Crop Talk

A Newsletter For The Clients Of Agri-Technologies, Inc.

Volume 1
January 2005

Where is Precision Agriculture?

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In the five years since **"Precision Ag" has been a household name**, we have experienced many changes. "Ups" and "downs" probably best describe the development of Precision Ag during this period. Originally, we associated Precision Ag as simply grid sampling and variable rate fertilizer and lime application. Almost everyone tried it or knew someone who did and most people quit after their initial entry into the technology. Precision Ag has now evolved to include many new and interesting products but the willingness of farmers to adopt these technologies is uncertain.

Recent reports from Purdue University indicate variable rate fertilizer applications resulting from grid soil sampling have dropped to less than 10 % of the total. **Farmers seem to be waiting for better data analysis tools that make the information easier to use and apply.** Yield mapping has dropped from a high of 20 % in 1999 to less than 12 % in 2004.

Guidance systems and light bars seem to be the most likely area for growth in 2005. Auto guidance can increase productivity and efficiency of equipment by 20 %. Light bar technology is especially interesting since it may provide a practical way to vary rates of Pix and nitrogen in cotton or Cerone and nitrogen in wheat. Other applications including variable rate nitrogen application in turf also hold great promise.

In summary, precision farming technologies have generally fallen by the wayside or been put on hold since 1999. However, we expect to see more growth and adoption of technologies that become available in 2005 and 2006. It's **likely that farmers will soon think of Precision Ag as more than just grid soil sampling.**

Can Satellite Imagery Revive Interest in Precision Agriculture?

When considering satellite imagery, we normally think of predicting weather patterns or assessing environmental conditions. However, affordable, high resolution, commercial satellite imagery is now expanding the use of imaging technology for precision farming. Currently, satellite imagery permits agricultural managers to predict crop yield, improve quality and fight disease.

Increasing yield and sustaining crop quality while decreasing the use of fertilizer, pesticides, and water is a primary challenge to farmers and agronomists worldwide. Precision farming techniques have proven to support these goals. Precision farming and geo-spatial technologies, such as satellite imagery, global positioning systems (GPS) and variable rate technology (VRT), are used to detect present or potential stresses and aid consultants and farmers in determining the causes, be it insects, lack of nutrients, salinity, water, soil conditions, diseases or other factors. Together, precision agriculture and aerial imagery are increasingly being explored as complementary tools to help improve overall crop yield and quality while minimizing environmental impact and maximizing the use of existing natural and financial resources.

The Quick-Bird satellite collects 8-foot resolution multi-spectral images and 2-foot resolution panchromatic (black and white) images. Utilizing the images, base maps are created to show field boundaries, fences, roads, drainage ditches, irrigation equipment and other permanent features.

Growers benefit most from multi-spectral imagery because it portrays sensitivities to soil moisture and chlorophyll levels in plant leaves. This allows crop managers to identify abnormal growing conditions.

A high-resolution satellite image used in conjunction with a GPS receiver can lead a farmer to a stressed area in a field weeks before the condition is visible in the plants. Today's high-resolution satellites "revisit" specific locations to obtain images of the same areas every few days, revealing changing crop conditions in a timely manner. Through such images, assessments and control of damage caused by water, insects, wind, hail, chemicals and weeds can be improved.

Once satellite images are collected, they must be processed into usable information and delivered promptly to the grower. This information might be in the form of a hard copy or an Internet-delivered, color-coded field map with an easy-to-read, quantifiable, overview of the conditions across a farm.

The utilization of precision agriculture with satellite imagery helps distinguish differences in crops and allows farmers to precisely apply remedies in a timely manner. Imagery establishes the perfect means to assess crop needs, showing soil conditions early in the season and vegetative status from emergence through harvest. The multi-spectral characteristics of the imagery permit farmers and crop consultants to determine which soil areas are rich in nutrients

and which areas require additional fertilizer. Qualities determined and portrayed by image maps include vegetative density, leaf color and texture, and soil moisture status. An accurate evaluation of existing nutrient content will result in more efficient fertilizer use, which can increase yields, reduce costs and potentially reduce environmental impact.

While satellite image processing and delivery systems are continuously being fine-tuned, the benefits of these technologies for protecting crops and saving money are already being realized by some farmers. As growers become more aware of the benefits of satellite imagery, they will learn to blend this powerful tool with proven technology already in use to further improve yield and quality while enhancing production efficiency and limiting environmental impact.

Best Way To Manage High Fertility Costs

"Liming pays" was the slogan on an old farm truck bumper sticker I remember as a boy and it still rings true today. With high fertilizer and fuel costs, the importance of liming to obtain proper pH and fertilizer use efficiency cannot be overstated.

Lime comes in two major forms: calcitic and dolomitic. Calcitic lime contains calcium carbonate and dolomitic lime contains both calcium carbonate and magnesium carbonate. Acidity in soil is caused by hydrogen ions. When lime is applied to soil, the calcium and magnesium ions "knockoff" the hydrogen ions from the soil particles and then the carbonate component of the lime neutralizes the ions. When buying lime, it is important to realize that the value of the lime is vary based on particle size and CCE (calcium carbonate equivalent) values. **The higher the calcium carbonate equivalence and the smaller the particle size, the faster the reaction of lime in acid soils.** Large particles of lime tend to react slowly over time making the material ineffective for the first crop if it is not applied several months ahead of planting. The minimum particle size of a good liming material should be as follows:

95% pass 8 mesh
70% pass 20 mesh
50% pass 60 mesh
40% pass 100 mesh

In order to determine the efficiency of your lime for acid neutralization based on its particle size, apply the following chart:

	Percent Efficiency	
Particle Size	**1-year later**	**4-years later**
8 mesh	5	15
8-30 mesh	20	45
30-60 mesh	50	100
60+ mesh	**100**	**100**

Gypsum- Valuable Product to Agriculture

Many years ago, most of us recall gypsum being used only as a pegging treatment in peanuts. When plasti-culture was started on farms in the eastern US, we soon recognized the benefits from applying gypsum in other production situations. Gypsum has become such an essential part of our production program that we are now using it on virtually all irrigated crops. It would not surprise me to see gypsum become a standard treatment in tobacco production as well as no-till cotton production in the near future.

There are two natural forms of gypsum: anhydrite ($CaSO_4$) and dihydrite ($CaSO_4.2H_2O$). Chemically, the only difference between them is that the dihydrite contains two molecules of crystallized water. Both of these materials go into the soil solution immediately after rain or irrigation and the time taken for the smaller particles to get into solution can actually be measured in seconds, which is a great contrast to the soil reaction time of limestone. There are many forms of gypsum. As a result, it is important to test a source before using it to determine quality and if there are contaminants that can influence crop production and/or quality. By-product gypsum, for example, can contain large amounts of other chemicals including citric acid, which can lower soil pH. Some sources contain large amounts of moisture, which adds to freight cost and impacts the amount of calcium sulfate you actually get in a ton. One form of by-product gypsum that is very similar to natural gypsum is associated with phosphate production. This material is an excellent and economical material but is sometimes difficult to spread and contains a fair amount of moisture. My experience with this material indicates that you can improve the physical properties buy storing it for a year under plastic before application.

Major Benefits of Gypsum

- Economical source of calcium and sulfur with no effect on pH.
- Improves soil structure and reduces compaction.
- Flocculates sand, silt, and clay particles and promotes more rapid humus production. This, in turn, improves water and air movement and promotes root aeration.
- Improved water penetration and irrigation efficiency.
- Displaces salts like sodium and in some cases magnesium to reclaim high salt soils and improve the balance between calcium and magnesium. As a rule of thumb there should be 16 times more calcium in a soil than sodium. Sodium should never occupy more than 15% of the CEC.
- Reduces permeability problems resulting from the use of high bicarbonate irrigation water.
- Enhances water use efficiency by 25 to 100 percent allowing the grower to achieve the same results with less water.
- Improves soil aeration and promotes better root growth.
- Reduces run-off, erosion, and soil crusting by forming larger and more stable soil aggregates.
- Reduces acidity in the subsoil by displacing aluminum deep in the soil profile subsequently promoting deeper rooting.
- Promotes accumulation of organic matter more rapidly.

Injecting Gypsum in Drip Irrigation Systems

Supplying calcium needs and preventing or solving soil permeability and salt problems can be achieved by injecting gypsum. High quality bulk and bagged gypsum is now available. The product we have worked with is called Aqua-Cal from US Gypsum. This material can be injected in drip irrigation systems as well as applied through pivot or sprinkler irrigation systems.

There are two forms of gypsum, dihydrate and anhydrite. The dihydrate form dissolves readily in water. Normally 90% of the gypsum will be dissolved in an agitated water solution within the first minute of agitation, however it will take 5-7 minutes to dissolve the remaining 10%. It is important to note that when injecting gypsum you must maintain the agitation while the injection is taking place. Another important factor is to remember to inject the gypsum before the filtration system.

It has been suggested that it is best to keep the rate of gypsum below 1000 ppm in the solution. Based on my calculations, this is a very high rate. We have injected rates of 100-200 ppm with success. A normal injection rate would be about 20 lbs. of Aqua-Cal per 1000 gals. of water.

If you plan to inject gypsum, note that a frequent or continuous injection is more beneficial when treating a salt problem or a permeability problem whereas weekly or bi-weekly injections would be adequate to supply calcium or address minor salt accumulation.

Cotton Quality

As a cotton grower you try to get the highest possible yield and quality as economical as possible. Some of the factors that improve quality do not cost more but are based on how timely they are implemented. Others cost more but in turn lead to greater yield and quality which, in turn, offset the extra cost. The following cultural practices are considered the more important factors in determining cotton quality.

- **Variety selection** is one of the most important factors in producing quality cotton. There are more RR and BT/RR varieties now that produce good quality cotton than in the past. Select cotton varieties with at least 2 years of yield and quality trials, preferably, in your region. Make sure the variety is a good yielder in addition to producing good quality cotton.

- **Protecting your crop** from insects is critical. Early Thrip damage can lead to a later maturing crop, which can lower quality. Stinkbug and plant bug damage can also lead to lower quality. These insects can stain cotton, cause boll rot, and damage fiber before maximum staple length has been reached. As more BT/RR cotton is planted, the crop, in general, receives fewer insecticide applications. Worm damage is lower but stinkbug and plant bug damage may increase. As a result, grade can be lower.

- **Keeping the fields clean** and free of weeds, which contribute to trash, is important. This job has become easier and less expensive than in the past with the development of RR

varieties. If your crop is not clean after using roundup, you need to make sure you are using residual herbicides in your program and fit them in at the right time.

- You cannot change the weather during the growing season but you can **pick varieties and plant in a timely manner that conforms to the best growing period for your area.** Pay close attention to variety selection based on land type and planting date. Planting late maturing varieties late will not provide enough time to fully develop the fiber. Planting early varieties very early on poor land can lead to early cutout during a dry or stressful period.

- **Fertility is very important.** If a nutrient is limiting, the cotton will not reach its full yield and quality potential. Proper timing of fertilizer applications is critical. Fertilizer applied too early can leach and not be available for plant uptake when needed. Fertilizer applied too late may not benefit the crop much since the critical uptake period has already passed. Generally, nitrogen and potash need to be applied and ready for plant uptake two weeks prior to first bloom.

- **Growth regulators are important** in that they help divert energy into fruiting instead of vegetative growth. Pix should be applied in a timely manner at the right concentration. Avoiding rank growth promotes earliness and generally improves quality.

- **Proper timing of defoliation** is critical to producing high quality cotton. Defoliate too early and fiber does not fully develop and provide maximum yield. Defoliate too late and mic may be adversely affected. Some varieties benefit more than others from proper timing of defoliation. ST4892BG/RR, for example, had good yields this past year but mic was high in some cases. This variety may have benefited from earlier defoliation in some cases. Some varieties do not seem as sensitive to time of defoliation and rarely produce high mic fiber.

Although all of these factors are important, variety selection seems to impact yield and quality more than any other cultural practice.

Spider Mites-A Growing Problem

Spider mites can be an ongoing problem in plasti-culture producing areas and require careful and consistent monitoring. **This past growing season proved to be most favorable for the onset of spider mite emergence and outbreak**. There are several types of spider mites but one is assuming major pest status: the two-spotted spider mite. Once infrequently considered a serious pests, spider mites continually progress each year and cause greater concern in southeastern plasti-culture crop production. These mites have particularly become a problem due to crop management practices such as the use of broad-spectrum insecticides and excessive nitrogen fertilization. Both promote mite population increases. Following is a brief discussion of why this pest has become so problematic and cultural practices that can be used to effectively manage it.

The two-spotted spider mite is the most widespread type, which can be found throughout the world in temperate and subtropical locations. The wide distribution is due to their small size, ease of transport and dispersal (by means of wind, animals, man, and equipment), ability to survive temperate climates, and their wide host range from which they can establish readily in new locations. Host plants include many vegetable crops such as beans, cucurbits, eggplant, pepper, and tomato. Beans, tomato, and cucurbits are more often injured.

Damage by the two-spotted spider mite results from feeding in which they pierce plant cells to withdraw the cell contents. The mites can pierce 18-22 cells per minute, which produces small, yellow or white, speckled lesions, which can cause leaf death when extensive. Wilting, leaf deformity and death, and abscission lead to a disruption of photosynthesis, which results in stunted plant growth and yield reduction. Spider mites generally infest the leaf undersides. Their damage can be distinguished from thrip damage by the presence of fine webbing. The greatest damage generally occurs on the canopy leaves because the adult females will migrate upward and the life cycle is shorter at higher temperatures. Favorable environmental conditions lead to outbreaks that result in moderate and severe losses.

The two-spotted spider mite has five developmental stages: egg, larva, protonymph, deutonymph, and adult. Two-spotted spider mites are very prolific upon infestation due to their short life cycle (8-15 days). As many as 20 generations could develop during a year. The duration time from egg to adult is inversely dependent on temperature: 3-5 days at 30° C and 12-16 days at 20° C. Adult females lay an average of 5-8 eggs per day depending on relative humidity which leads to a total of 60-120 eggs. Mites develop on the leaf where the egg was deposited and will remain on the same host plant as long as food is available. The two-spotted spider mite is very mobile. Once the mite population becomes very high or the infested plant dies, mites accumulate at the top of the plant or the leaf tips waiting for dispersal by man, equipment, etc.

The two-spotted spider mite can be controlled effectively by using crop monitoring, sound cultural practices, miticides, and, biological control. Crop monitoring consists of routine visual examinations of foliage to detect spider mite infestation levels in a crop. Lower leaves are usually found infected early in the season since mites migrate to younger foliage.

When mite populations reach the established threshold level, miticides are generally the preferred control measure in most plasti-culture crop production. Crop monitoring of mite

populations is important early in the season since most broad-spectrum insecticide applications including pyrethroids, even though directed at other pests, reduce mite predators, which facilitates an increase in spider mite populations. Where possible, it is advantageous to use selective insecticides, which manage pests without disrupting natural control by mite enemies. When thresholds have been met, application timing and thorough coverage of the plants are essential when miticides are applied. Spider mite outbreaks can be controlled using miticides, but it is important to treat populations when their numbers are low. Miticides are effective when applied early but will only offer suppression if timing is delayed. Crop monitoring after miticide application is effective to evaluate the amount of control within the crop and determine if further action is required. Frequent applications of a miticide will eventually led to mite resistance and a reduction in the efficacy of a chemical. Other viable chemical options to using miticides would include oils, soaps, and sulfur.

Cultural practices also have to be considered in the effective management of two-spotted spider mite. Water availability is critical since water stress can influence mite injury by making plants more suitable for mite population increase. Mite survivability is also enhanced when mites grow on plants in dry, dusty conditions under high temperatures. Excessive nitrogen fertilization also promotes mite population increase. Field sanitation such as weed removal and destruction of crop residues, etc. are important for disrupting the over-wintering potential of spider mites.

Biological control is the most recent control measure being implemented in spider mite management. The biological suppression of mites has been well developed for greenhouse but now is receiving considerable attention for field-grown vegetable crops. The need for biological control of mites has become urgent since the two-spotted spider mite has acquired extensive resistance to most miticides. The biological control system consists of using a predatory mite such as *Phytoseilus persimilis*, which is introduced when the prey population is low to ensure success. Uniform distribution of the predator is important and control is usually achieved within five weeks after introduction. The critical factor in managing the biological system is maintaining the stability of a favorable predator to prey ratio (typically 1:6 and 1:25).

Soybean Rust

Soybean rust or Asian Rust is a serious problem. Soybean growers across the U.S. have been very concerned since the disease showed up in early November in Louisiana. Several other cases have been reported since then as far north as Tennessee.

Following are points relating to some of the most commonly asked questions regarding this important disease:

1. **The disease is hard to identify.** Scouting is a necessity and quick response is imperative. There are a number of fungicide choices. Agri-Tech will advise our customers of the best control measures in a timely fashion. Growers should have fungicide on hand during the season and be prepared to spray two times. Fungicides are likely to cost $20-$25/ac., if two sprays are necessary the costs could range from $35-$60/ac.

2. **Our best guess is that the organism spread east and north as far as southwest Georgia by Nov. 19.** It probably moved further north and could have made an appearance in S.C. although the crop there was likely too mature to be affected. The real issue is what we should expect next year.

3. **Some pathologists think the disease could be more damaging in the U.S.** than it is in Brazil. Others think it may be bad one year and light the next.

4. **The disease has existed in Brazil since 2001 and has spread rapidly.** The first year, many growers ignored the seriousness of the disease and yield losses were in the 40-60 percent range. It is not uncommon to get 100 percent yield loss in unsprayed fields.

5. Potential **yield losses depend solely on how early in the season infection occurs.** Many growers are already planning to switch to early planting systems.

6. The **causal agent for Asian Rust is *Phakopspora pachyrhizi*** and there may be more than one strain. Pathologists have suspected that the disease would eventually make it to the U.S. but are surprised that it occurred this soon. Rust has been an important soybean disease in other countries for many years.

7. **Variety selection and proper scouting as well as good fungicide selection** will be important. Growers who watch other growers and spray when they start spraying may not have effective control. If your neighbors do not implement control measures, their fields can become a source of re-infestation for you.

8. The **disease thrives better in narrow rows** where the moist environment underneath the canopy allows for more spores to be produced.

Monitoring systems are important. Fungicides are an important part of a vegetable farmer's program but are very new to many soybean producers. Growers need to understand that the available fungicides have different modes of action. Some are more preventative while others are more curative. Some last longer than others depending on application rate

Peanut Production 101: Emphasize the Basics

Most agronomists agree that **peanuts appear more responsive to residual soil fertility than to current fertilizer applications.** So what does that mean to the producer? Fertilization of the crop preceding peanuts and the overall fertility practices on a given farm is essential in achieving success in peanut production.

Experts agree that **peanuts respond positively to *Rhizobium* bacteria found naturally in the soil and/or provided through crop-specific inoculants**. A well-nodulated peanut crop will generally not need a direct nitrogen fertilizer application. Inoculants used at planting helps ensure that peanut-specific Rhizobium bacteria will be present in the soil and in close proximity to the roots of the peanuts. Producers will need to budget approximately 1 to 2 percent of the

overall production costs to inoculant applications. With the high costs of fuel, transportation, and delivery of products to the marketplace, it is imperative, from a financial viewpoint, to manage nitrogen use and avoid unnecessary expenditures. The most efficient way of doing this is through the use of inoculants.

Peanut production should begin with a soil test to determine the pH and fertility requirements necessary to produce a high-yielding peanut crop. Peanuts require a pH that ranges between 6.0 to 6.5 for optimal growth and nodulation. The nutrients in the soil and the nitrogen-fixation process are also optimized if the pH falls in this range.

Soil selection is another key factor in growing peanuts. Peanuts grown on virgin soil or in areas with high acidic content need a source of Rhizobia, which is found readily in inoculants. Another pitfall can be avoided by applying inoculants to land that has been flooded or tends to hold water due to poor drainage, etc. Inoculant applications are the best way to ensure nodulation levels are adequate for the production of optimal yields. Relying on nodulation carry-over can be risky. Remember to consider application methods and special preparation needs when selecting an inoculant. There are several methods of application including hopper box mixtures, in-furrow, or seed.

Regardless of the product you choose remember that **the inoculant must be handled according to the label directions to ensure that the bacteria remains alive and viable.** Always keep inoculants cool, dry, and out of direct sunlight. The ultimate goal is to achieve uniform emergence and a quick canopy cover when growing peanuts. Proper inoculant placement is important to ensure proper grow-off and overall crop performance. The application of 5-10 gal/acre of 10-34-0 as a pop-up starter may help peanuts get off to a good start while nodules are getting established and the plant is building nitrogen production capacity.

Remember that the most important aspects of peanut production relate directly to soil selection, fertility, and rotation. Always get soil tested and ask for advice in making important decisions that impact crop production and efficiency.

Diagnostic Tools Provide a Foundation for Success

Late winter is a time for planning and a fresh start in crop production. Decisions made now can have profound affects on outcome of a production enterprise. **Soil testing and nematode assay** are basic tools that should be used to plan fertility and nematode control strategy. Rather than guess at the nutritional and pest control requirements, why not take samples and plan the most economic approach to crop production. Wasting money on unnecessary treatments or failing to apply just the right amount of nutrients can mean the difference in success or failure.

A **Soil Test** indicates pH and lime requirement along with nutrient availability. If pH is not in the desired range, crops cannot respond to nutrients that are applied. In addition to addressing needs of the upcoming crop, a soil test indicates trends in fertility that should be managed for long-term success. Many times it takes several years to get a piece of land in optimum production.

There are three classes of nutrients that are required for plant growth. The **major elements nitrogen, phosphorus, and potassium** are required in the greatest quantities and are generally the major components in a fertilizer. The **secondary elements calcium, magnesium, and sulfur** are equally important but generally are not included in a standard fertilizer. The **micronutrients (Iron, Manganese, Zinc, Copper Boron, and Molybdenum)** are required in very small amounts but are equally important in promoting plant growth. They generally serve as catalyst and promote chemical reactions in the plant. Most times it is necessary to develop special fertilizer blends and to apply soil amendments such as lime and/or gypsum to supply just the right amount of nutrients for crop production.

Waste analysis provides a prediction of the amount of nutrients supplied in a particular waste product and their availability for the upcoming crop. A waste analysis is absolutely essential to ensure that the proper nutrients are supplied for crop production. They also help avoid excess application and adverse impact on the environment. A waste analysis indicates the availability of essential nutrients for the first crop. It also indicates if potentially harmful levels of some elements are included in the waste product and helps protect land resources. Soils can actually become sterile from over-application of copper and and/or zinc.

Plant analysis provides a mechanism for follow-up and evaluation of crop fertility. It is absolutely essential when using waste products to meet nutrient requirements. It also provides a mechanism to fine-tune crop production and optimize yield and quality. A **plant analysis indicates the status of** the essential elements **(N. P. K, Ca, Mg, S, Fe, Mn, Zn, Cu, B, Mo)** at a given point in the production season. Many times, nutrient shortfalls can be addressed before they become critically limiting. Both crop yield and quality can be protected with a good plant analysis program. It is essential in the production of high quality vegetables.

Solution or water analysis can be used to evaluate the usability of an irrigation water source or to confirm that an agricultural enterprise is not adversely affecting ground water quality. Long-term records should be maintained of all ground and surface water sources on a farm to spot any gradual changes that may be taking place. These records also provide a record of stewardship and responsible farming practices. All water sources should be sampled at least annually. This practice is critical for trickle irrigation systems. Seasonal and long-term impact of the water on crop production can be predicted with this information.

It’s not too late to implement a comprehensive sampling program on your farm. Call your Agri-Tech consultant and ask them to suggest a sampling program that meets your needs and protects the long-term future of your farm. A good sampling program may be the least expensive insurance you can buy.