FFF Review

Fertility/tillage Management System Takes Planning

Designing a fertility/tillage management system requires an understanding of the resources available.

The first essential in fertility/tillage management is to develop a plan. Any business can function more efficiently by following an overall plan. While most farmers have a mental image of what they want to do, few commit their management plan to a written outline.

With goals and available resources in mind, a management plan should be developed that will make best use of the resources in achieving those goals. The resources available, particularly finances, may determine the rate at which one can work toward the goals, but in most cases the goals themselves should not be affected.

This is an important step. It will help to evaluate the practices being used and can serve as the basis for improved record keeping for the operation. Such plans and records, along with expected agronomic effects of the practices used, can then be evaluated through economic analysis.

Another essential step in evaluation of any management plan is economic analysis of the options available. This usually requires a detailed budget preparation and comparison of the options of tillage, fertilizer application, and other inputs with concurrent analysis of yield and income variations of the different scenarios.

Budget analysis software allows the farmer to analyze a range of options in a short time, providing more information on which to base his management decisions.

What follows is an overview of the range of resources, elements, and goals that must be considered or understood when developing a sound fertility/tillage management system.

Soil

The soil on a farm will often determine which type of tillage system is best suited. Local soil survey information identifies potentials and limitations of various soil types and should be used in developing the systems.

Soil scientists in universities, the Natural Resource Conservation Service (NRCS), and USDA have developed rating systems for adaptability of tillage and planting systems to different soil types. These ratings consider such factors as soil texture, water-holding capacity, and slope. They are an excellent general guide for determining whether a change in tillage system might be advisable on a given farm.

Knowledge of soil characteristics is also important in decisions relative to fertilizer placement and timing.

Sandy soils often require more frequent nutrient applications because cation exchange capacity (CEC) is usually low and nutrients are more easily leached below the root zone. On soils with very low CEC, potassium (K) applications may be needed annually rather than attempting to build up soil test levels. Nitrogen (N) should be applied as close to the time of uptake as possible on such soils. Split N application maybe more efficient than a one-time application.

Silt loams are generally the most productive soils and provide the widest range of options for tillage and fertility management systems. They have a relatively high water-holding capacity, good nutrient storage, and are easily worked under a wider range of moisture conditions.

Clay/clay loams have higher nutrient and water-holding capacities, but they are more subject to physical limitations due to moisture conditions during tillage. They are also more easily compacted under normal field operations. Crop residues from high-yield management can help improve the tilth of these soils by increasing aggregation of the clay particles into stronger structural units, allowing for better aeration, water movement and root penetration.

Organic soils are more easily managed, have high water-holding capacity, and high CEC, but they are often low in K and some micronutrients. To meet crop demand, higher soil test levels will usually have to be maintained than for mineral soils.

Alkaline soils (pH above 7.0) require special attention to P management. Placement of P in a band and/or in combination with ammonium-N fertilizers will help improve P efficiency on low P-testing soils. It may be more efficient to apply P fertilizer more often on these soils to ensure adequate supplies for the crop.

Soil testing/plant analysis are essential for a good fertility and tillage management system. A good soil testing plan should be developed to provide information on each field at least every two to three years. In a buildup or intensive management situation, or where crops are irrigated, annual soil tests can help monitor

progress. Plant analysis can determine if nutrients are being absorbed by plants. Accurate records on soil test results and locations of the sample allow subsequent tests to be taken from the same areas of fields.

When changing tillage or fertilizer placement systems, soil test levels at different depths in the profile should be carefully monitored. If shallow or reduced tillage or no-till is used, the top two inches (for determining pH, especially) should be sampled separately. A second sample of the top 6- to 7-inch layer (for determining P and K needs) should be taken.

Soil pH at the surface is critical in reduced tillage systems and affects herbicidal activity, early plant growth, and nutrient availability. Phosphorus and K stratification can occur, with high availability near the surface and sharply lower levels below 6 inches. Under low rainfall conditions. P and K could be subject to poor utilization because of the lack of moisture at the surface. This positional unavailability problem may be corrected with occasional deep tillage.

Sampling subsoil occasionally may provide useful management information. Some soils have very low P and/or K levels in the subsoil. Continuous cropping can further deplete these levels to the point where they limit production. This is especially true under reduced tillage systems where roots tend to be more shallow and nutrients do not move as readily down the soil profile.

Corrective action may require occasional deep tillage or deep placement of fertilizer materials. Maintaining adequate nutrient levels in the subsoil helps crops to root deeper and to better utilize water and nutrients during dry seasons.

Fertilizing soils should be planned on the basis of soil tests, previous crops and yields removed, and yield goals that have been established for each field, If soil tests are maintained at a high level, timing and method of application will be less critical, increasing the number of options available.

Climate

While climate is similar within a given region, it does have an impact on whether a farmer in one region can adapt a tillage system that is being used in another.

Rainfall, rainfall distribution, temperature cycles, etc., influence whether a given tillage system would be a good choice.

Weather factors may need to be assessed each year to determine if plans should be changed. For example, if deep tillage in the spring is planned and the weather stays wet, the plan may need to be altered.

Soil and climatic conditions (cold soil temperatures, soil compaction, excess soil moisture) can also influence the need for starter fertilizers and must be considered along with soil nutrient availability.

Finances

Financial considerations can limit the options available for tillage and fertilizer placement.

Even if it is decided that tillage systems should be changed, finances may dictate delaying the change.

It is still important to have the option of a long-range plan to cover equipment changes as replacements are needed.

Computer software

Evaluation of tillage and fertility management systems for different soil types and management can be enhanced with the use of decision-aid programs for personal computers.

Management models have been developed by many universities, the USDA, Agriculture Canada, and industry sources. Some models concentrate on evaluating adaptability of systems to soil type and climatic region. Others handle economic analysis and crop budgets for various management systems.

As data bases and management decision software have become more readily available, they have become common management tools for farmers and consultants.

Setting goals

Every farmer should have clear goals defined for his operation. Goals form the foundation upon which management decisions can be made.

Profit. Business plans should be developed around a profit goal and might include overall profit for the farm or a profit per unit of yield.

Yield. Fertility decisions, hybrid/ variety selection, and other management decisions must be made on the basis of a yield goal. It is important that the yield goal be realistic with respect to the resources available. The goal should be based on past experience. It should be above the historical average for a given field.

Risk associated with setting yield goals should be carefully considered. Some practices and goals have a higher risk and should be selected with that in mind. Resources -- soil, climate, finances, etc -- will help determine the acceptable level of risk.

Environmental. Considerable attention has been focused on selecting best management practices (BMPs) for different soils and crops. Environmental goals should include reduced runoff, control of wind erosion, and efficient use of fertilizers and chemicals for the protection of groundwater.

Practices that work toward environmental goals may sometimes conflict with production and economic goals. Fortunately, however, there are many more cases where practices that lead to increased yield and profits also lead to more responsible attention to the environment.

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