

# Crop Management

## I. VARIETY INTEGRITY AND SELECTION

Tobacco variety integrity is a quality assurance step that requires that the seed used is the correct type for the growing region, was certified by an approving governing body, and has a lot number for traceability should issues arise. Variety selection is the foundation for a successful crop from an agronomic, environmental, quality and economic perspective.

### Good Agricultural Practices

- Variety selection should be based on the following criteria:
  - Disease resistance
  - Curing characteristics and cured leaf quality
  - Yield
  - Holding ability
- Review actual on-farm variety performance records and Extension information such as the “University Tobacco Production Guides” at the start of each season. Your local Extension Agent is also available to help in variety selection.
- Identify and test new varieties which show potential to improve your farm’s overall performance.
- Use only certified seed and LC varieties for dark and burley tobacco. Plant only varieties approved by your contracting company.
- Avoid planting varieties with high resistance to black shank race 0 and little or no resistance to race 1 in the same fields consecutively over a period of years.

### Documentation

- Document:
  - Varieties planted
  - Seed lot numbers
  - Seedling sources -- whether you purchase plants or grow your own plants, all varieties and seed lot numbers should be documented
  - If applicable, verification of screened seed or LC varieties
  - Seeding dates
- Document sources of variety information (seed company literature, university production guides, buying company recommendations, etc.).

### Inspection List

- Are seed or seedling sources documented?
- Are seed lot numbers and variety names recorded?
- Are transplant seeding dates recorded with their respective varieties?
- Are published sources used to select varieties?
- If applicable, did the grower use screened and low converter (LC) seed?

## II. INTEGRATED PEST MANAGEMENT

Integrated Pest Management (IPM) is a coordinated approach to crop management that uses as many suitable and compatible methods (cultural, biological, and chemical) as possible so that pest populations do not exceed economic thresholds and, therefore, avoids unacceptable crop losses and environmental damage.

IPM does not necessarily mean completely eliminating agrochemicals, but rather their judicious use as a defense against pests and diseases whose population cannot be maintained at acceptable levels using other alternatives. Where agrochemicals have to be applied they should be used safely and in accordance with all State and Federal laws and regulations.

### Good Agricultural Practices

#### IPM Fundamentals:

- Select varieties resistant to common diseases, nematodes, and other pests when available and appropriate to your field histories.
- Use a rotation of tobacco with other crops that effectively reduces pest pressure as appropriate for your field history. Follow local Extension recommendations in designing an appropriate rotation.
- Top and manage suckers in a timely fashion.
- Observe likely future tobacco fields for possible disease and weed problems, and review field records from previous years in tobacco prior to tobacco planting.
- Collect soil and root samples for nematode identification and population determination to determine management practices in areas where nematodes have been identified as a problem.
- Use disease and pest free seedlings that are uniform and healthy.
- Transplant the crop within the recommended time period for your area.
- Avoid possible transfer of infection from tobacco products, waste tobacco materials, or infected soil by maintaining strict hygiene in the seedling production area and during the early stages of field crop production.
- Use alternative crop protection practices that minimize the use of synthetic pesticides such as promoting the proliferation of natural pest predators and destroying alternative host plants.
- Clean or sanitize equipment used in the production of seedlings and the crop regularly.
- Destroy unused transplants, tobacco field crop residues, and all waste tobacco materials (such as scrap) as soon as possible after their respective productive cycles are completed.



#### IPM Control Fundamentals:

- Monitor or scout frequently and systematically for infestation by pests.
- Identify the problem: pest, disease, or weed species.
- Understand pest life cycle, habits, damage caused to tobacco, and natural predators.
- Know economic threshold levels for pests with established thresholds and treat if pests reach this level.

#### IPM Chemical and Biological Fundamentals:

- Properly match pesticide to pest and time treatments to match the pest's most vulnerable life stage.
- Use only those agrochemicals and biological agents registered and approved for the particular tobacco type and specific pest problem, strictly following label instructions and complying with all regulations and guidelines.

- Apply pesticides at the right time of day and with the proper equipment for most effective control.
- Ensure adequate spray coverage.
- Select the appropriate rate of a pesticide for target pest(s).
- Rotate pesticide mode of action if multiple pesticide applications are necessary and use a variety of alternative practices to avoid the development of pests and pathogen resistance to crop protection agents or other control practices.
- Use natural crop protection agents such as biological control agents and plant extracts or other low toxicity products when they are economical, registered for use on tobacco and proven effective against the target pest.

## Documentation

- Document:
  - field scouting dates
  - pests identified during scouting, and the level of infestation
  - crop protection agent applications made by field and date
  - follow-up assessment of pest control practices
- Maintain accurate field/tract records including the cropping history, pests, diseases, and weeds for at least the previous two growing seasons
- Document sources of pest control information

## Inspection List

- Does the grower have scouting records indicating an established scouting program?
- Are pest problems (diseases, insects, weeds, etc) identified and recorded by field/tract?
- Are the levels of infestation recorded?
- Are records maintained that include cultural pest control practices and chemical controls, application date, rates by field/tract locations?
- Does the grower use appropriate information to determine best pest management practices?

## III. NUTRIENT MANAGEMENT

Nutrient management is the practice of applying plant nutrients in the appropriate amount for the most profitable level of production while minimizing negative environmental impacts.

### Good Agricultural Practices

- Review Extension Service publications for specific tobacco fertilization recommendations such as the “University Tobacco Production Guides.” Your local Extension Agent is also available to help with fertilization requirements.
- Maintain adequate soil fertility over time.
- Fertilization should be based on:
  - soil type
  - crop rotation (previous planted crop)
  - requirements as determined by a soil test that is no more than three years old
  - contract requirements
- Confirm fertilizers are appropriate for use with tobacco and applied using recommended or required application rates, timing and methods.
- Follow recommendations for the use of organic materials and animal manure. Take into account nutrients from organic sources when setting rates for inorganic sources of fertilization.
- If required by state or watershed regulations, implement a Nutrient Management Plan through your local Soil and Water Conservation District, the Natural Resource Conservation Service, or applicable organization in your area.



## Documentation

- Keep field/tract specific records of:
  - soil test results that are no more than three years old at the applications are made,
  - soil type, and
  - specific nutrient(s) and/or lime applied and dates and rates of application (for all pre-plant, side dress, and foliar applications).
- To help determine if nutrient availability has been affected due to leaching keep records of:
  - rainfall received at each farm location per weather event and
  - if applicable, amount of water applied with irrigation per field/tract.
- Recommended observations and records:
  - Other weather conditions that may have affected nutrient availability
  - Performance of applied nutrient by field/tract
  - Agricultural practices which may impact nutrient management for tobacco fields in the future (i.e., crop rotations, fertilizer applications to other crops, cover crops , etc.)

## Inspection List

- Does the producer have soil tests no more than three years old at the beginning of the field season on all tobacco fields/tracts?
- Are nutrient management practices consistent with soil test and University and contracting company guidelines?
- Is tobacco treated with fertilizers appropriate for use with tobacco and applied in accordance with the recommended application rates and methods?
- Are records of specific applications that include fertilizer analysis, application date, and rates kept by field/tract?
- Are rainfall and irrigation amounts recorded?

## IV. CROP AND OPERATION MANAGEMENT

### Good Agricultural Practices

- If required by your contract, complete FSA Form 578 Crop Report each year.
- Ensure surfaces used for market preparation, baling, storing or hauling tobacco do not have materials that have been treated with or have spillage of petroleum-based preservatives or fluids or pesticides.
- Keep tobacco types (burley, dark, Maryland, cigar, flue-cured, etc.) strictly separated from each other during seeding, curing, and market preparation operations.
- Manage the tobacco crop with a focus on improving agrobiodiversity. This means consider growing practices that will improve the ecosystem in regard to protection of different species of mammals, birds, bacteria, plants and fungi.
- Strictly follow crop identity preservation practices (e.g., the selection of genetically modified GM crop fields) to prevent commercial tobacco crops from mingling with other GM crops.
- Develop an awareness of climate change issues; e.g., carbon dioxide, impact of CPA usage and fertilizer.

### Seedling Production:

- Manage tobacco plant production greenhouses in an environmentally responsible manner and grow healthy, vigorous, uniform plants.
- Prohibit smoking or the use of tobacco products in the greenhouse to reduce the risk of spreading of tobacco mosaic virus.

### **In the Field:**

- Transplant and top the tobacco at the appropriate time and harvest it at the correct stage of maturity to be consistent with contract requirements to achieve desired product quality while maintaining yield.
- Follow the terms of your contract with regard to specific leaf number or plant spacing requirements or recommendations related to the particular tobacco type.

### **Curing, Market Preparation and Storage:**

- Separate tobacco by stalk position and quality to meet contract requirements.
- Ensure the moisture levels and bale weight are within contract specifications.
- Ensure marketing packages are uniform and meet all contractual requirements.

### **Tobacco Transportation from Farm to Market:**

- All tobacco should be covered and secured to ensure protection from inclement weather. Avoid use of plastic covers.
- Ensure all transportation surfaces are free from contaminants (e.g. oils, greases, animal residues, agrochemicals)

## **Documentation**

- Keep records of:
  - plant population
  - planting, topping, and harvesting dates
  - worker training on grade/stalk separation
  - worker training on moisture and weight requirements

## **Inspection List**

- Is tobacco planted within the required dates if stated in your contract?
- Are records kept of plant population (or row width and plant spacing)? Does tobacco planted meet the plant population density requirements (if stated in your contract)?
- Are dates of key production practices recorded by field?
- Are workers trained on grade/stalk position separation (posters, videos, CDS, GAP handbook)?
- Are workers trained on moisture and weight requirements?

## **V. CURING AND BARN MANAGEMENT**

Proper curing and barn management is critical for maximizing both yield and quality and, therefore, crop value. Curing tobacco is the culmination of all previous steps taken to produce and maintain the crop. Quality can decline with improper curing, or be maintained and realized when curing is performed correctly.

### **Good Agricultural Practices**

- Select sites and designs for curing barns that will allow the most efficient operation.
- Balance barn capacity with its capability to cure efficiently and cure in ways that optimize output while maintaining the desired cured leaf quality.
- Ensure that the curing structures are safe and well designed for workers and protect the tobacco.
- Exclude livestock from curing barns/structures

### **Flue-cured Tobacco Operations:**

- Use only indirect fired systems to prevent the tobacco from being exposed to combustion gases.
- Inspect the overall condition of the barn prior to curing including exposed insulation, heat exchangers and equipment in curing barns for leaks that could result in exposure to combustion gases.

- Barns must be tested every three years for CO<sub>2</sub> (carbon dioxide) emissions that indicate possible leaks in the barn heating system.
- Use hygrometers, a wet-bulb or other temperature and humidity sensors to either automatically or manually control barn ventilation to optimize leaf quality.
- Conserve fuel by employing the most energy efficient curing structures and management systems to cure tobacco in the most efficient manner.
- Consider selecting fuel supply systems that use renewable energy sources when technology advances make them economically feasible and environmentally positive.

### **Air-cured Operations:**

- Check that adequate ventilation is provided during the curing process and that the tobacco is spaced properly for good air movement to prevent “house burn.”
- Burley growers should use the Burley Curing Advisory website to get the latest weather and climatic forecasts to help you manage your burley curing program in locations where available (most of Kentucky and counties that border Kentucky in adjoining states).

### **Documentation**

- Document:
  - the type and number of curing structures/barns
  - the curing structure/barn used for each field’s/tract’s harvested tobacco
  - the date tobacco was put in curing structure and the date it was taken out of the curing structure
- Air-cured and fire-cured operations need to document the spacing of sticks in curing structures.
- Fire-cured operations need to document the number of firings used to cure each field/tract.
- Flue-cured operations need to maintain proof of a “passing” barn test for CO<sub>2</sub> emissions and faulty or cracked heat exchangers that is no more than three years old.
- Flue-cured operations need to maintain records of fuel used in curing for calculation of pounds cured per gallon of fuel

### **Inspection List**

- Are air cured and fire cured barns well designed to be safe for workers and allow adequate ventilation and efficient operation?
- In air cured structures, is tobacco adequately protected from adverse weather?
- Flue-cured Operations:
  - Verification of barn test no more than three years old.
  - Presence of instrumentation for monitoring temperature and humidity in each barn.

## **VI. NON-TOBACCO RELATED MATERIALS (NTRM)**

NTRM or foreign matter is a broad term that refers to all materials that are not tobacco lamina and stem. This includes, but is not limited to: soil particles, paper, string, metal fragments, tobacco stalks and suckers, plastics, foam materials, wood, grasses, weeds, oils and burlap fibers, as well as gloves and other personal protection equipment. Providing a product that is free of all forms of NTRM is a critical aspect of GAP that begins at the farm level with elimination of NTRM sources and physical removal of all NTRM materials during on-farm tobacco handling, storage and transport.

### **Good Agricultural Practices**

- Provide training and increase awareness on NTRM issues and the importance of clean tobacco throughout production and marketing preparation.
- Develop a proactive program (see details below) to eliminate and avoid any tobacco contamination and insect infestation sources on the farm: before the growing season begins, during growing, harvesting, curing, market preparation, and transportation.

- Ensure that all facilities including green and cured leaf working areas, machinery and equipment are routinely inspected for possible NTRM contamination.
- Follow recommended crop management practices to control weeds and grasses in the field, which can be a source of NTRM.
- Monitor and inspect farmer facilities and bales for NTRM throughout the production and marketing cycle.
- Ensure that all the tools used in the market preparation area are in good condition and have handles made of wood or metal.
- Confirm elimination of NTRM sources and physical removal of all NTRM materials through regular visual inspections.
- Provide trash cans in market preparation areas that are secured i.e. not easily tipped over.
- Provide and enforce the use of designated break areas for workers in market preparation areas.
- A farm-level proactive NTRM program to eliminate and avoid any tobacco contamination and insect infestation sources on the farm often includes:
  - focusing upon the individual stages of the production cycle (e.g., greenhouse seedling production area, field, harvesting, curing, grading, baling, etc.),
  - identifying specific items to be inspected for each stage of production and for all tobacco handling areas, facilities, equipment, and storages,
  - maintaining general farm sanitation and cleanliness, and
  - reviewing materials and products used in tobacco production, handling, curing, and storage that could be potential NTRM.

## Prevention of Weed Seed Contamination

Contamination of cured and baled tobacco with seed of herbicide resistant pigweed and/or other problem weeds has become an important issue in some export markets. This is largely a flue cured issue but can be a problem in all tobacco types. All reasonable efforts should be made to prevent weeds from forming seed in the field prior to harvest.

Best practices include:

- Choose the most effective herbicide for control of the problem weeds.
- Use timely cultivation and hand weeding to supplement herbicides.
- Control weeds in field borders where harvesters will be turning.
- Scout fields before harvest and clean out escaped weeds.
- Control weeds after harvest by tillage or chemicals until a cover crop is established.

## Documentation

- Keep records of worker training on NTRM prevention, including
  - topics covered,
  - dates conducted, and
  - number of workers who attended.
- Keep records of inspection dates for all facilities, machinery and equipment for NTRM contamination.
- Keep records of practices for preventing weed seed contamination.

## Inspection List

- Has a program to eliminate NTRM (suckers, stalks, grass, weeds, etc) been developed?
- Are problem weed control practices documented?
- Are there designated break areas?
- Are there trash cans?
- Are tools and equipment in market preparation areas in good condition and constructed with metal or wooden handles?
- Are stripping facilities cleaned on a regular schedule?

*Recommended but not required:*

- For flue cured operations:
  - Does the grower have picking lines?
  - Does the grower have sand reels?
- For air cured and fire cured operations using stripping tables:
  - Does the grower have a slotted stripping table which allows dirt to fall out of the stripped tobacco?
  - Does the grower have wire mesh on the stripping table?



## VII. ON-FARM TOBACCO STORAGE

On-farm storage is often necessary to hold cured tobacco until it is ready to be marketed. Correct tobacco leaf conditions are required to avoid deterioration in quality and loss of yield. On-farm storage should provide safe and secure storage conditions.

### Good Agricultural Practices

- Tobacco for storage should be:
  - stored at the correct moisture and density,
  - free from any non-tobacco related materials (NTRM), contamination, or infestation,
  - regularly inspected for moisture content, heating, molding, fermentation, infestation, and deterioration in quality, and
  - free of any agrochemical product applied post harvest
- All tobacco storage facilities, structures, and/or areas should have good site hygiene and sanitation.
- Tobacco in the storage area should be protected from rainfall and other sources of excess moisture.
- Tobacco should be stored in an area free of agrochemicals, seed, or other products (including empty agrochemical containers) that could contaminate the tobacco.
- Do not use chemical and fumigation controls, including rodenticides, for on-farm storage.
- When storage facilities, structures, and/or areas are being used to store tobacco they should be:
  - clean, dry and properly ventilated,
  - free of NTRM and all tobacco scrap and byproducts,
  - if applicable, constructed of appropriate material that has not been treated or contaminated by chemicals that could transfer to tobacco, and
  - monitored and inspected for leaks, damage, and insect and pest infestation.
- If the storage facility used to store tobacco has:
  - a door it should be tight fitting and securable.
  - windows and/or other openings they should be equipped with screen-wire or other materials to prevent insect and pest infestation.
  - lighting fixtures they all should be covered with shatterproof shields
- Livestock should be excluded from storage areas

### Documentation

- List all facilities and areas used for tobacco storage.

### Inspection List

- Is the baled tobacco stored at the correct moisture and density?
- Are the storage facilities and/or storage areas:
  - adequate to protect the stored tobacco from adverse weather?
  - clean, dry, and properly ventilated?
  - equipped with tight fitting and securable doors?
  - have windows/openings that are sealable and equipped with screen-wire or other materials to prevent insect and pest infestation?
  - constructed of appropriate material that has not been treated or contaminated by chemicals that could transfer to tobacco?
  - being used for storing agrochemicals, petroleum products, fertilizer, or any other product that could potentially contaminate the tobacco?
  - free from NTRM and all tobacco scrap and byproducts?
- Are livestock excluded from the storage facility/area?

