

## *Production, Protection and Profit (3 Ps)*

### **Situation**

Highly productive and sustainable cropping systems require more efficient as well as environmentally sound practices. Additionally, there is an ever-increasing public demand to maintain and improve soil quality, conserve resources, and protect water quantity and quality. Without profitability, neither productivity nor protection will be sustainable, so growers are constantly seeking information to maximize the “3Ps”, production, protection, and profit.

Several challenges to the 3Ps are present in Kansas.

**Weeds:** Weeds cause tremendous economic loss in cropland each year due to reduced crop yields, cost of control, harvest related issues, and lower value of the harvested crop. Weeds have developed herbicide resistance from the lack of integrated weed control practices, which result in lower crop yields, increased cost of control, and reduced profitability. Inappropriate use of herbicides can result in environmental concerns from off target movement and contamination of our natural resources.

**Diseases:** Complexes of diseases annually threaten field crop production in Kansas. Annual yield loss estimates for the wheat crop indicate an average statewide yield loss of 11.4% valued at approximately \$170 million. Similar estimates for soybeans suggest a 12.5% annual yield loss to diseases. Since 2012, the annual estimated yield loss in corn due to diseases is 15.7%. Stalk rots annually contribute to about 2/3 of that total amount. The most common and damaging diseases in Kansas vary by crop. For wheat, the fungal diseases leaf rust, stripe rust, and septoria leaf spot as well as several viral diseases including wheat streak mosaic and barley yellow dwarf are responsible for the bulk of the annual losses. In corn, gray leaf spot, southern rust, Goss’s wilt and various stalk and ear rots are the most threatening diseases. Charcoal rot, seedling blights, and soybean cyst nematode are responsible for nearly all of the state’s annual soybean losses. For grain sorghum, stalk rots and head molds are the most common yield limiting diseases.

**Insects:** A various arthropod pests create dynamic challenges to profitable crop production in Kansas. In wheat, Barley Yellow Dwarf Virus and the Wheat Streak Mosaic / Triticum Mosaic Virus complex are vectored by bird cherry oat aphid and wheat curl mite, respectively. Range expansion of the wheat stem sawfly into northwest Kansas represents an imminent threat to winter wheat production. In the east, Hessian fly and chinch bugs are annual problems in wheat and sorghum, respectively, and alfalfa weevil is a perennial problem that is costly to control in alfalfa. In addition, multiple migratory pests arrive annually that inflict significant economic costs on multiple crops. These include corn earworm (corn and sorghum), greenbug (wheat and sorghum), head moth (sunflower), potato leafhopper (alfalfa) and fall armyworm (multiple crops). Sugarcane aphid has become a significant pest across much of Kansas wherever sorghum is produced. This invasive pest first reached economic levels in Kansas in 2015 and many more fields exceeded thresholds and required insecticide treatments in 2016. Kansas remains at risk of serious infestations in 2018 as migrant

aphids disperse northward again from a broad region to the south. Early detection of this pest relies heavily on a coordinated team of specialists, agents, consultants and farmers from Texas to Kansas.

**Nutrients:** Crops with high yield potentials, currently grown in Kansas, cannot reach optimum yields without ensuring adequate, balanced supply of nutrients. Conversely, excessive levels of soil nutrients (particularly manured soils) often generate buildup of nutrients over time, resulting in high risk of ground and surface water contamination. The animal production industry in Kansas produces over 97 million pounds of recoverable N and 65 million pounds of recoverable P annually; it is an important resource for meeting the N and P needs of Kansas crops. However, both economic and environmental concerns arise when manure is not used efficiently.

**Crops and Soils:** Tillage and crop residue management is another vital component of sustainable cropping systems for the Great Plains. Crop residue can increase utilization of available water from rainfall and irrigation, and decrease the transport of nonpoint source pollutants (e.g., fertilizers, pesticides, etc.). Proper residue and vegetation management can increase crop production and enhance sustainability in highly variable environments. Losing soil to wind and water erosion is unsustainable. Many producers are seeking information on profitable ways to improve the health and quality of their land, management of soil and available water, and use of appropriate plant populations. This can be accomplished through diverse crop rotations, using cover crops, and through reduced or zero tillage.

## Outcomes

### Short-Term (Knowledge)

- Participants gain awareness of the benefits and effectiveness of an integrated pest management program.
- Growers will learn the characteristic symptoms of the common crop diseases in Kansas.
- Growers will learn the appropriate timing for implementing various disease management strategies, particularly the optimal crop growth development stages for foliar fungicide use.
- Growers will learn about KSU publications that can help them select the most appropriate fungicide products for disease control.
- Growers will know where to find information about disease resistant varieties and fungicide products.
- Participants will raise their awareness and interest in nutrient management issues aiming to increase yields while minimizing environmental impact.
- Participants will increase their knowledge and understanding of current soil fertility and nutrient management issues, such as soil fertility management under reduced tillage production, the use of manure and waste materials as nutrient sources.
- Participants will raise their awareness of and interest in profitable, sustainable residue management, including tradeoffs associated with intensive tillage or removal of crop residue from fields.
- Participants will increase their knowledge and understanding of issues related to residue management, such as soil and water impacts including declining irrigation availability.
- Participants will build their knowledge and expertise in selecting and utilizing cover crops for soil building, soil saving, water efficiencies and potential yield improvements in their crop production systems.

### Indicators

- What awareness do participants gain about the benefits and effectiveness of an integrated pest

management program?

- What do grower participants learn about crop diseases and insects in Kansas and crop disease management?
- What do grower participants learn about growth stages that are appropriate for disease management? - Are the grower participants able to identify the KSU publications that help them select the most appropriate fungicide or insecticide products for disease and/or insect control?
- Are grower participants able to identify sources of information for selecting disease resistant varieties and fungicide products?
- Have participants increased their awareness of nutrient management issues?
- What knowledge and understanding have participants gained about soil fertility?
- What awareness and interest did participants gain about profitable and sustainable residue management?
- What knowledge and understanding did participants gain about residue management?
- What knowledge and expertise of successfully implementing cover crops into their cropping systems did participants gain?

### **Medium-Term (Behavior)**

- Participants will make informed decisions about integrated pest management.
- Growers will integrate variety/hybrid selection for disease resistance along with fungicide applications for profitable crop disease management.
- Participants will improve decision making for more efficient, agronomic and environmentally responsible nutrient management.
- Participants improve their management of crop residue to maintain or improve soil quality and sustainability of crop production.

### Indicators

- What choices do participants make for an integrated pest management program?
- Do grower participants integrate variety/hybrid selection with fungicide applications to manage crop disease?
- Do participants demonstrate decision-making that will lead to more efficient, agronomic and environmentally responsible nutrient management?
- How have participants sought to improve their management of crop residue?

### **Long-Term (Change in Condition)**

- Adoption of weed and/or management practices that maximize profitability and are sustainable while having minimal impact on the environment.
- Reduction in the yield losses caused by crop diseases in Kansas.
- Increased stability of field crop production for our state.
- Improved nutrient use efficiency and yield while minimizing environmental impact.
- Maintain and improve soil test P, particularly in regions with history of manure use.
- Increased number of producers implementing nutrient management plans.
- Increase in the number of producers and acres involved in soil testing programs.
- Kansas producers will have efficient, sustainable and competitive cropping systems.
- Kansas producers will save water and increase efficiency.

## Indicators

- Among participants who adopt integrated pest management practices, how do these practices influence their profitability, sustainability, and environmental impact?
- Have field crop growers in Kansas reduced their yield losses due to diseases?
- Has field crop production in Kansas become more stable?
- Have producers demonstrated improved nutrient use efficiency, as shown by increased yields and minimized environmental impact?
- Do producers maintain and optimize soil test P?
- As compared to before, how many producers implement nutrient management plans?
- As compared to before, how many producers are involved in soil testing programs?
- How many Kansas producers demonstrate efficient, sustainable and competitive cropping systems?
- How much have Kansas producers saved water and increased their operational efficiency due to improved residue management?

## **Public Value**

When you support the crop production, protection and profit program, participants will gain knowledge needed to practice cost effective and environmentally sound crop production practices. This can include, but not limited to: cropping systems, nutrient and water management, weed and pest management, and how to better identify which diseases and diseases threaten the productivity of their farms. In addition, by supporting a cross-disciplinary team approach, solutions that consider multiple interactions between factors affecting crop production can be developed and implemented. Meanwhile, producers will develop management strategies that help maintain the profitability of their farms and avoid unnecessary herbicide and pesticide applications. When producers can gain information to increase production and protection while increasing profit, this will benefit other community members by increasing the viability of rural communities and access to a safe food supply.

## **Outputs**

Our audience includes: producers, extension agents, consultants, and agribusiness. Educational efforts will continue through publications, e-updates, press releases, websites and web-based decision support systems, radio/TV interviews, on-farm demonstrations and applied research, and crop diagnostic schools. In addition, we will do the following specific activities:

- Revise the Chemical Weed Control Guide on an annual basis and distribute to county extension offices, farmers, crop advisors, and agricultural industry, as well as make it accessible on <http://myfields.info>.
- Participate in crop schools and field tours to provide information on integrated weed, disease, and insect management in field crops.
- Provide information to the public on integrated pest management through traditional media, electronic media, publications, and newsletters.
- Conduct a series of Integrated Weed Management meetings throughout the state to focus on integrated weed management and current weed science issues.
- Meetings will be conducted that focus on helping farmers identify and adopt the best strategies for profitable management of crop diseases in Kansas.
- Field crop variety/hybrid demonstration plots that allow growers hands-on training in disease identification and provide important information about the most appropriate varieties/hybrids for their area of the state.

- Pre-plant crop schools that target variety/hybrid selection, fertility, crop rotation and other cultural practices that minimize disease risk and maximize productivity of the crop.
- Coffee-shop meetings that provide in-depth training on crop disease management in a discussion format.
- Soil fertility schools: a basic soils 101 school, one day program, will provide training in basic soil fertility providing information on soils and soil nutrients. Topics will include: soil basics, soil pH, soil nutrients (N, P, K and micronutrients), soil sampling and testing, and manure nutrient management.
- An additional school is also proposed as continuation of the basic soils training to discuss concepts of soil fertility and nutrient management. Topics would include newly developed technologies for nutrient management and useful theoretical concepts in soil fertility. These schools would be developed in addition to regular winter meeting and in cooperation with county agents.
- On-farm demonstrations will be established on the effect of different nitrogen management approaches, including the effect of application timing and methods. These demonstrations will also incorporate the use of available remote sensors for in-season nitrogen management strategies. These technologies can include Chlorophyll Meter SPAD for corn and reflectance meters for wheat and sorghum.
- Workshops to equip producers for the specific challenges that come with management of high-residue cropping systems, how to optimize no-till, and the agronomic, economic, soil, and water quality benefits of maintaining appropriate amounts of residue for their soils and crop rotations. Content will be tailored for audiences, particularly those who are just beginning in no-till or other high residue systems.
- Summer demonstration ideas for crops schools for crop advisors and extension agents will be developed as a result of focused discussion from the winter meetings.
- On-farm demonstrations and studies: Specialists and agents will work together to establish demonstrations and/or replicated strips of residue management and/or no-till practices of particular interest in a given area.
- Information on production practices, pest management, nutrients, and precision agriculture technologies will be presented at corn and soybean crop schools held across Kansas, which are supported by state commodity organizations.