AGGRAND®

Transitioning to an Organic or Natural Cropping System

An organic fertility program increases the productivity and quality of any cropping system. AGGRAND natural and organic fertilizers can help growers make a seamless transition from a chemical fertilization system to a natural or organic system. The time it takes to make the transition to a system that reduces the non-renewable inputs depends on the degree of degradation of the soil's ecosystem. The biological ecosystem is damaged by many practices common to modern agriculture, including the following:

1. Addition of **toxic substances** (chemicals) to the system.
2. **Continuous mono-cropping** without a crop rotation plan.
3. Lack of attention to soil **chemical imbalance** (i.e. base saturation percentage out of balance).
4. **Soil compaction** from overuse of heavy machinery on fields.
5. Practices that reduce **microbial activity** in the top 6 inches of soil.

Chemical Inputs

Chemical fertilizers are top among toxic substances that degrade the health of the soil. These salt-based fertilizers, such as ammonium nitrate and potassium chloride, inhibit the natural systems in the soil. While their use maximizes growth of crops, it also maximizes growth of weeds. Salt-based fertilizers also greatly reduce tissue solute levels and make leaf cuticles weak, which makes crops 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. This leads to a never-ending upward spiral in the use of chemical inputs and an equal downward spiral in the level of beneficial soil biological activity. This spiral can lead to reduced profits.

Continuous 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. As an example, successive corn planting without crop rotation leads to nitrogen depletion, and the farmer must add greater amounts of nitrogen 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, and the spiral continues.

Chemical Imbalance

Chemical imbalance leads to conditions that reduce the availability of nutrients. Here's an example of what happens: Calcium 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. The farmer enjoys the beneficial effects until continued applications of dolomite lime to acidic soils leads to the buildup of magnesium in the soil. When the magnesium level becomes unbalanced at 14 or 15 percent, the soil becomes a solid mass, reducing its ability to hold oxygen and other nutrients, and magnesium is no longer available to the soil. Crops look chlorotic, show yellowing, and have difficulty becoming established. Which means even greater levels of fertilizer are necessary to produce a crop.

Soil 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 fine-seeded crops 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. As an 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. 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 blanket of weeds by spring that must now be disked in or field-cultivated before final seedbed preparation. Then the field must be run over with the disk twice more before planting. In the effort to create a clean, fine seedbed, the repeated trips over the field compact the soil and break down the soil aggregates. This causes reduced pore space that leads to the same soil condition that results from too much magnesium — inhibited root growth and microbial activity and reduced availability of oxygen and nutrients.

Microbial Activity

The practices that cause soil compaction also reduce microbial activity in the plow layer. Crop residue, such as old corn stalks, must remain in the top 4 to 6 inches of soil for microbial activity to flourish. 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. However, plowing organic material underneath the more aerobic topsoil inhibits microbial breakdown of the crop residue into humus – the source of readily-available nutrients for plants. As an example, if the top layer of soil is plowed under, fungi become ineffective and lack oxygen, which slows down the ability of the microbes to break down the old corn-stalk residue. Under these conditions, it can take 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 to 6 inches of soil.

Creating Healthy Soil

An organic cropping system supports the health of the soil and enriches it from year to year. 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 to 6 inches of soil. The final result is humus, which provides highly-available nutrients to plants. Microbes produce their weight in humus every day. Some bacteria and algae also fix free nitrogen from the air, which contains 78 percent nitrogen. In a healthy acre of soil, these microbes fix 100 pounds of nitrogen per acre into plant-available forms each growing season. In addition, earthworms produce 700 pounds 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. AGGRAND fertilizers supply natural inputs that increase nourishment of the soil to sustain this natural environment.

Steps to Transition

The transition to an organic or natural system requires time and planning. AGGRAND natural and organic fertilizers can help growers ease into the new system.

- Gather as much information as possible about sustainable practices and soil fertility as it relates to natural soil biology.
- Visit farms where these practices have been implemented.
- Write down the practices applicable to your farm.
- Determine how much land on which to start the transition. It will take three to five years to fully implement the plan.
- Choose which methods can be put into practice for the amount of resources available. A consultant who works in sustainable agriculture can be a great benefit in pinpointing specific areas of concentration.
- Put together a specific plan.
- Implement the plan.

AGGRAND Recommended Procedures

Soil Testing

First, determine soil fertility. Obtain a soil sample and send it for testing at a recognized laboratory. The soil test will reveal the saturation percentages of the base positively charged elements such as calcium, magnesium, potassium, sodium and hydrogen, plus the cation exchange capacity (CEC) of the soil. These parameters are vital to creating the right conditions for microbial and root growth and nutrient uptake. Adjustments in base saturation often involve addition of calcitic or dolomitic lime, potassium sulfate or other minerals.

AGGRAND Fertilizers

After soil fertility is known, apply AGGRAND Natural Fertilizer or AGGRAND Organic Series Fertilizer to stimulate microbial activity in the soil and supply additional nutrients to the crop. Microbes and other soil life require oxygen, hydrogen, carbon, nitrogen and trace amounts of other elements to proliferate. AGGRAND fertilizers contain 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 fertilizers are needed early in the conversion process as chemical fertilization is eliminated. Most situations require a gradual decline in chemical fertilizer applications along with applications of moderate levels of AGGRAND fertilizers. 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. 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 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 pounds of nitrogen, 50 pounds of phosphorus and 20 pounds 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 fertilizers directly supply some of the nutrient needs, they supply others through the synergistic compounds that release otherwise unavailable nutrients by stimulating soil chemistry and supply other nutrient needs through the stimulation of soil biological activity. In the following years, a 10 percent to 20 percent reduction in chemical fertilizers may be possible depending on the other sustainable methods that have been employed. The minimum application rate for AGGRAND fertilizer is 1 gallon per acre per year for crops such as hay and small grains, and 3 gallons per acre per year for vegetable crops and citrus (rates may be reduced even further by using low-volume sprayers). Adding 1 gallon of AGGRAND Liquid Bonemeal 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 to 2 pints of AGGRAND Natural Kelp and Sulfate of Potash 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 also are obtained with foliar applications when plants are 4 to 6 inches 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, apply 1 to 3 gallons of AGGRAND Natural Fertilizer or AGGRAND Organic Series Fertilizer. Some crops may respond to the addition of 1 to 2 gallons of AGGRAND Liquid Bonemeal and/or 1 to 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 to 3 gallons of AGGRAND Natural Fertilizer, AGGRAND Organic Series Fertilizer or 1 to 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 addition of organic matter to the soil offsets the need to apply high amounts of AGGRAND fertilizers 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. Using the example of sweet corn, if alfalfa was the previous crop, the initial application of AGGRAND Natural Fertilizer or AGGRAND Organic Series Fertilizer and chemical nitrogen is reduced because the alfalfa supplies as much as 100 pounds of nitrogen in the first year, 50 pounds in the second year and 25 pounds in the third year, while also supplying appreciable levels of other nutrients. The chemical nitrogen application is reduced to 25 pounds, applied as a starter to ensure rapid growth in the early stages of development during the first two years. The AGGRAND fertilizer application is reduced to 6 gallons per year in the first three years, 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 fertilizer will supply enough nitrogen for another crop of sweet corn; 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 percent to 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 also are 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 transition process proceeds. They are as follows:

- 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, (tissue sugar levels) and forage protein levels increase.
- Livestock become healthier for higher milk production, faster weight gains and 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 efficiency in use of nutrients and water.
- Costs of production decrease.

Long-Term Benefits

The transition to an organic or natural 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 working with nature's ability to provide.

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G2789 10/15