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.

Comment [P1]: These have not yet been discussed or decided upon, but were included in the generic tools from Maine.

* 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

PRINCIPLE	PRACTICES	REFERENCES	Field Corn	Soybean	Alfalfa	Wheat
PREVENTION	Use certified pest, weed and disease-free-seeds when available.		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.	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.		If necessary treat seeds with fungicide that controls seedling blights, bunt and loose smut.
	Prevent weeds from going to seed. (Example: Cultivate, pull, mow, flame, etc.)	*Flame weeding for agronomic crops*[9]				
	Reduce moisture on plant surfaces to prevent disease incidence. (Example: Avoid overhead irrigation between 6 p.m. and midnight to minimize disease.)					
	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.)	Organic Weed Management[21]		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.		Incorporate residues from fields with heavy disease infestation.
Preventing pest problems reduces the need for pesticide applications and thus potential impacts of pesticides on resource concerns	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.)	Ohio IPM Elements[3]				
	Eliminate unmanaged plants that serve as pest reservoirs, such as: abandoned crops, volunteers from previous crop, or weed hosts of viruses.					Destroy volunteer wheat, and other weed grasses to reduce inoculums of pathogens in wheat fields.

PRINCIPLE	PRACTICES	REFERENCES	Field Corn	Soybean	Alfalfa	Wheat
	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.	Tri State Fertilizer Recommendations for corn, soybeans, wheat and alfalfa[30], Ohio IPM Elements[3]	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
AVOIDANCE	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[3]	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 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, A*nthracnose*, *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.	CT fact sheet on Perimeter Trap Cropping[6] Use of Soybean as a Trap C[5]				

PRINCIPLE	PRACTICES	REFERENCES	Field Corn	Soybean	Alfalfa	Wheat
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.)	Pest Management Guidelines from University of Missouri[47], Field Crop IPM Resources from Illinois State University[48], Ohio IPM Elements[3], Invasive Plants of the Midwest[16], Weed Assessment List[28], Pest Bulletins [37-42], Economic Thresholds for Weeds[33]	1. If corn rootworm is suspect place sticky traps in soybean fields and monitor to determine if western corn rootworm beetles are large enough to justify treatment the following year. 2. Scouting fields for damage from leaf blight at tasseling. 3. Scouting fields in the fall prior to harvest to determine level of stalk rot, harvest fields with greatest levels of stalk rot first to avoid losses due to lodged corn.		Scout weekly for alfalfa weevil during first and second cutting. Scout for potato leaf hopper on second and third cuttings. Control when populations reach economic threshold or cut early.	Scout fields from flag leaf emergence through flowering for powdery mildew, leaf rust, *Stagonospora nodorum* leaf and glume blotch.
Monitoring limits pesticide use to those occasions when intervention is needed to prevent economically significant damage to crops.	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.)	Skybit[36]				
	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.	Cucurbit Downy Mildew Weather Forecaster[34], Pestwatch[35]				

PRINCIPLE	PRACTICES	REFERENCES	Field Corn	Soybeans	Alfalfa	Wheat
	CULTURAL AND PHYSICAL CONTROLS		**CULTURAL AND PHYSICAL CONTROLS**		**CULTURAL AND PHYSICAL CONTROLS**	
SUPPRESSION	Use cover crops, especially pest-suppressing crops (allelopathic), in the rotation cycle to reduce weeds and disease incidence and to improve soil quality.	See references four, seven, 16, 18, 23,26 for cover crop guidance and SARE Nematode fact sheet[11].		Weed control especially important as weeds act as hosts for *Sclerotinia* white mold and soybean cyst nematode.		
	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.)	Ohio IPM Elements[3] for crop-specific recommendations.				
	Use reduced tillage and other residue management practices to suppress weeds and maintain soil organic matter as appropriate for crop.	See NRCS practice standards 329, 345, 346 for residue management.	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)	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)		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)
Applying suppression actions only when pest populations exceed the action threshold reduces potential impacts of pesticides on resource concerns.	Use mulches including plastic or reflective mulches for insect or weed control.					
	Inter-seed cover crop within or between rows to suppress weeds.	See references 4, 7, 16, 18, 23, and 26 for cover crop guidance and SARE Nematode fact sheet[10].				
	Use mechanical pest controls. (Examples: Cultivate, mow, hoe, and hand remove insects and weeds, prune diseased or insect-infested plants, remove diseased plants.)					
	Use physical pest controls and deterrents. (Example: noise-makers; reflectors; ribbons; and predator models.)	Guide to Biological Control[28]				

PRINCIPLE	PRACTICES	REFERENCES	Field Corn	Soybeans	Alfalfa	Wheat
SUPPRESSION **Applying suppression actions only when pest populations exceed the action threshold reduces potential impacts of pesticides on resource concerns.**	Maintain or improve soil aeration and drainage to avoid standing water and minimize plant disease. (Example: Use tile drainage, sub soiling, grassed waterways, raised beds, and organic matter additions. Avoid planting in low and wet spots in field.)	.		Improved drainage will reduce damage caused by P*hytophthora* and other seedling diseases		
	BIOLOGICAL CONTROLS		**BIOLOGICAL CONTROLS**		**BIOLOGICAL CONTROLS**	
	Use insect mating disruption devices, if available.					
	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.)	Natural Enemies in Field Crops[33], Environmental Impact of Pesticides (EIQ)[19], Guide to Biological Control[28]				
	Release beneficial organisms where appropriate. (Example: release predatory mites for control of two-spotted mites and thrips.)	Guide to Biological Control[28]				
	Use compost as a soil amendment to increase biological diversity in soil and plant health and suppress plant disease.	Ohio IPM Elements[3]				
	CHEMICAL CONTROLS		**CHEMICAL CONTROLS**		**CHEMICAL CONTROLS**	
	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.)	Weed Control Guide For Field Crops[34], Ohio IPM Elements[3], Economic Threshold for Weeds[34b]	Spot or rescue herbicide treatments are based on available economic threshold and weed interference information.	Spot or rescue herbicide treatments are based on available economic threshold and weed interference information.	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	PRACTICES	REFERENCES	Field Corn	Soybeans	Alfalfa	Wheat
SUPPRESSION	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)[19].				
	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.	Herbicide programs and rates are selected on a field-by-field basis, based on tillage, soil factors, and knowledge about weed populations.	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[20].				
	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.					

PRINCIPLE	PRACTICES	REFERENCES	Field Corn	Soybeans	Alfalfa	Wheat
	Use mitigation practices as necessary in accordance with pest monitoring results, pest predictions, action thresholds, and WinPST output.					
	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.					
	NOTE: Additional pesticide use requirements from the 595 Practice Standard:	***NOTE:** See documents listed in the attached resource list for additional guidance.				
	> Always follow all pesticide label instructions and environmental cautions.					
	> Store, handle, transport, mix, use, and dispose of pesticides and pesticide containers per state pesticides regulatory agency recommendations and regulations.					
	> Follow state and federal worker protection standards.					
	> 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.					
	> Do not mix or load pesticides within 50 ft from the high water mark of any surface waters of the state.					

IPM Practices for Field Crop Production

Resource List

IPM Guidelines and Elements

1. .Howell, J.C., A.R. Bonanno, T.J. Boucher, R.L. Wick, R. Hazzard, & B. Dicklow. New England Vegetable Management Guide 2006-2007. [The 2008-2009 edition of the guide and supplement are bound together. Available from state Cooperative Extensions, UMCE Highmoor Farm: 207-933-2100, or University of Massachusetts Outreach Bookstore: 413-545-2717.] http://www.nevegetable.org/

2. Mid-Atlantic Commercial Vegetable Production Recommendations. 2007. University of Delaware. [This guide is identical for PA, MD, DE, VA, and NJ]. http://ag.udel.edu/extension/vegprogram/pdf/DEvegrecs2007.pdf

3. Ohio State IPM Program. IPM Elements 2000-2009 http://www.ipm.osu.edu/default.asp

4. Umass Amherst. IPM Guidelines. 2007. http://www.umass.edu/umext/ipm/guidelines/index.html

Crop Specific Guides, Pest Fact Sheets, and Other Resources

5. Luttrell, R.G., Greene, J. and Smith, J. 2004. Refining the Straegic Use of Soybean as a Trap Crop for Stink Bugs in Arkansas' Diverse Cropping Systems. Univeristy of Arkansas Department of Entomology. http://www.arspb.org/research/2005/08%20Soybean%20as%20a%20Trap%20Crop%20for%20Stink%20Bugs.pdf

6. Boucher, T.J. and R. Durgy. 2003. Perimeter trap cropping works. University of Connecticut Integrated Pest Management. http://www.hort.uconn.edu/IPM/veg/htms/ptcworks.htm

7. Clark, A. (Ed.). Managing Cover Crops Profitably 3rd ed. 2007. Sustainable Agriculture Network. Beltsville, MD. Handbook Series Book 9. http://www.sare.org/publications/covercrops/covercrops.pdf

8. Dill, J. & G. Koehler (Eds.). 2005. Agricultural pocket pesticide calibration guide. University of Maine Cooperative Extension & USDA. http://pronewengland.org/INFO/PROpubs/CalibrationGuide-small.pdf

9. Sullivan, P. 2001. Flame weeding for agronomic crops. National Sustainable Agriculture. Information Service. ATTRA Publication #CT157 http://attra.ncat.org/attra-pub/PDF/flameweed.pdf

10. DuFour, R. 2001. BioIntensive integrated pest management. National Sustainable Agriculture Information Service. ATTRA Publication #IP049. http://www.attra.org/attra-pub/ipm.html ATTRA Nematode Fact Sheet

11. Everts, K., S. Sardanelli, R. Kratochvil, and L.B. Gallagher. 2005. Agricultural innovations fact sheet: Cultural practices for root-knot and root-lesion nematode suppression in vegetable crop rotations. Sustainable Agriculture Research and Education. SARE Publication #06AGI2005. http://www.sare.org/publications/factsheet/0605.htm

12. Flint, M.L. and P. Gouveia. 2001. IPM in Practice: Principles and Methods of Integrated Pest Management. University of California. Publication 3418.

13. Gugino, B.K., O.J. Idowu, R.R. Schindelbeck, H.M. van Es, D.W. Wolfe, J.E. Thies, and G.S. Abawi. Cornell soil health assessment training manual. ed.1.2. 2007. http://soilhealth.cals.cornell.edu/Soil Health Manual Edition 1.2.pdf

14. Hazzard, R., A. Brown, and P. Westgate. 2008. Using IPM in the field: Sweet corn insect management field scouting guide (draft). University of Massachusetts Extension Vegetable Program.

15. Hendrickson, J. 2003. Cover crops on the intensive market farm. http://www.hort.wisc.edu/FreshVeg/Publications/Cover crops on the intensive market farm.pdf

16. A Field Guide to Invasive plants of the Midwest. Midwest Invasive Plant Network http://mipn.org/index.html

17. Kersbergen, R. Cover crops for soil health. 2005. http://www.newenglandvfc.org/2005_conference/proceedings_05/soil_health/cover_crops_soil_health.pdf

18. Kovatch, J., C. Petzoldt, & J. Tette. n.d. A method to measure the environmental impact of pesticides. New York State Integrated Pest Management. Cornell University. [Environmental impact quotients of pesticides]. http://nysipm.cornell.edu/publications/eiq/default.asp

19. Managing pest resistance to pesticides. 2008. Gemplers. http://www.gemplers.com/pages/tech/ipmresistance.aspx

20. May, H.L. and M.B. Ryan. IPM and wildlife. 2004. NRCS. Fish and Wildlife Management Leaflet. No. 24. [Good introduction to IPM. Illustrated with specific examples.].ftp://ftp-fc.sc.egov.usda.gov/NHQ/ecs/Wild/IPM_Wildlife.pdf.

21. Organic weed management. n.d. National Sustainable Agriculture Information Service. http://attra.ncat.org/attra-pub/PDF/IPM/weed.pdf

22. Pest management. 1998. National Association of Soil Conservation Districts. [Tip sheet].http://www.ma.nrcs.usda.gov/news/publications/pestmgt.pdf

23. Vaughn, M., M. Shepherd, C. Kremen, and S.H. Black. Farming for Bees: Guidelines for Providing Native Bee Habitat on Farms. 2nd ed. 2007. Xerces Society for Invertebrate Conservation. Portland, OR. http://www.xerces.org/Pollinator_Insect_Conservation/Farming_for_Bees_2nd_edition.pdf

24. Sullivan, P. 2003. Overview of cover crops and green manure. National Sustainable Agriculture Information Service. ATTRA Publication #IP024. http://attra.ncat.org/attra-pub/covercrop.html

25. Sullivan, P. 2003. Principles of sustainable weed management for cropland. http://www.attra.org/attra-pub/PDF/weed.pdf

26. Weeden, C.R., A.M. Shelton, and M.P. Hoffmann (Eds.). n.d. Guide to biological control: A guide to natural enemies in North America. Cornell University. http://www.nysaes.cornell.edu/ent/biocontrol/

27. Windows pesticide screening tool Win-PST 3.0. n.d. Natural Resources Conservation Service. http://www.wsi.nrcs.usda.gov/products/W2Q/pest/winpst.html

28. Weed Assessment List. n.d. New York State Integrated Pest Management Program. Cornell University. http://nysipm.cornell.edu/scouting/weed_assmt.pdf

29. Weed Risk Assessment Tool Weed Resistance Risk Assessment

30. Tri-State Fertilizer Recommendations for Corn, Soybeans, Wheat and Alfalfa.2000. MSU Extension Bulletin E-2567 http://web2.msue.msu.edu/bulletins/Bulletin/PDF/E2567.pdf

31. Natural Enemies in Field Crops: A Guide to Biological Control. 2001. MSU Extension Bulletin 2721. http://web2.msue.msu.edu/bulletins/Bulletin/PDF/E2721.pdf

32. 2009 Weed Control Guide for Field Crops. 2008. MSU Extension Bulletin E-434 http://web2.msue.msu.edu/bulletins/Bulletin/PDF/E0434.pdf

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

Forecasting Service Websites

34. Cucurbit downy mildew forecast homepage. 2008. 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/

36. Skybit.com. [Commercial weather service].http://www.skybit.com/

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/

39. Minnesota Pest Report. Minnesota Department of Agriculture 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

45. Northcentral IPM Center. http://www.ncipmc.org/index.cfm

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