IPM Plan Guide Sheet
Practices for Field Crop Production

This tool has been designed as a guide for developing the integrated pest management (IPM) component of a Natural Resource Conservation Service (NRCS) 595 Pest Management Plan. A 595 Pest Management plan is one of many cost sharing conservation programs available to farmers through the NRCS Environmental Quality Incentives Program (EQIP). A 595 Pest Management plan outlines industry standards of IPM that have been peer reviewed by: universities, independent consultants, nongovernmental organizations, NRCS staff, and other state and federal agencies, and provides site specific information as to how these strategies of pest management will be implemented.

The National IPM Program has defined the practice of IPM through the IPM Road Map of 2004, and is defined as:

“Integrated Pest Management, or IPM, is a long-standing, science-based, decision-making process that identifies and reduces risks from pests and pest-management-related strategies. It coordinates the use of pest biology, environmental information and available technology to prevent unacceptable levels of pest damage by the most economical means, while posing the least possible risk to people, property, resources and the environment. IPM provides an effective strategy for managing pests in all arenas from developed agricultural, residential, and public areas to wild lands. IPM serves as an umbrella to provide an effective, all encompassing, low-risk approach to protect resources and people from pests.” (IPM Roadmap, USDA, 2004)

IPM can help protect resource concerns by reducing pesticide use and impacts on the following:

**Soil** - Reducing pesticide use reduces the amount of pesticide in the soil and/or on the soil surface, and potential for impacts on soil biology, and carryover to subsequent crops.

**Water** - Reducing pesticide use reduces potential for leaching or runoff of pesticides into water and impacts on aquatic life, wildlife, and humans.

**Air** - Reducing pesticide use reduces potential for drift, air contamination, inhalation toxicity to humans and other animals and deposition on non-target surfaces.

**Plants** - Reducing pesticide use reduces potential for off-target movement and phytotoxicity to non-target plants.

**Animals** - Reducing pesticide use lessens potential for exposure and impacts on beneficial and other non-target organisms.

**Humans** - Reducing pesticide use reduces exposure potential and impacts on applicators, consumers, and others.

The first step in the planning process is to develop a basic pest management plan. NRCS will use the WIN-PST program to evaluate the environmental and human risks of the pesticides to be used. Soil type, methods of pesticide application, and other factors will influence this assessment. NRCS will evaluate which, if any,
mitigating practices may be needed to reduce the potential risks and will develop a plan to reduce risks related to runoff, erosion, and/or leaching to groundwater which is specific to the site and resources. Alternatively or in addition, a producer may choose to substitute pesticides that pose less risk in accordance with WIN-PST. Pesticide application setbacks and buffers from sensitive areas will be identified (such as surface waters, schools, residences, neighboring crops, etc.) based upon label instructions for each pesticide and marked on field maps. (Labels may also be viewed at: http://www.greenbook.net/.)

The addition of IPM practices to a pest management plan reflects a higher level of management, with the objective of further reducing the impacts of pesticides used. Implementing IPM practices can enhance the environmental benefits of a plan, and improve the health of crops and the farm system.

**To develop an IPM component of a Pest Management Plan, the following requirements apply.**

* Pesticide applicators must be properly licensed as per their state regulations. However, it is recommended that all IPM adopters become certified.

* Producer will obtain a copy of regional IPM guidelines or field crop production IPM elements for reference and for use in developing the IPM plan. EQIP field crop IPM elements and self evaluation of practices are available through the Ohio Integrated Pest Management program at: http://www.ipm.osu.edu/default.asp

* Develop a pest management plan with NRCS, as above, that includes needed mitigation practices.

* Develop an IPM plan. In addition to items in the pest management plan, you will need to choose appropriate practices from each major category (Prevention, Avoidance, Monitoring, and Suppression) in the "Practices" tab.

* Keep records. Records form the basis for decision-making including selection of crop rotations, economic thresholds, and suppression options. Keep records of scouting results including pest incidence and distribution, crop plantings/rotations, yields for each crop and field, pesticide applications, cultivations, and other activities.

NRCS encourages the building of soil health as an important part of an IPM plan. Increasing soil organic matter, reducing soil compaction, and managing nutrients will lead to healthier, more pest-resistant plants and reduce the need for chemical or other interventions. Practices that enhance soil quality include:

Cover crops
Crop rotation with high residue crops (grains/grass/legumes)
Residue management/reduced tillage
Nutrient management
Mulching with compost or other organic materials
Manure utilization
Limiting traffic/tillage on wet soils

Comment [P1]: These have not yet been discussed or decided upon, but were included in the generic tools from Maine.
<table>
<thead>
<tr>
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<th>Soybean</th>
<th>Alfalfa</th>
<th>Wheat</th>
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<tbody>
<tr>
<td>PREVENTION</td>
<td>Use certified pest, weed and disease-free-seeds when available.</td>
<td></td>
<td>Plant hybrids with resistance to leaf blight and stalk rots. If necessary treat seeds with fungicide if there is a current history of fungal disease in the field.</td>
<td>Plant-disease-free seed with a germination of 80% or higher. If necessary treat seeds with fungicide if there is a current history of fungal disease in the field.</td>
<td>If necessary treat seeds with fungicide that controls seedling blights, bunt and loose smut.</td>
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<td>Prevent weeds from going to seed. (Example: Cultivate, pull, mow, flame, etc.)</td>
<td>Flame weeding for agronomic crops[^2]</td>
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<td>Reduce moisture on plant surfaces to prevent disease incidence. (Example: Avoid overhead irrigation between 6 p.m. and midnight to minimize disease.)</td>
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<td>Employ methods to avoid spreading pests (pathogens, weeds, and insects). (Example: Work crop when dry, work infested fields last, hose down equipment between fields, etc.)</td>
<td>Organic Weed Management[^2]</td>
<td></td>
<td>Incorporate post-harvest residues if severe disease problems occurred during season from leaf diseases or brown stem rot. Tillage will improve surface drainage and reduce damage from Phytophthora root rot.</td>
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<td>Incorporate residues from fields with heavy disease infestation.</td>
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<td>Preventing pest problems reduces the need for pesticide applications and thus potential impacts of pesticides on resource concerns</td>
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<td>Destroy and/or remove crop residues for field sanitation procedures. Include fall tillage where appropriate to control weeds and break pest cycles. (Example: Plow under corn refuses in the fall to control European corn borer.)</td>
<td>Ohio IPM Elements[^1]</td>
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<td>Eliminate unmanaged plants that serve as pest reservoirs, such as: abandoned crops, volunteers from previous crop, or weed hosts of viruses.</td>
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[^1]: Ohio IPM Elements
[^2]: Organic Weed Management
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<td>Test soil or plant tissue annually to determine proper fertility and pH levels for crop and time application according to crop needs. Apply nutrients, fertilizers, and pH-adjusting agents according to recommendations.</td>
<td>Tri State Fertilizer Recommendations for corn, soybeans, wheat and alfalfa. &lt;sup&gt;20&lt;/sup&gt; Ohio IPM Elements&lt;sup&gt;3&lt;/sup&gt;</td>
<td>If manure is applied the nitrogen contribution is accounted for and reductions of synthetic nitrogen fertilizer are reduced accordingly. Maintain soil pH in the 6.5 to 7.0 range. Apply lime, if needed, six to 12 months before planting crop. Maintain soil pH in the 6.5 to 7.0 range. Apply lime, if needed, six to 12 months before planting crop. No more than 20 lbs of nitrogen are applied in the fall.</td>
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| Rotate crops that break the pest cycle. Do not plant crops from the same family at less than recommended intervals for the identified pest(s). | Ohio IPM Elements<sup>2</sup> | Rotate to crops other than corn. Rotate soybean with corn or small grains; a two or three year rotation is adequate under most circumstances. At least three years may be necessary for high populations of soybean cyst nematode. Rotate to corn or small grains, never follow alfalfa with alfalfa. Never plant wheat after wheat or spelt. A two to three year rotation away from wheat is recommended. |

| Match crops to appropriate sites to optimize plant health and avoid known pests. (Example: Avoid planting crops susceptible to fungal diseases in low wet fields.) | Treat seeds with fungicide if there is a current history of fungal disease in the field. Treat seeds with fungicide if there is a current history of fungal disease in the field. | Plant varieties with resistance to Phytophthora root rot, Sclerotinia stem rot. Use soybean cyst nematode resistant varieties in conjunction with rotation to reduce nematode populations. Plant winter hardy varieties with resistance to Phytophthora root rot, Anthracnose, Verticillium wilt and Aphanomyces root rot. Plant potato leaf hopper resistant varieties. Select high yielding varieties with good straw strength, winter hardiness and resistance to the important diseases in your area. Plant Hessian fly-resistant varieties. Plant after Hessian fly-safe date for your county. |

| Plant pest and disease-resistant-seed. | Plant Bt corn if in an area that has a history of European corn borer. | Plant varieties with resistance to Phytophthora root rot, Sclerotinia stem rot. Use soybean cyst nematode resistant varieties in conjunction with rotation to reduce nematode populations. Plant winter hardy varieties with resistance to Phytophthora root rot, Anthracnose, Verticillium wilt and Aphanomyces root rot. Plant potato leaf hopper resistant varieties. Select high yielding varieties with good straw strength, winter hardiness and resistance to the important diseases in your area. Plant Hessian fly-resistant varieties. Plant after Hessian fly-safe date for your county. |

| Implementing measures to avoid the buildup of pest populations reduces the need for pesticide applications. | Adjust planting dates and select cultivars with maturity dates that allow avoidance of early or late-season pests. | Time seeding with adequate soil moisture for rapid germination and to prevent losses from crown, and root rot and seedling diseases. Time seeding with adequate soil moisture for rapid germination and to prevent losses from crown, and root rot and seedling diseases. For late summer no-till seeding, plant as early in August as possible to avoid seeding losses due to Sclerotinia crown and stem rot. |

| Use and manage trap crops to protect main crop from insect pests and insect-vectored diseases. | | |
### PRINCIPLE

#### MONITORING

Monitor for pests as recommended for each crop. If no monitoring guidelines available, monitor weekly to determine presence, density, and locations of pests and to determine crop growth stage. Record findings. Record keeping is required. (Example: Scout crops and use other appropriate monitoring aids such as pheromone traps, disease diagnostic tests, etc. Map weeds in the fall to help plan where specific measures may be needed to target problem weeds the following spring.)

Use on-farm weather monitoring devices to measure precipitation, humidity, temperature, and leaf wetness and/or use commercial weather prediction service for prevention and control of plant diseases. (Example: Install weather station with rain gauge, hygrometer, maximum and minimum temperature recording equipment, leaf-wetness sensors.)

Use pest-forecasting tools (e.g., computer modeling software) as additional guides for on-farm pest monitoring activities in conjunction with weather data to predict risk of pest infestation.

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### SUPPRESSION

Applying suppression actions only when pest populations exceed the action threshold reduces potential impacts of pesticides on resource concerns.

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<td></td>
<td>Use cover crops, especially pest-suppressing crops (allelopathic), in the rotation cycle to reduce weeds and disease incidence and to improve soil quality.</td>
<td>See references four, seven, 16, 18, 23,26 for cover crop guidance and SARE Nematode fact sheet 11.</td>
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<td>Plant using appropriate within- and between-row spacing optimal for crop, site, and row orientation. (Example: Use row spacing and plant densities that assure rapid canopy closure.)</td>
<td>Ohio IPM Elements' for crop-specific recommendations.</td>
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<td></td>
<td>Use reduced tillage and other residue management practices to suppress weeds and maintain soil organic matter as appropriate for crop.</td>
<td>See NRCS practice standards 329, 345, 346 for residue management.</td>
<td>Conserve organic matter with no-tillage or minimum tillage where feasible. (Depends on soil texture, soil moisture and drainage, soil temperature and lay of the land)</td>
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<td>Use mulches including plastic or reflective mulches for insect or weed control.</td>
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<td>Inter-seed cover crop within or between rows to suppress weeds.</td>
<td>See references 4, 7, 16, 18, 23, and 26 for cover crop guidance and SARE Nematode fact sheet 11.</td>
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<td>Use mechanical pest controls. (Examples: Cultivate, mow, hoe, and hand remove insects and weeds, prune diseased or insect-infested plants, remove diseased plants.)</td>
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<td>Use physical pest controls and deterrents. (Example: noise-makers; reflectors; ribbons; and predator models.)</td>
<td>Guide to Biological Control 28</td>
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Weed control especially important as weeds act as hosts for *Sclerotinia* white mold and soybean cyst nematode.
**PRINCIPLE**

**PRACTICES**
- Maintain or improve soil aeration and drainage to avoid standing water and minimize plant disease. (Example: Use tile drainage, subsoiling, grassed waterways, raised beds, and organic matter additions. Avoid planting in low and wet spots in field.)

**REFERENCES**

**Field Corn**
- Improved drainage will reduce damage caused by *Phytophthora* and other seedling diseases

**Soybeans**

**Alfalfa**

**Wheat**

**BIOLOGICAL CONTROLS**
- Use insect mating disruption devices, if available.

**REFERENCES**
- Natural Enemies in Field Crops, Environmental Impact of Pesticides (EIQ), Guide to Biological Control

**Field Corn**

**Soybeans**

**Alfalfa**

**Wheat**

**BIOLOGICAL CONTROLS**
- Conserve naturally occurring biological controls. (Example: Select pesticides and time applications to minimize impact on beneficial, use floral perimeter crop to attract and support beneficial insects.)

**REFERENCES**
- Natural Enemies in Field Crops, Environmental Impact of Pesticides (EIQ), Guide to Biological Control

**Field Corn**

**Soybeans**

**Alfalfa**

**Wheat**

**BIOLOGICAL CONTROLS**
- Release beneficial organisms where appropriate. (Example: release predatory mites for control of two-spotted mites and thrips.)

**REFERENCES**
- Guide to Biological Control

**Field Corn**

**Soybeans**

**Alfalfa**

**Wheat**

**BIOLOGICAL CONTROLS**
- Use compost as a soil amendment to increase biological diversity in soil and plant health and suppress plant disease.

**REFERENCES**
- Ohio IPM Elements

**Field Corn**

**Soybeans**

**Alfalfa**

**Wheat**

**SUPPRESSION**

**CHEMICAL CONTROLS**
- Applying suppression actions only when pest populations exceed the action threshold reduces potential impacts of pesticides on resource concerns.

**REFERENCES**
- Weed Control Guide For Field Crops, Ohio IPM Elements, Economic Threshold for Weeds

**Field Corn**
- Minimize chemical use. Use in conjunction with accurate pest identification and monitoring, action thresholds, alternative suppression tactics (biological, cultural, etc.), and judgments based on previous year's weed map and/or pest scouting records. (Example: Use pheromone traps to monitor for corn earworm in sweet corn.)

**CHEMICAL CONTROLS**
- Spot or rescue herbicide treatments are based on available economic threshold and weed interference information.

**Field Corn**

**Soybeans**

**Alfalfa**

**Wheat**

**CHEMICAL CONTROLS**
- Spot or rescue herbicide treatments are based on available economic threshold and weed interference information.

**Field Corn**

**Soybeans**

**Alfalfa**

**Wheat**

**CHEMICAL CONTROLS**
- Monitor viability of alfalfa stand to determine whether herbicide application is justified, or if the field should be rotated to another crop. Spot or rescue herbicide treatments are based on available economic threshold and weed interference information.
### PRINCIPLE

**Select pesticides, formulations, and adjuvants based on least negative effects on environment, beneficial (e.g., pollinators, predators, parasites), and human health in addition to efficacy and economics.**

See environmental cautions on pesticide label and Environmental Impact of Pesticides (EIQ)\(^9\).

**Use lowest labeled rate that is effective based on label, scouting results, and Extension-recommended action thresholds for target pest.**

Contact state NRCS or Extension office for spray record keeping forms.

**Limit applications to partial fields or banding to reduce quantity or impact of pesticide. (Example: Spot treat where pests are found or use banding, seed, edge or field perimeter/border treatments.)**

Herbicide programs and rates are selected on a field-by-field basis, based on tillage, soil factors, and knowledge about weed populations.

**Calibrate sprayers or applicators prior to use to verify amount of material applied.**

Pesticide Calibration Guide\(^8\)

**Use pesticide-resistance management strategies as appropriate and where required on pesticide label. Example: Alternate applications of chemicals with different modes of action to avoid development of pest resistance or leave part of crop unsprayed to serve as a refuge for susceptible pests and natural enemies.**

Managing Pest Resistance to Pesticides\(^10\).

**Use specialized pesticide application equipment to increase efficiency and reduce chemical drift. (Examples: Use wiper applicators, digitally controlled adjustable tool bars, direct injection sprayers, double-drop sprayers, laser guided precision sprayers, direct injection, low-drift nozzles, shielded applicators or air induction booms, built-in tank washers, etc.)**

**Use spray-monitoring equipment. (Example: Use water-sensitive cards to measure spray pattern and drift.)**

**Use vegetative buffers, set-backs, or filter strips to minimize chemical movement to sensitive areas such as surface waters, schools, residences, and neighboring crops.**

### SUPPRESSION

Herbicide programs and rates are selected on a field-by-field basis, based on tillage, soil factors, and knowledge about weed populations.

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<td>Use mitigation practices as necessary in accordance with pest monitoring results, pest predictions, action thresholds, and WinPST output.</td>
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<td>Pesticide applicator must be properly licensed and certified when using restricted use pesticides or when doing custom pesticide applications for hire. Contact state pesticides regulatory agency for license and certification requirements.</td>
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<td><strong>NOTE: Additional pesticide use requirements from the 595 Practice Standard:</strong></td>
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<td>&gt; Always follow all pesticide label instructions and environmental cautions.</td>
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<td>&gt; Store, handle, transport, mix, use, and dispose of pesticides and pesticide containers per state pesticides regulatory agency recommendations and regulations.</td>
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<td>&gt; Follow state and federal worker protection standards.</td>
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<td>&gt; When drawing water for pesticide mixing from any surface waters of the state, use anti-siphoning devices and do not use hoses that have been in contact with pesticides.</td>
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<td>&gt; Do not mix or load pesticides within 50 ft from the high water mark of any surface waters of the state.</td>
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*NOTE: See documents listed in the attached resource list for additional guidance.*
IPM Practices for Field Crop Production

Resource List

IPM Guidelines and Elements


Crop Specific Guides, Pest Fact Sheets, and Other Resources


29. Weed Risk Assessment Tool Weed Resistance Risk Assessment


33. Economic Threshold for Weeds. Field Crop Resources at University of Illinois Formula
    for calculating Economic Treatment Threshold

   **Forecasting Service Websites**

   http://www.ces.ncsu.edu/depts/pp/cucurbit/

35. PestWatch. n.d. Penn State University. [A free internet-based insect and disease
    forecasting service for sweet corn and other crops. Based on in-season data from Maine
    and other NE states.]. http://www.pestwatch.psu.edu/


   **Pest Bulletins and News Letters**

37. IPM Pest Monitoring Network. Univesity of Missouri
   http://ppp.missouri.edu/pestmonitoring/subscribe.htm

38. Wisconsin Pest Bulletin. Wisconsin Department of Agriculture Trade and Consumer
    Protection (DATCP) http://pestbulletin.wi.gov/

   http://www.mda.state.mn.us/plants/pestmanagement/pestreports.htm

40. *Pest & Crop Newsletter* (Purdue University)--
    http://extension.entm.purdue.edu/pestcrop/index.html

41. *Field Crop Advisory Team Alert Newsletter* (Michigan State University)
    http://www.ipm.msu.edu/field-cat.htm

42. *Integrated Crop Management News*. Iowa State University Extension
    http://www.extension.iastate.edu/cropnews

   **IPM Websites**

43. Database of IPM resources (DIR). http://ipmnet.org/cicp/Vegetable/veg.htm

44. National Sustainable Agriculture Information Service. 2007. [Source for IPM and
    organic guidelines for many pests and practices].
    http://www.attra.ncat.org/pest.html

46. Integrated Pest Management Resources at Iowa State University
   http://www.ipm.iastate.edu/ipm/

47. Pest Management Guidelines. University of Missouri http://ppp.missouri.edu/pestguide/

48. Field Crop IPM Resources. University of Illinois
   http://ipm.illinois.edu/fieldcrops/index.html