Biointensive Integrated Pest Management (IPM)

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Defining Biointensive IPM systems

The most effective suppression of pests, diseases and weeds (pests) is achieved when producers *integrate* a variety of tactics that prevent, avoid or mitigate crop losses, with limited need for the use of suppressive measures, including pesticides. The term *Integrated Pest Management* (IPM) is used to define this approach, which is based on an understanding of the ecology of the pest organism and the relative contributions that cultural, biological and chemical approaches make to pest suppression.

The term *Biointensive IPM*, defines the more dynamic and ecologically-informed approach to IPM that considers the farm as part of an agroecosystem, with particular characteristics that need to be understood and managed in order to minimize pest damage. Biointensive IPM is widely practiced in the Pacific Northwest by producers that have developed such an understanding of their systems. This approach is information-intensive, and it relies upon diagnosis and observation, combined with a commitment to longer-term, ecologically-based solutions to pest problems. This systems approach to IPM evolves largely through communication among growers who learn from each-other. They are supported by an increasingly sophisticated network of research, education and outreach programs from universities, agencies and non-profit organizations. The rate of growth in IPM knowledge and of these support systems is impressive, but we are still at a relatively early stage in development of the comprehensive IPM programs that are needed to ensure sustainable crop production in the long term.

Biointensive IPM is one of the most complex and sophisticated aspects agricultural production, with no one group being the sole resource for information delivery or support. It still pays to consult multiple sources of information, and to communicate with growers that share problems and approaches in common with you. For an excellent general introduction and guide to Biointensive IPM see "*Biointensive Integrated Pest Management*" by Rex Dufour, available on line from ATTRA (http://www.attra.ncat.org/) (or see below). Examples of the rapid development of Biointensive IPM internationally and global news and information about IPM in general, can be found at several locations on the Internet (see below). We have a huge amount to learn from examples of sustainable farming systems overseas. We also have a number of excellent examples and case studies in the Pacific Northwest that should be better reported in the international arena.

International Organizations	Comments
IPMnet News Web site: http://www.ipmnet.org/news.html	A globally-distributed IPM newsletter from Oregon State University Integrate Plant Protection Center (IPPC) in collaboration with Consortium for International Crop Protection (CICP)
United Nations FAO Community IPM Web sit: http://www.communityipm.org/	Advanced biointensive IPM systems in Asia and the Pacific rim
Farming Solutions Web site: http://www.farmingsolutions.org/	Success stories and news about sustainable agriculture, including IPM
United Nations FAO Organic Agriculture Web site: http://www.fao.org/organicag/	Includes many links to organizations and information sources and an on-line search tool for information sources
Pesticide Action Network-International Web site: http://www.pan-international.org/	An organization promoting the adoption of alternatives to pesticides
IPM World Textbook Web site: http://ipmworld.umn.edu/textbook.htm	Ambitious on-line textbook about IPM

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USDA Foreign Agricultural Service Organic Perspectives Newsletter Web site: http://www.fas.usda.gov/agx/organics/organics.html	Organic agriculture news from around the world and many other resource links with relevance to IPM
Organic e-prints Web site: http://orgprints.org/	Open access international archive for published research in organic agriculture, including IPM
CABI Organic Research Web ste: http://www.organic-research.com/	Subscription-only database of literature on organic agriculture with free listings of events and other materials
International Federation of Organic Agriculture Movements (IFOAM) Web site: http://www.ifoam.org/	Limited IPM content, but site includes links to many affiliated organizations internationally

What does a Biointensive IPM system look like?

Farms that practice biointensive IPM all seem to converge on a similar set of approaches, that differ in specific details according to the crops grown, climate, soil and surrounding landscape, but which share the essential feature that diversity has been enhanced in such a way that the farm is rendered less susceptible to pest outbreaks. Planned diversity is enhanced, including the arrangement of purposely included plants in time and space and the addition of beneficial organisms. This supports the enhancement of unplanned diversity i.e. those organisms, above and below ground, that persist in systems that are less disturbed, and which colonize it from the surrounding landscape. Producers *integrate* a variety of pest management approaches, and if sprays are required, these tend to have reduced risks to applicators and the environment.

For example, organic management methods for flea beetle pests (5 *Phyllotreta* flea beetle species attack a variety of cole crops and other vegetables in the Pacific Northwest) can include the following in farms practicing biointensive IPM.

- Use of non-crop crucifers as trap crops within the season, that are removed between seasons.
- Timing of transplant establishment to avoid peaks of beetle emergence.
- Use of barriers in the form of floating row covers, before beetles emerge.
- Use of under-sowing or inter-planting with non crucifers.
- Mass trapping of adults with yellow sticky traps.
- Use of repellent sprays including Neem-based products.

How do I get started? (see "*Biointensive Integrated Pest Management*" by Rex Dufour [cited above])

- **Diagnose your problems**
  - Confirm the identity of pests, diseases and weeds in your crops (e.g. state diagnosticians, county-based extension agents, on-line PNW Pest Management Handbooks, printed materials [see below])
  - Map your farm over the season (e.g. winter, spring, summer, autumn), including crop and non-crop areas and the cultural, biological and chemical pest control practices that you use
  - Are Economic Injury Levels (EIL's) for pests known, that might help determine how damaging pest outbreaks are, and help determine the best time for sprays if needed? (see on-line *World Textbook of IPM* listed below for a definition and use of EIL concept)
- **Determine management options**
  - Develop you own resources from printed and on-line materials (e.g. extension bulletins, BIRC and ATTRA publications [see below])
  - Find a local expert (e.g. county extension agent [see below])
  - Talk to producers with similar crops/problems and consider forming a grower group to develop IPM practices
  - Can the pest problem be prevented by changing rotation, variety, cultural methods or through habitat modifications?
  - If suppressive tactics are required (e.g. sprays), which are the least hazardous (e.g. OMRI approved, or reduced risk pesticides [see below])
- **Select options that best fit your system**
  - Which might be the most cost effective?

- Are decision aids available (see weather and degree-days links below, and IPM program contacts)?
- Which methods fit best within your calendar of activities?
- Might other problems be encouraged by some approaches?
- How might approaches be integrated to achieve more sustainable pest suppression?
- Are methods compatible with certification system (see below)?

❖ **Consider experiments to evaluate options**

- Do you need to select from among several possible approaches?
- Are grants or local researchers available to help support comparisons (see funding options below)?
- Might adoption of these practices qualify me for Farm Bill support programs (see below)?
- Design a simple, practical experiment (see "*On-Farm Research Guide*" by Jane Sooby, Organic Farming Research Foundation [see below])

❖ **Monitor the results and check how well your approach works and to help it evolve**

- Note the timing and severity of outbreaks on simple maps of your farm
- Can you enhance natural controls or cultural practices in locations where severity is higher?
- Develop a whole farm perspective (see USDA SARE "Whole Farm Approach to Managing Pests" [see below])

Resources for organic and certified amendments, reduced risk pesticides and biological control agents

Organization	Description
Organic Materials Review Institute (OMRI) Box 11558, Eugene, OR 97440 Tel: (541) 343-7600 Web site: http://www.omri.org/	Reviews materials for compliance with NOP standards and produces lists of approved products
IR-4 Program, Rutgers, The State University of NJ 681 US Highway 1 South North Brunswick, NJ 08902 Tel: (732) 932-9575 Web site: http://ir4.rutgers.edu/biopesticides.html	Program ensures that specialty crops receive registrations for modern, often reduced risk pesticides, including biopesticides. These chemicals are listed by commodity.
EPA Biopesticides Division Web site: http://www.epa.gov/pesticides/biopesticides/	Web site includes excellent biopesticide active ingredient fact sheets
EPA Reduced Risk Pesticides classification Web site: http://www.epa.gov/pesticides/health/reducing.htm	Reduced risk criteria include low-impact on human health, low toxicity to non-target organisms (birds, fish, and plants), low potential for groundwater contamination, lower use rates, low pest resistance potential, and compatibility with Integrated Pest Management. This web site provides a list of these products.
California Department of Pesticide Regulation, list of suppliers of biological control organisms in N. America Web site: http://www.cdpr.ca.gov/docs/ipminov/bensuppl.htm	34 page booklet can printed from CDPR web site

Selected general sources of information about Biointensive IPM and biological pest control locally and nationally in the USA

All the following organizations and Internet sites provide widely used and high quality guides to IPM practices tuned to the needs of organic and sustainable producers.

Organization	Description
National Sustainable Agriculture Information Service (ATTRA), Pest Management (800) 346-9140 Web site: http://www.attra.org/pest.html	Over 30 publications about IPM available on line, including landscape management for biological control, and IPM approaches relevant to many crop types
Bio-Integral Resource Center (BIRC) PO Box 7414, Berkeley, CA 94707 Tel (510) 524-2567 Web site: http://www.birc.org/	A very large number of IPM publications available, with members receiving *IPM Practitioner* and *Common Sense Pest Control Quarterly*.

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USDA Alternative Farming Systems Information Center (AFSIC) Web site: http://www.nal.usda.gov/afsic/ofp/	A National Agriculture Library service, including a large number of links to governmental and non-governmental information sources, and historic agricultural research publications from before the era of synthetic insecticides
Organic Farming Research Foundation (OFRF) PO Box 440, Santa Cruz, CA 95061 Tel: 831.426.6606 e-mail: research@ofrf.org Web site: http://www.ofrf.org/index.html	Access to summaries of OFRF-sponsored research in organic pest, disease and weed management. See also printable booklet on on-farm research methods at http://www.ofrf.org/research/On-farm.Research.Guide.pdf
Oregon Tilth, Inc. 470 Lancaster Dr., NE, Salem, OR, 97301 Tel: (503) 378-0690 e-mail: organic@tilth.org Web site: www.tilth.org	A non-profit research and education organization that supports biologically sound and socially equitable agriculture. Programs include *In Good Tilth*, a bimonthly newspaper; organic certification; Organic Education Center, Organic Seed Project and collaborative research and education projects with regional Universities and non-profit organizations.
Northwest Coalition for Alternatives to Pesticides PO Box 1393, Eugene, OR 97440 Tel (541) 344-5044 e-mail: info@pesticide.org Web site: http://www.pesticide.org/	Work to protect people and the environment by advancing healthy solutions to pest problems. Publish a quarterly journal with pesticide fact sheets, alternatives fact sheets for common pest problems, and helpful information on how to take action for change.
Protected Harvest 3053 Freeport Blvd. #251, Sacramento, CA 95818 e-mail: info@protectedharvest.org Web site: http://www.protectedharvest.org/	Biointensive IPM certification (e.g. Wisconsin potato growers Healthy Choice brand)
USDA Cooperative State Research, Education and Extension Service (CSREES) Web site: http://www.csrees.usda.gov/	Includes summary of USDA programs including IPM, and databases of past and present research, so you can find out about relevant programs in the Pacific Northwest
USDA Sustainable Agriculture Research and Education Program: *Whole Farm Approach to Managing Pests* Web site: http://www.sare.org/publications/farmpest/index.htm Printable book from Internet: http://www.sare.org/publications/farmpest/farmpest.pdf	Excellent 20-page book on whole-farm pest management, can also be ordered from Sustainable Agriculture Publications, 210 Hills Building University of Vermont, Burlington, VT 05405-0082, Email: sanpubs@uvm.edu, Telephone: (802) 656-0484
Cornell University Guide to Natural Enemies of North America Web site: http://www.nysaes.cornell.edu/ent/biocontrol/	Comprehensive on-line text book and guide to biological control organisms including parasitoids, predators, pathogens of crop pests and weed biological control agents
University of California, Riverside, Biological-Integrated Pest Control and Insect Identification Web site: http://faculty.ucr.edu/~legneref/bc.htm	Informative and detailed databases and guides to concepts and practices of biological control and to the agents themselves
The IPM Institute of North America, Inc. 1914 Rowley Avenue Madison, Wisconsin 53726 USA Tel: (608) 232-1528 e-mail: ipminstitute@ipminstitute.org Web site: http://www.ipminstitute.org/about.htm	A non-profit organization fostering recognition of IPM practices in the marketplace
Acres USA Tel: 1 (800) 355-5313) Web site: http://www.acresusa.com/	One of America's oldest and largest magazines covering ecological agriculture. Acres USA also sponsors national conferences and publishes books.

Examples of grower organizations with programs in IPM research, development or implementation

Community Alliance with Family Farmers P.O. Box 363, Davis, CA Tel: (530) 756-8518 Web site: http://www.caff.org/index.shtml	Well established organization with multiple programs including biological farming. Activities include lighthouse farms, biologically-integrated orchard systems and farmscaping for wildlife and conservation
Practical Farmers of Iowa P.O. Box 349, Ames, Iowa 50010 Tel: (515) 232-5661 Web site: http://www.practicalfarmers.org/	Organization includes extensive Farming Systems, on-farm research program with detailed summaries of projects
Healthy Grown Tel: 715.623.7683 Web site: http://www.healthygrown.com/index.htm	A group of Wisconsin Potato Growers who have developed a reduced risk IPM program and successfully marketed their brand
Hood River Grower-Shipper Association Integrated Fruit Production e-mail: hrgsa2@gorge.net Details at: http://community.gorge.net/hrgsa/	Implementing a continually developing program of Integrated Fruit Production (IFP), including growing, packing and marketing pome fruit from the Mid-Columbia region

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Finding and obtaining university-based IPM information in Oregon and Washington State

The western united states are well served with university-based research, education and outreach resources, including county and regionally-based extension offices and research centers. The links and addresses below provide access to a number of these, and to key personnel that can direct you to the relevant person, program or publication. They will also provide access to relevant state and federal laboratories based in this region. Many publications are available free of charge or at low cost, and Internet-based resources are increasingly rich and comprehensive. **CAUTION**: *most of these publications provide recommendations for conventional pesticide and nutrient applications and are not specifically focused on compliance with certification systems or organic standards*. To help provide this additional focus, Oregon has produced an Organic Farmers Guide to OSU, which is available on-line as a .pdf file at http://eesc.orst.edu/agcomwebfile/edmat/EM8835.pdf, or through the OSU extension service (see below).

Western United States	
Technical Assistance Source	**Description**
USDA Western Region IPM Center University of California, Davis Director, Rick Melnicoe (530) 754-8378 Web site: http://www.wripmc.org/	Administration of regional IPM grants programs, coordination of Pest Management Strategic Plans, organization of regional IPM workshops and conferences, web site includes announcements for grant programs and events
National Pesticide Information Center Oregon State University Tel 1 (800) 858-7378 e-mail: npic@ace.orst.edu Web site: http://npic.orst.edu/	National 1-800 access service for the public to answer questions and respond to concerns about any aspect of pesticide use, exposure or toxicity
Center for Agroecology and Sustainable Food Systems (CASFS) UC Santa Crua, 1156 High St., Santa Cruz, CA 95064 Tel: (831) 459-3240 Web site: http://zzyx.ucsc.edu/casfs/index.html	Center dedicated to ecological sustainability and social justice in the food and agriculture system.
University of California Statewide IPM Program Peter B. Goodell, IPM Extension Coordinator Tel: (559) 646-6515 E-mail: ipmpbg@uckac.edu Web site: http://www.ipm.ucdavis.edu/index.html	Web site provides access to a wide array of services, publications and other resources of relevance to N. California/S. Oregon counties. ECIPM publications on IPM are among the best of their type in the world.

Pacific Northwest States	
Technical Assistance Source	**Description**
PNW Plant Disease Management Handbook Web site: http://plant-disease.ippc.orst.edu/	Hard copy and on-line manuals of pest management options from extension personnel in OR, WA and ID. On-line versions produced at OSU IPPC and include thousands of photographs and links to useful information resources. Up to date chemical information, with the plant disease guide now listing products approved for use within organic agriculture. Content increasingly IPM-oriented
PNW Weed Management Handbook Web site: http://pnwpest.org/pnw/weeds	
PNW Insect Management Handbook Web site: http://pnwpest.org/pnw/insects	
Treasure Valley Pest Alert network Web site: http://www.tvpestalert.net/index.php3	OSU, UI joint pest alert system, using e-mail and web-based alerts for producers in the Treasure Valley region
Weather and degree-days for IPM decision making Web site: http://www.pnwpest.org/wea/	OSU IPPC service with development models for over 40 pests, diseases and weeds, and general degree-day models, for PNW states linked to weather data and maps
Northwest Berry and Grape Information Network Web site: http://berrygrape.oregonstate.edu/	Comprehensive web-based resources, including IPM information

Oregon	
Technical Assistance Source	**Description**
Integrated Plant Protection Center Oregon State University Director, IPM Coordinator Paul Jepson (541) 737-9082 e-mail: jepsonp@science.oregonstate.edu Web site: http://ippc.orst.edu/ IPM news at http://oregonipm.ippc.orst.edu/	Coordination of IPM programs in Oregon, delivery of on-line Weed and Insect Management Handbooks, on-line weather and degree models to aid IPM decision making (see above), e-mail news service supported by web site for links and documents, IPM Newsletter, home of the *Farmscaping for Beneficials* program, Farm Safety Program and Pesticide Safety Education Program. See additional IPM program links below, providing access to programs, personnel and services

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Internet connections OSU Programs with IPM components: Cereals Extension: http://cropandsoil.oregonstate.edu/cereals/ Commercial Vegetable Production Guides: http://oregonstate.edu/Dept/NWREC/vegindex.html Dryland Cropping Systems: http://extension.oregonstate.edu/umatilla/cereals/ Fruit and Nut Orchard Network: http://oregonstate.edu/dept/hort/orchardnet/ Fruit Crop Pest Alerts http://ippc.orst.edu/pestalert/ Nursery Crops: http://oregonstate.edu/Dept/nurspest/ Nursery Weed Management: http://oregonstate.edu/dept/nursery-weeds/ Oregon Forages: http://forages.oregonstate.edu/ Potato: http://oregonstate.edu/potatoes/index.html Viticulture: http://wine.oregonstate.edu/ Weed Science Program: http://cropandsoil.oregonstate.edu/weeds/	
Oregon Invests! database Available on line at http://oregoninvests.css.orst.edu/	Use this unique database to find a researcher or project that is relevant to your needs in Oregon
Diagnosis: OSU Plant Clinic Melodie Putnam Cordley Hall, Corvallis OR, 97331 Tel: (541) 737-3472 Web site: http://www.bcc.orst.edu/bpp/Plant_Clinic/index.htm	Identification of plant disease nematode and arthropod pests, fee based for disease diagnosis. Many samples submitted via county extension offices. Submission forms for insect and disease diagnosis available on web site.
OSU Extension Service Publications Tel: 1-800-561-6719 Web site: http://eesc.oregonstate.edu/agcomwebfile/edmat/default.html	Access to all extension publications, including IPM in multiple commodities

Washington	
Technical Assistance Source	**Description**
IPM Coordinator Doug Walsh (509) 786-9287 e-mail: dwalsh@wsu.edu web site: http://ipm.wsu.edu/	Coordination of IPM programs in Washington, web site providing comprehensive access to IPM programs in numerous commodities including tree fruits, field crops and small fruits
Center for Sustaining Agriculture an Natural Resources (CSANR) 7612 Pioneer Way, Puyallup, WA, 98371 Tel: (253) 445-4626 e-mail: csanr@wsu.edu Web site: http://csanr.wsu.edu/AboutCSANR/	Develops approaches to agriculture that is economically viable, environmentally sound, and socially acceptable. Facilitates interdisciplinary linkages and coalitions at WSU, in the Pacific Northwest and among growers, industry, environmental groups and agencies.
Washington Public Agriculture Weather System (PAWS) Director, Francis Pearce Washington State University IAREC, 24106 N. Bunn Road, Prosser, WA 99350-8694 Tel: 509-786-9212 e-mail: fjpierce@wsu.edu Web site: http://index.prosser.wsu.edu/	Agricultural weather information and decision support tools for agriculture including IPM.
Diagnosis: Diagnostic Plant Pathologist Jenny Glass WSU Puyallup 7612 Pioneer Way East Puyallup, WA 98371-4998 Tel: (253) 445-4582. Web site: http://www.puyallup.wsu.edu/plantclinic/index.html	Fee-based diagnostic service for insects, diseases and noxious weeds. Instructions for sample submission available on web site.
WSU Extension Publications Tel: (509) 335-2857 Web site: http://pubs.wsu.edu/cgi-bin/pubs/index.html	Access to all extension publications, including IPM in multiple commodities

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Funding Sources for producers, non-profits and researchers

A number of organizations provide grants directly to producers, or seek to have producers, or commodity groups directly engaged in the research that they fund. In the Pacific Norwest, grant sources for IPM-related research, demonstration and outreach include:

Source of Funding	Details of Funding Program
Natural Resources Conservation Service (NRCS) "What organic producers need to know" Web site: http://soils.usda.gov/sqi/soil_quality/land_management/organic2.html For details contact state NRCS offices or local conservation districts NRCS: Oregon NRCS: 101 SW Main Street, Suite 1300, Portland, Oregon 97204. State Conservationist Bob Graham, tel: (503) 414-3200 Washington NRCS: 316 W. Boone Ave., Suite 450 Spokane, WA 99201. State Conservationist Gus Hughbanks, tel: (509) 323-2900 Conservation Districts: *USDA Office Locator web site:* http://offices.usda.gov/scripts/ndCGI.exe/oip_public/USA_map	Organic and sustainable growers are eligible for a number of farm assistance programs, detailed on the informative web site listed opposite. NRCS now has a pest management policy and can incorporate IPM practices within conservation planning procedures: Contact Ken Pfeiffer at the USDA/NRCS National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204 Or view: http://www.wcc.nrcs.usda.gov/pestmgt/
USDA Western Region IPM Center University of California, Davis Director, Rick Melnicoe (530) 754-8378 Web site: http://www.wripmc.org/Research/index.html	The WRIPMC administers regional IPM grants (for universities), Pest Management Alternative Program grants (that can include producers and commodity groups) and their own grants for IPM working groups, and critical issues. Direct links with producers and produce organizations are strongly encouraged. The WRIPMC also sponsors development of pest management strategic plans for individual commodities
USDA Cooperative State Research, Education and Extension Service (CSREES) Web site: http://www.csrees.usda.gov/	Numerous grant programs support research and outreach in IPM through university-based research. Many encourage cooperation with producers and producer groups, including grants fro organic agriculture. This web site lists available grants by subject area.
Organic Farming Research Foundation Web site: http://www.ofrf.org/	OFRF is a leading exponent of on-farm research in organic agriculture
Western USDA Sustainable Agriculture Research and Education Room 322, Agricultural Science Building 4865 Old Main Hill Road Logan, Utah 84322-4865 435-797-2257 e-mail:wsare@mendel.usu.edu Web site: http://wsare.usu.edu/	WSARE supports research and outreach projects in sustainable agriculture that can include pest management in a farming system context. WSARE funds Farmer Rancher grants that support producers directly
The Bullitt Foundation 1212 Minor Avenue Seattle, WA 98101-2825 Tel: 206-343-0807 e-mail: info@bullitt.org Web site: http://www.bullitt.org/	Supports research in non-profit organizations in the Pacific Northwest in numerous areas including conservation and stewardship in agriculture
National Foundation for IPM Education Inc. 111 Congress Ave., 4th Floor, Austin, Texas 78701 (512) 391-4998 e-mail: mwallipm@ev1.net Web site: http://www.ipm-education.org/	Awards funds to growers groups and others from EPA's Pesticide Environmental Stewardship Program (PESP). The EPA lists previous award holders at: http://www.epa.gov/oppbppd1/PESP/grants.htm