AGGRAND®

Converting To An Organic Or More Sustainable Cropping System

Converting to an organic fertility program will increase the productivity and quality of any cropping system in the long run. The length of time it takes to convert to a more sustainable system (one that reduces the number of non-renewable inputs) depends on the degree of degradation of the biological ecosystem, which is impacted by the following:

1. The addition of toxic substances to the system.
2. The continuous mono-cropping in the absence of a viable crop rotation plan.
3. The lack of attention to soil chemical imbalance (i.e. base saturation percentage out of balance).
4. Soil compaction from the overuse of heavy machinery on the fields.
5. Practices that reduce the presence of organic matter in the top 6″ of soil.

Each of these factors must be addressed in some fashion, but it usually takes at least three years to see meaningful results; it takes time to detoxify the soil and open the soil pores so the soil microbes can multiply and begin releasing nutrients as crops need them.

Soil Microbes, Beneficial Insects, Soil Invertebrates

Many inputs used in modern agriculture are toxic to soil microbes, beneficial insects and soil invertebrates (such as earthworms) that cycle nutrients and make them available to plants. Each grain of healthy soil (about a thimbleful) contains several billion microbes, including bacteria, fungi, actinomycetes and algae. Fungi are the primary invaders, breaking down residue left in the highly-aerobic surface layer to a point where bacteria and actinomycetes can continue the process in the top 2-6″ of soil. The final result is humus, which provides highly-available nutrients to plants. Microbes produce their weight in humus everyday. Some bacteria and algae also fix free nitrogen from the air, which contains 78% nitrogen. In a healthy acre of soil, these microbes fix 100 lbs. of nitrogen per acre into plant available forms each growing season. In addition, earthworms produce

700 lbs. of casting in one acre of healthy soil each day. Beneficial insects digest other insects, nematodes and residue, producing even more plant food.

Beneficial nematodes consume other nematodes, reducing or eliminating root damage and supplying available nutrients. This incredible army in the soil supplies most of the nutrients necessary for prolific crop growth as long as the proper substrates and environment are provided. However, the addition of toxins to the system inhibits their activity.

Chemical Inputs

Salt-based fertilizers such as Ammonium Nitrate and Potassium Chloride inhibit the natural systems in the soil. Their use maximizes luxury growth of many crops (and weeds), but because tissue solute levels (BRIX%) are very low and leaf cuticles weak, crops are more vulnerable to insect attack. Increased insecticide and herbicide applications become necessary, further degrading the natural ecosystem in the soil. As the soil ecosystem degrades, it opens niches for pathogenic fungi, nematodes and other non-beneficial invaders to populate the soil, and the farmer must increase the use of fungicides, nematicides and insecticides to control damage and diseases caused by the offending invaders. One can begin to see how the use of toxic chemicals creates a never-ending upward spiral in the use of chemical inputs and an equal, but opposite, downward spiral in the level of beneficial soil biological activity, which can result in reduced profit margins.

Mono-Cropping

Continuous mono-cropping of the land, especially with row crops that remove large amounts of nutrients from the soil, reduces the soil's ability to produce viable crops year after year. In addition to reduced yields, the crops become more susceptible to disease and insect attack. For example, successive corn crops without crop rotation leads to nitrogen depletion, and the farmer must add increased levels of nitrogen in order to produce a viable crop. Insects and other pests that attack corn are able to multiply and thrive on the susceptible corn crop, so the farmer must increase the use of pesticides. However, the pests develop resistance to the pesticides faster than the farmer can raise the treat rates or try new combinations of pesticides.

Chemical Imbalance

Lack of attention to soil chemical imbalance leads to conditions that reduce the availability of nutrients. For example, continued applications of dolomite lime to acidic soil leads to the buildup of soil magnesium levels. Calcium flocculates the soil (loosens the soil by forming a glue in conjunction with humus polysaccharides, and organic acids paste together the fine clay fraction into stable soil aggregates), and the farmer enjoys the beneficial effects until the magnesium level reaches 14 or 15% (depending on what method of analysis is used). The soil then turns into a solid mass, reducing its capability of holding oxygen and other nutrients (magnesium also becomes unavailable at this point). Crops look chlorotic and have difficulty getting established, and increased levels of fertilizer are necessary to produce a crop.

Compaction

In the attempt to create a clean seedbed, farmers often run over the field five or six times in a growing season. Although a fine seedbed is required when planting a fine-seeded crop such as alfalfa or mixed hay crops, these crops are only planted every four years or more. Compaction becomes problematic when crops are planted each year on the same ground using traditional tillage methods (moldboard plowing, disking, dragging, etc.) with heavy modern equipment. For example, a farmer under contract who plants vegetable row crops on the same ground each year feels pressure to plant the crop by a certain date to gain optimum yields and meet contractual harvest dates, so he disks and plows the field in the fall to incorporate the crop residue so the field dries out faster in the spring. The plowing brings new weed seeds to the surface that create a healthy blanket of weeds by spring that must be disked in or field-cultivated before final seedbed preparation. Then the field must be run over with the disk twice more before planting (if the weather cooperates). In the effort to create a clean, fine seedbed, the repeated trips over the field compact the soil and break down the soil aggregates, resulting in pore space reduction that leads to the same soil condition as too much magnesium. Root growth and microbial activity are inhibited and oxygen and nutrient availability are reduced.

Microbial Activity

The same practices that cause soil compaction also reduce microbial activity in the plow layer. When the moldboard plow turns over the soil, placing organic material underneath the more aerobic topsoil, it inhibits microbial breakdown of the residue into humus. The first microbes to break down the residue are fungi, which funnel nitrogen out of the soil into the crop residue through their mycelium. The carbon and oxygen from the loose crop residue and the nitrogen from the soil provide the elements necessary for prolific fungal growth. Crop residue must remain in the top 4″ of soil for this process to be effective. For example, fungi are ineffective and lack of oxygen slows the ability of bacterial microbes to break down old corn stalk residue if it is plowed under and rests six or eight inches below the soil surface. Under these conditions, it takes up to several years to break down. In addition, nutrients such as nitrogen and potassium, which are released as the residue breaks down, leach into the groundwater rather than becoming available to the roots that proliferate in the top 4-6″ of soil.

Steps to Conversion

Converting to a more sustainable system does not come quickly or easily. When considering all the mitigating factors, conversion can be implemented on part of the farm on a trial basis to reduce risk factors and enable the farmer to ease into the new system without undue hardship. The first step is gathering as much information as possible about sustainable practices and soil fertility as it relates to natural soil biology. The second step is visiting farms where these practices have been put into place. The third step is writing down the practices applicable to your farm. The fourth step is figuring out how much land can be put at risk for conversion and how much funding is available in the three to five years it takes to implement the plan. The fifth step is choosing which methods can be put into practice for the amount of funding available. A consultant who works in sustainable agriculture can be a great benefit in pinpointing specific areas of concentration. The sixth step is putting together a specific working plan. The last step is implementing the plan.

Soil Testing

The choice of methods depends on the soil type, fertility levels, base saturation balance, type of crops and soil tilth. Biological activity is maximized when the soil chemistry is in balance. The first method to put into practice is soil testing. The saturation percentages of the base (Cationic) elements (Ca, Mg, K, Na, and H) and the cation exchange capacity of the soil are extremely relevant to creating the right conditions for microbial and root growth and nutrient uptake. Major adjustments to this balance take time; if the soil is too far out of balance, it may not be economically effective depending on the potential productivity of the soil and the potential value of the crops to be grown on that soil. Major adjustments in base saturation often involve addition of lime (calcitic or dolomite), sulfate and/or potassium sulfate.

AGGRAND Fertilizers

The second method to put into practice is the addition of AGGRAND Natural Fertilizer 4-3-3, which stimulates microbial activity in the soil and supplies additional nutrients to the crop. Microbes and other soil life require oxygen, hydrogen, carbon, nitrogen and trace amounts of other elements to proliferate. AGGRAND Natural Fertilizer contains the elements necessary for proliferation of soil life in the form of proteins, enzymes, hormones, humus substances, vitamins, sugars and synergistic compounds. Higher application levels of AGGRAND are required early in the conversion process as chemical fertilization is eliminated. It is possible to recoup the cost of high application rates during the first two or three years when growing high-value crops such as tomatoes or melons, but most situations require a gradual decline in chemical fertilizer applications while maintaining moderate levels of AGGRAND Natural Fertilizer applications.

For example, the gradual reduction scheme for sweet corn involves reducing the standard chemical fertilizer rate by 50 percent in the first year, 75 percent in the second year and elimination in the third year. The initial AGGRAND Natural Fertilizer application rate focuses on the nitrogen, phosphorus and potassium (N-P-K) requirement for sweet corn on a specific soil. If the fertility level of the particular soil requires the addition of 100 lbs. of nitrogen, 50 lbs. of phosphorus and 20 lbs. of potassium per acre, 50 percent of this requirement is supplied by the chemical fertilizer in the first year, 25 percent in the second year and 0 percent in the third year. The soil life (through the release of nutrients as excrement and rupture of cell membranes upon death) supplies some nutrients. While AGGRAND directly supplies some of the nutrient need, it supplies others through the synergistic compounds that release unavailable nutrients by stimulating soil chemistry and others through the stimulation of soil biological activity. On average soil that is not overly burned out by chemicals or compacted, apply 10 percent of the remaining fertilizer need (focusing on the need for the remaining nitrogen requirement since it is often the limiting factor in sweet corn production). Ten percent of 50 lbs. equates to five lbs. of nitrogen supplied by AGGRAND. It takes 120 lbs. of AGGRAND Natural Fertilizer (about 12 gallons) to meet this need.

In the second and third year of the conversion process, it is a good practice to apply the same amount of AGGRAND Natural Fertilizer to the crop to give the soil ecosystem a chance to develop. In the following years, a 10-20 percent reduction per year may be possible depending on the other sustainable methods that have been employed. The minimum application rate for AGGRAND is one gallon per acre per year for crops such as hay and small grains and three gallons per acre per year for vegetable crops and citrus (rates may be reduced even further by using low volume sprayers).

Adding one gallon of AGGRAND Liquid Bonemeal 0-12-0 per acre banded at planting stimulates early growth and development of many crops, including sweet corn, because microbial release of phosphate is minimal in cool, wet soil. The addition of 1-2 pints of AGGRAND Natural Kelp and Sulfate of Potash 0-0-8 per acre banded at planting aids in the development of strong stems and roots on sandy and organic soils (soils with low potassium saturation). Positive responses to AGGRAND fertilizers are also obtained when foliar applications are 4-6″ tall. The stimulation of early growth and establishment of high value vegetable crops is what often makes these crops profitable. The second window for foliar applications is during the pre-bloom stage, while the last window is after fruit set, up to three weeks before final harvest. During the pre-bloom stage, 1-3 gallons of AGGRAND Natural Fertilizer are applied. Some crops may respond to the addition of 1-2 gallons of AGGRAND Liquid Bonemeal and/or 1-2 pints of AGGRAND Natural Kelp and Sulfate of Potash per acre to the tank mix at pre-bloom. During the fruit fill pre-harvest stage, the application of 1-3 gallons of AGGRAND Natural Fertilizer or 1-2 pints of AGGRAND Natural Kelp and Sulfate of Potash lengthens the harvest period and increases the fruit shelf-life. The rates and combinations vary according to soil fertility, crop type and developmental stage.

Organic Matter

The third method to put into practice is the addition of organic matter to the soil, which offsets the need to apply high amounts of AGGRAND in the first couple of years. Cover crops, manure, compost and residue from previous crops can supply a large portion of the nutrient requirements for many crops. In the sweet corn example, if alfalfa was the previous crop, the initial application of AGGRAND Natural Fertilizer and chemical nitrogen is reduced because the alfalfa supplies as much as 100 lbs. of nitrogen in the first year, 50 lbs. in the second year and 25 lbs. in the third year, while also supplying appreciable levels of other nutrients. The chemical nitrogen application is reduced to 25 lbs. applied as a starter to ensure rapid growth in the early stages of development during the first two years. The AGGRAND Natural Fertilizer application is reduced to six gallons per year in the first three years (instead of 12 gallons), which still promotes increased proliferation of microbial activity. In this example, enough nitrogen is supplied during the first and second years by the preceding crop and chemical nitrogen. In the third year, the alfalfa, crop residue, biological activity and AGGRAND will supply enough nitrogen for another sweet corn crop; an alternate plan involves rotating in a small grain or another legume such as beans. The rotation effect, return of crop residue and AGGRAND applications produce optimum yields of succeeding crops in the fourth and fifth years. The AGGRAND application rate is reduced by 10-20 percent each year thereafter, until the minimum threshold is reached, which will maintain crop productivity levels and soil biological activity. By the fifth year, the field is rotated back to alfalfa.

The alfalfa is maintained for four years or more depending on severity of climatic conditions. This 10-year rotation plan is much more sustainable, less expensive and produces optimum yields of successive crops throughout the rotation.

Minimum Tillage

Other methods such as minimum tillage can be incorporated into this plan. The land only needs to be plowed once on the alfalfa, sweet corn, small grain and bean rotation (before alfalfa planting). Minimum tillage for row crops and small grains involves special "no-till" planters that are effective in planting through stubble. Special once-over tillage machines are also available and provide effective seedbed preparation in one or two passes. Minimum tillage reduces weed competition, keeps residue near the soil surface where it can be broken down quickly by fungi and bacteria, reduces compaction, protects the soil from erosion and minimizes leaching of nutrients into the groundwater.

Numerous beneficial effects become apparent as the conversion process proceeds:

- Heavier soils become looser and more friable as stable aggregates form.
- Lighter soils become stickier and less porous.
- Earthworms begin to proliferate (an indicator of a balanced soil ecosystem).
- Crops are less susceptible to insect and disease attack.
- Seed weights, seed protein, BRIX (tissue sugar levels) and forage protein levels increase.
- Livestock become healthier (higher milk production, faster weight gains, lower vet bills).
- Crops are more tolerant of drought, heat and cold.
- Crops are darker green in color, mature earlier and recover quicker from stress.
- Crops exhibit increased nutrient and water use efficiency.
- Costs of production decrease.

Long-Term Benefits

Converting to a more sustainable or organic system produces many noticeable short-term benefits. However, the long-term benefits often determine the real success of the system:

- Reduction or elimination of environmental impacts.
- Viable crop production in years when other farms experience crop failures.
- Buildup of topsoil.
- Satisfaction of becoming more dependent on nature's ability to provide.

AGGRAND products and Dealership information are available from your local AGGRAND Dealer.

AGGRAND®

