpreting the presence of a weed, we need to know all the factors to which it is responding.

14. Perennial weeds often make better indicators than annuals. Perennial weeds, having been able to tolerate the conditions in a particular locality for more than one year, are often more reliable indicators than annuals, which may survive only one season.

15) Weed communities are better indicators than single species. The presence of a group of weeds that are associated with one another because of similar requirements for specific soil conditions provides a more reliable indicator in contrast to a single weed species, which may only indicate chance establishment.

16) Growth characteristics of a weed may be as revealing as its presence. The growth characteristics of weeds and the color of their leaves and flowers may be as important as their presence in showing information about the soil. The vigorous growth of leguminous weeds usually indicates a soil lacking in nitrogen; as does the presence of stunted non-leguminous weeds with pale green leaves. Cornflowers make particularly useful indicators as their flowers are blue when found on soils with a high lime content but are pink when they are growing on acid soils.

The observant farmer and gardener will notice subtle changes in the weed populations on his land in response to his agricultural practices. As his soil improves, he may find that chickweed, chicory, common groundsel, common horehound, and lambsquarter become the dominant weeds. However, if he discovers that the daisy, wild carrot, mugwort, common mullein, wild parsnip, wild radish, and biennial wormwood become dominant, he should review his practices as these weeds thrive on soils of low fertility. The addition of well-balanced compost, organic manures, and other fertilizers together with specific tillage and drainage practices may be required to bring the soil back into production.

We are not advocating that all weeds be encouraged indiscriminately, for even "beneficial" weeds poorly managed, will reduce yield. What we are suggesting is that by being able to on our position to manage our soils wisely. Identify the weeds land and know what their presence indicates, we will be in a better position to manage our soils wisely.

- **[http://eap.mcgill.ca/Publications/eap_foot.htm]**

The Truth About Weeds - Friend OR Foe? If we look at the origin of the word "weed," we find the Anglo-Saxon word, "weod" which means "little herb." Herbs are good plants used for healing and beneficial uses. Weeds are also intended for healing; "Weeds and Why They Grow"

Weeds are often called "Pioneer Plants," as their job in nature is to colonize poor bare soil, to provide a quick cover to prevent soil erosion.

Most weeds are annual species that produce lots of seeds that will live a long time in the soil (dormant) waiting for the right conditions to sprout.

A study in England found counts of seeds between 900 to 3,000 per square foot on cropland!

Weeds are "opportunistic," able to sprout and multiply, even in adverse weather conditions; hence they often get a jump on crops or flowers.

From the Soils Up

Weeds help improve the soil:

- Roots grow deep loosening hard compacted soil.
- Bring up useful minerals from deep soil layers.
- They scavenge and conserve nitrogen that might otherwise wash away.
- When roots and tops die, they add valuable organic matter to the soil.
- Weeds make excellent cover crops (in 6 weeks can produce 1 ton of dry organic matter).
- Weeds prevent erosion.

Some weeds are incredibly nutritious (more nutritious than common vegetables) for both livestock and humans.

Weeds serve as food for many forms of wildlife from butterflies to deer.

Many weeds provide essential pollen and nectar that beneficial insects require completing their diet.

Many weeds are useful as herbs or sources of medicine, dyes or sources of tasty wild foods.

The most troublesome weeds are imported from different countries and have run wild since the natural predators that kept them in check are not available.

Most importantly weeds are teachers. Weeds tell us about the soil conditions (indicators). All species of plants have specific environmental conditions that must be met for them to grow (soil type, moisture, nutrients, climate, etc.), weeds are no different.

Effects of synthetic fertilizer and lime, tillage, and method of recycling of crop residues and other organic matter tend to create soil conditions favorable to weeds! Other synthetic chemicals (pesticides, herbicides, fungicides, etc.) make the situation worse, resulting in more weeds.

Many weeds only grow on soils with something wrong with them. These weeds are good indicators of soil conditions. For example:

Weeds often proliferate due to excessive short-term poor weather conditions. Some weeds are better able to grow in cold, hot, wet or drought conditions. They flourish where the desired crop or plant fails.

Bad weather usually has bad effects on the soil such as crusting or waterlogging, conditions, which favour weeds (i.e., poor or wrong soil conditions favour weeds over desired plants and are the fundamental cause of weedy fields or flowerbeds).

"Don't shoot the messenger." Chemically intensive methods of gardening view weeds as a pure pest and try to wipe out the weeds with herbicides, which makes the problem worse (soil conditions more favorable to weed growth). Studies have shown that frequent use of herbicides increases the number of weeds found. Also, weeds become resistant to the toxic herbicides.

Remember - weeds are only indicators or symptoms of soil problems....IF the problem is not corrected, weeds will return in higher numbers as nature tries to fix the problem.

Many "modern" horticultural and agricultural practices such as high use of synthetic fertilizers and frequent tilling favour weeds and discourage crops.

From the Soils Up

Over 200 weed species are now resistant to strong toxic herbicides. Using dangerous synthetic chemicals to control weeds is not working.

Weeds such as prostrate spurge and chickweed, attract tiny predatory wasps that control caterpillars. Knotweed, wild carrot, and toothpick ammi also attract several species of tiny predatory wasps. These predators help keep harmful insects under control naturally.

Studies have shown that goldenrod, redroot, pigweed, ragweed, and mustard attract several species of beneficial insects upon flowering.

Studies have shown that some pest prefers to dine on weeds rather than commercial food crops IF given a choice. For example, the USDA has found that destructive leafminers prefer ragweed and redroot pigweed to bell peppers at the research lab in Weslaco, Texas.

Studies have shown that the diamondback moth will lay its eggs on wild mustard (a weed) instead of cabbage or other brassica plants if given a choice.

Many weeds produce unique dissolving substances from their root tips that allow them to literally "eat" their way through tough, compacted soils allowing for deep root growth. This feeding from deep subsoil layers returns minerals to the surface and loosens compacted soil.

Many weed species produce deep roots that recover minerals in subsoil layers. For example, leafy spurge (*Euphorbia esula*) can reach 4-8' deep and Canadian thistle (*Cirsium arvense*) can reach 20 feet deep!

Prospectors use weeds in the search for deposits of minerals like selenium or copper. Early settlers used weeds to indicate groundwater quantity and quality before digging a well.

Seldom is one weed species the result of only one soil or environmental condition. Since there are many variables involved it is better to use groups of weeds as indicators of soil problems. Note: The word "problem" is emphasized since weeds are not the problem; it is the poor condition of the soil that is the problem.

Some weeds that are easily cultivated under can supply 20-30 pounds of nitrogen per acre.

WEED MANAGEMENT

In weed management, we do not mean eradication. Even in the good soil, we will not have 100% control. Weeds seeds can lie dormant in the soil up to 50 years waiting for the right conditions to sprout. New weed seeds can blow in or arrive with purchased plant seed.

The best time for weed control is when they are first sprouting; this is when they are most vulnerable.

Extensive plantings of one species tend to encourage weed germination (monocultures of one species tend to reduce the soil of certain minerals creating a soil imbalance). In farming crop rotation helps reduce weeds.

Large amounts of synthetic fertilizers create soil mineral imbalances, which in turn help weeds to germinate and increase the weed problem.

Application of synthetic chemicals such as fungicides kills microorganisms in the soil creating a nutritional imbalance that encourages weeds to grow. Many fungal species living in healthy soil eat weed seeds.

From the Soils Up

Some plants have the ability to naturally suppress weed growth, a property that is called allopathy. These plants include rye, barley, oats, wheat, corn, tall fescue, sorghum sudangrass, soybeans, alfalfa, red clover, peas, field beans, sunflowers, and buckwheat to name a few.

Improve soil conditions. Since the underlying cause of most weed problems is the poor or wrong soil conditions, naturally correcting what is wrong with the soil will significantly reduce weed pressure. Adding organic matter to the soil is the best and fastest way to improve soil conditions and INSTAGrowth compost is the best form of organic matter to use.

Maintaining a soil with high fertility and a balanced soil with plenty of calcium will eliminate a lot of troublesome weeds. They just do not want to grow in this type soil. Desired crops and plants do want to grow in a healthy balanced soil hence outgrow, out-compete and shade the few weeds that do germinate.

Keep soil covered either by a cover crop or by mulch. Many species of weed seeds need light to germinate hence covering prevents light from reaching the seeds. A cover crop or mulch also prevents weeds from reaching maturity and producing more seeds.

Mechanical control can also be a tool in controlling weeds if used early in the season before weeds become established. These controls include hoeing, raking, burning, disking, mowing, etc.

Certain herbivores like to eat weeds and can be a useful tool under the right conditions. Geese and chickens have been used for years for weed control in certain crops. Goats, sheep, and insects can also be used for specific crops and plants.

A recent study has found that a naturally occurring rhizobacteria can reduce populations of Jointed Goatgrass (*Aegilops cylindrica*), a $72 million problem per year for farmers, by 64% in winter wheat. USDA, AW91-5: Soil Bacteria to Control Jointed Goatgrass in Integrated Cropping Systems.

Research is showing that the types and amounts of pesticides applied to vegetation (trees, shrubs, plants, etc.) on the edges of a field effect the type and concentration of weeds in a field. Pesticide Research Center, University of Michigan.

A recent study has found that chisel plowing or ridge tillage reduces the number of weed seeds germinating in corn. The study also found that if anhydrous fertilizer is replaced with manures, there are lower survival rates of weeds. David A. Andow, University of Minnesota, LNC88-1: Integration of Conservation Tillage, Animal Manures, and Cultural Pest Control in Corn.

Scientists have found that using Geese are a way to help control weeds and diversify income for farmers. USDA, AW91-1: Use of Domestic Geese to Control Weeds In Agriculture and Forestry Applications.

Keeping the calcium and phosphate levels in equilibrium will roll back more weeds than all the chemicals in the Dow and Monsanto armamentarium. "pH and Cation Exchange Capacity, A Conundrum," Acres, USA, September 1994.

One researcher (Dr. Phillip Callahan) believes that the spines on weed species are "antenna" that are tuned to receive (absorb) specific frequencies (energy) from space. This energy is needed to help restore the vitality of the soil.

From the Soils Up

Broadleaf weeds like a soil environment in which the available potash exceeds the available phosphate. Note: Most soil analyses give total nutrients in the soil, not the chemical form of the nutrient or it's availability to plants.

Grassy weeds tend to like a tight soil. One way this can occur is if the soil contains an excess of magnesium to calcium. Calcium tends to separate soil particles, and magnesium makes them stick together. In some soils, the magnesium is held as trimagnesium orthophosphate $Mg^3(PO4)^2$-22 H^2O which allows the soils to dry up and crack and not release the water to plants in dry conditions.

Most microbes in the soil need oxygen to live (aerobic conditions) and break down plant residues and complete the decay cycle. Synthetic chemicals (fertilizers, fungicides, herbicides, etc.) kill off many microbe species directly and others by destroying soil structure creating soil compaction and anaerobic (without oxygen) conditions. Plant residues at this stage ferment (instead of aerobic decay) producing toxins like alcohol, formaldehyde, and methane gas. These chemicals sterilize the soil even further creating conditions where weeds like velvetleaf thrive. Further soil degeneration produces ethane gas, which helps jimsonweed to prosper. Nature is just trying to correct the problems in the soil.

Certain synthetic fertilizers create conditions that help preserve weed seeds. They will lay there waiting for the opportunity to germinate and grow.

Decaying vegetation can produce chemicals that prevent the germination of weed seeds (allopathy).

Seeds, whether crop or weed produce chemicals (root exudates or auxins) that help prevent other seeds from germinating. In some soils, these auxins last only 1 or 2 days. In biologically active soils these effects can last 6-8 weeks (free weed control).! Tilling the soil increases weed seed germination rates. Some weed seeds require only one-millionth of a second of light to start the germination process. Tilling the soil exposes many additional weed seeds to light.

The two most common soil problems that encourage weeds are low humus and low available calcium. Note: Tillage also destroys soil humus faster.

Many parasites will attack weeds if given a chance. These include insects, fungus, bacteria, etc. For example:

- Field bindweed is controlled by a Mediterranean mite that will attack it and nothing else.
- Hemp sesbania is controlled by a fungus found in pasta dough.
- A Greek weevil controls star thistle.
- Earthworms eat and digest many weed seeds.

Research at Iowa State University has indicated that corn gluten, available at feed stores, when applied to lawn and garden areas (10 lbs. x 1,000 sq. ft.) serves as a pre-emergent when applied before spring weed seed germination. It is more efficient than most herbicides and contains 9-12% nitrogen that helps fertilize the right plants.

It is reported that grass burs can be controlled with humates since grass burseeds will not germinate if humic acid is present and active in the soil. Apply humate at 10-15 lbs. per 1000 sq. ft. or 3,000-lbs./ acre. Howard Garrett's Basic Organic Program Guide

From the Soils Up

New research has found that mice (95%) and ants will eat (70%) of the weed seeds in agricultural fields depending on the crops grown hence they are the most effective natural weed killers. University of Guelph, Ontario, Canada.

A Danish study has shown that herbicide resistant rape in two generations has passed on its resistance to its weedy brassica cousin. About 42% of the second generation brassica weed seedlings had inherited the resistant gene. New York Times, 7 March 1996.

New studies have shown that nitrate from synthetic fertilizers stimulates the germination of weed seeds. In tests of 85 species of weeds, it was found that nitrate could replace light requirements for germination, and increase germination under adverse temperatures. Other studies have shown that nitrate increases weed germination rates 11 times higher (3% to 34%). Another field study found that equivalent nitrogen supplied from crimson clover (green manures cover crop) had reduced emergence of some weeds by 27% while the use of ammonium nitrate increased rates by 75%. Acres USA February 1997, Harold Willis, Ph.D.

Research at the University of Florida has shown that compost unusually immature compost, applied to crop row middles reduces weed growth due to its high concentration of acetic, propionic and butyric acids. Avant Gardener, April 1998.

Studies have found that many plants produce allelo-chemicals that suppress the growth of other plants, from the time the seeds germinate till quite some time after the plant dies. Small amounts of fresh residues of vegetables, grains, grasses, and weeds have been found to reduce the growth of many plants (including desirable ones). This is why unfinished or "green" compost should not be used very close to young crops or ornamentals. Avant Gardener, April 1998.

Tests by the Henry Doubleday Research Association in England have found that sunflowers and cucumbers produce root secretions, which suppress many common weeds by 50% or more. Avant Gardener, April 1998.

Tests by the Henry Doubleday Research Association in England have found that a Mexican marigold, Tagetes minuta, is remarkably effective against some very tough weeds such as quackgrass, wild oats, field bindweed, ground ivy, and plantain. Avant Gardener, April 1998.

Other Weeds

§ Bindweed (*Convolvulus*) - crusted, tight soil, low humus.

§ Broomsedge (*Andropogon virginicus*) - depleted, oxidized soil, low in calcium and possibly magnesium; poor soil structure; possible overuse of salt fertilizers.

§ Foxtail barley (*Hordeum jubatum*) - wet soil, maybe high salts and low calcium, compacting, possibly acid, unavailable potassium and trace elements.

§ Common burdock (*Arctium minus*) - high iron, acid, low calcium; also grows on high gypsum soil or from excess use of dolomite lime or ammonium sulfate plus lime.

§ Cheat, chess (*Bromus secalinus*) - wet, compacted, puddles (fine particles, no granular structure).

§ Chickweed (*Stellaria media*) - high organic matter at the surface, low mineral content.

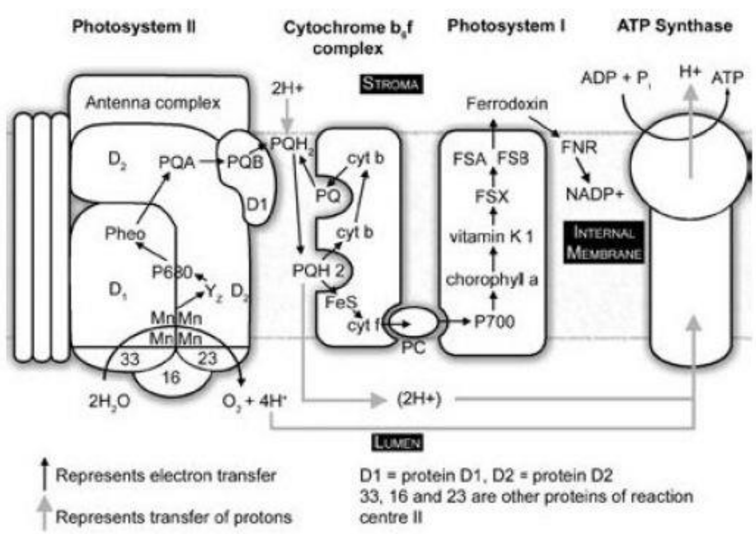
§ Chicory (*Cichorium intybus*) - reasonably good soil, clay or heavy soil.

§ Cocklebur (*Xanthium pennsylvanicum*) - reasonably good soil with high available phosphorus, but may have low available zinc.

From the Soils Up

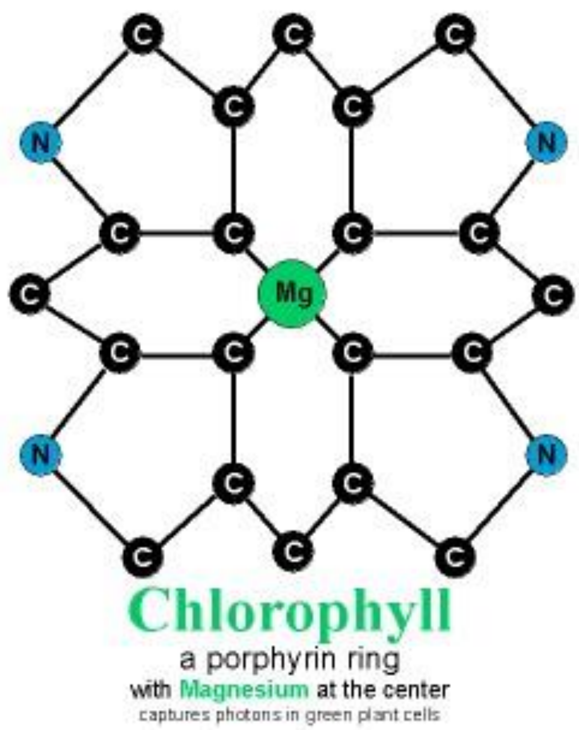
- Crabgrass (*Digitaria sanguinalis*) - tight, crusted soil, low calcium, an inadequate decay of organic matter.
- Dandelion (*Taraxacum officinale*) - low calcium, organic matter not decomposing.
- Dock (*Rumex*) - wet, acid soils.
- Fall panicum (*Panicum dichotomitlforum*) - anaerobic, compacted soil.
- Foxtail, giant foxtail (*Setaria*) - tight, wet soil, possible high magnesium; seed germinates in anaerobic conditions (elevated carbon dioxide).
- Horsenettle (*Solanum dulcamara*) - crusted soil, low humus.
- Jimsonweed (*Datura stramonium*) -improper decomposition of organic matter (fermentation)
- Johnsongrass (*Sorghum halepense*) - depleted soil, low organic mater, low calcium, and possibly high iron
- Lamb's quarters (*Chenopodium album*) - rich, fertile soil; good decay or organic matter, high humus
- Common milkweed (*Asclepias syriaca*) - good soil, generally grows in fallow areas
- Mustard (wild mustard, yellow rocket, wild radish, peppergrass, etc.) (*Brassica*, *Raphanus*, *Lepidium*) - crust, hardpan, poor soil structure, poor drainage
- Nettles, stinging nettle (*Urtica*) - anaerobic, toxic soil, wrong decomposition of organic matter (fermentation)
- Pigweed (*Amaranthus*), red root (rough pigweed) (*Amaranthus retroflexus*) good soil
- Purslane (*Portulaca oleracea*) - fairly good soil
- Quackgrass (*Agropyron repens*) - wet, anaerobic soil, high aluminum (toxic); in west, low calcium and high magnesium and sodium
- Ragweed - dry, poorly aerated soil, low available potassium
- Red sorrel, sheep sorrel (*Rumex acetosell*) - acid soil, low calcium, low decomposition or organic matter
- Russian thistle (*Salsola kali* var. *Tenuifolia*) - salty soil (high sodium and potassium), low calcium and iron, low organic matter
- Smartweed (*Polygonum*) - wet, poorly drained soil
- Thistles (*Cirsium*) & sowthistle (*Sonchus oleraceus*) - reasonably good soil
- Tumbleweed (*Amaranthus album*) (Russian thistle is also called tumbleweed: see above) - dry soil, low humus
- Velvetleaf (buttonweed) (*Albutilon theophrasti*) - anaerobic soil, wrong decay of organic matter (fermentation)

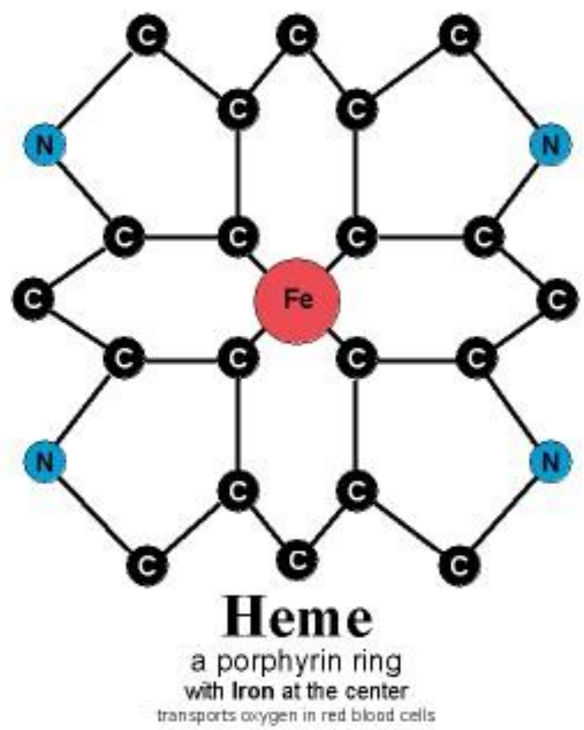
Photosynthesis Diagram Chemistry



From the Soils Up

Differences Between Chlorophyll and Hemoglobin





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Interesting Reading

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Weeds and Why They Grow, Jay L. McCaman, 1994

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