



Compendium of IPM Definitions (CID)

What is IPM and how is it defined in the Worldwide Literature?

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Origin of IPM

The full expression “Integrated Pest Management” (IPM) appeared in press, for the first time, 30 years ago (Kogan 1998). The scientific basis of “Integrated Pest Control” evolved over a period of about 10 years, mainly among researchers at the University of California, Berkeley and Riverside campuses. The concept was explicitly defined in 1965 at a symposium sponsored by the Food and Agriculture Organization (FAO), of the United Nations, held in Rome, Italy (FAO 1966b). The concept of “Integrated Control”, originally limited to the combination of chemical and biological control methods (Michelbacher & Bacon 1952), was greatly expanded in that symposium, and redefined to become synonymous with what we presently consider IPM. Thus the concept of “integration” stemmed from foundations established in the U.S.A. Concurrently, however, the concept of “Pest Management” that had been proposed by Australian ecologists in 1961 (Geier & Clark 1961), started receiving greater recognition in the U.S.A. Publication of Geyer’s Annual Review of Entomology article in 1966 (Geyer 1966), a report by the US National Academy of Sciences (NAS 1969), and the proceedings of a conference held in North Carolina which included participation by the original proponents of pest management from Australia (Rabb and Guthrie 1970), provided the impetus for that recognition. The convergence of the concepts of integrated control and pest management, and the ultimate synthesis into integrated pest management, opened a new era in the protection of agricultural crops, domestic animals, stored products, public health, and the structure of human dwellings against the attack of arthropod pests, plant and animal diseases, and weeds. A more detailed account of the historical development of IPM is found in Kogan (1998).

Definitions and Concepts

An ongoing search of the worldwide literature has yielded 67 definitions (listed below under the section IPM Definitions List), proposed between 1959 (definition of integrated control) and 2000). An analysis of the frequency of key words or expressions included in those definitions is summarized in Table 1.

The concept of decision making implicitly permeates most definitions of IPM. In an attempt to reconcile those multiple definitions as they evolved over the years, the following was recently

proposed by Kogan (1998): "IPM is a decision support system for the selection and use of pest control tactics, singly or harmoniously coordinated into a management strategy, based on cost/benefit analyses that take into account the interests of and impacts on producers, society, and the environment"

Table 1. Frequency of occurrence of terms or expressions used in 67 definitions of IPM compiled in the Compendium of IPM Definitions.

Term or Expression	Referenced Context	Frequency (%)
Economics	Of the benefits to producers or users of the system	53.8
Environment	Benign effects of control measures in IPM. Factor in computation of benefits and costs of the IPM system beyond the producer level	48.1
Pest populations	Target for control tactics	40.4
Pest control	Goal of the IPM system	38.3
Methods or tactics	Components of the control actions	26.9
Ecology or ecological	The conceptual foundation of IPM or the system impacted by IPM tactics	25.0
System	Implementable program or ecological unit	24.2
Combination or multiple	Tactics or control methods	19.2
Economic threshold/ Economic injury level	Bases for decision making	17.3
Optimization/ Maximization	Benefits to producers, society, environment	13.5
Social/ Sociological	Factor in computation of benefits and costs of the IPM system beyond the producer level	9.6

Recently, IPM is commonly referred to as a "crop protection/pest management system" with implication for both methodological and disciplinary integration in the socioeconomic context of farming systems. IPM is a sustainable agricultural approach with a sound ecological foundation. It is generally targeted against the entire pest complex of an agroecosystem. IPM focuses on the crop plant as a system for channeling the sun's energy into harvestable yield. In an IPM program, pest management is coordinated with production practices to achieve economical protection from pest damage (injury) while minimizing hazards to crops, human health, and the environment. Generally,

the emphasis is on the anticipating and preventing pest problems whenever possible. IPM uses all appropriate pest management techniques such as enhancing natural enemies, using semiochemicals, planting pest-resistant crops, adopting cultural management, using pesticides judiciously, etc. Its aim is to limit the occurrence of pests, starting with environmentally benign cultural and biological measures and ending with chemical pesticides with direct mode of action. However, pesticides are only applied if the epidemiologically relevant infestation levels or economic thresholds are exceeded. In brief, the formalized concept of IPM has been around for only three decades. IPM is a broad ecological approach to pest management utilizing a variety of pest control techniques targeting the entire pest complex of a crop ecosystem. Integrated management of pests ensures high quality agricultural production in a sustainable, environmentally safe and economically sound manner.

IPM Definitions List

This section contains IPM definitions and their citations from the literature published worldwide. The chronological sequence of these definitions reveals how IPM was first identified and how it has evolved into a sophisticated system approach that ensures sustainability of an agricultural system as well as preservation of its environment.

There are a large number of conceptual definitions of IPM. Everybody, well almost everybody, has had a shot at defining IPM. For all referring to the same topic, the definitions are amazingly varied, doubtlessly reflecting each definer's background and philosophy. Most definitions include using natural or ecologically sound principles or techniques, preventing pests from reaching the economically damaging levels, and using multiple tactics, including cultural, biological, and chemical.

Definitions

1. "Integrated control is defined as: 'Applied pest control which combines and integrates biological and chemical control. Chemical control is used as necessary and in a manner which is least disruptive to biological control. Integrated control may make use of naturally occurring biological control as well as biological control effected by manipulated or induced biotic agents'."

V. M. Stern, R. F. Smith, R. van den Bosch, and K. S. Hagen. 1959. The integrated control concept. *Hilgardia*, 29: 81-101.

2. "Integrated control is in fact a program of arthropod population management designed to keep populations below economic tolerance levels by maximizing environmental resistance and supplementing this by the use of selective pesticide applications in economic levels are exceeded."

A. D. Pickett and A. W. MacPhee. 1965. Twenty years' experience with integrated control programs in Nova Scotia apple orchards. Proc. XIIth International Congr. Ent. London. 597 pp.

3. "Integrated pest control is a pest population management system that utilizes all suitable techniques in a compatible manner to reduce pest populations and maintain them at levels below those causing economic injury."

R. F. Smith and H. T. Reynolds. 1966. Principles, definitions and scope of integrated pest control. Proc. FAO Symposium on Integrated Pest Control 1: 11-17.

4. "Integrated control is a pest management system that in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains the pest populations at levels below those causing economic injury."

FAO. 1967. Report of the first session of the FAO Panel of Experts on Integrated Pest Control, Rome (Italy), Sept. 18-22, 1967, 19 pp.

5. "Integrated control is a pest population management system that utilizes all suitable techniques either to reduce pest populations and maintain them at levels below those causing economic injury or to so manipulate the populations that they are prevented from causing such injury."

R. F. Smith and R. van den Bosch. 1967. Integrated Control. pp. 295 - 340. In: Pest control: biological, physical and selected chemical methods, Wendell W. Kilgore and Richard L. Doutt (eds.), Academic Press, New York. 477 pp.

6. "Utilization of all suitable techniques to reduce and maintain pest populations at levels below those causing injury of economic importance to agriculture and forestry, or bringing two or more methods of control into a harmonized system designed to maintain pest levels below those at which they cause harm - a system that must rest on firm ecological principles and approaches."

National Academy of Science. 1969. Insect-pest management and control. pp. 448- 449. Vol. 3. Principles of plant and animal pest control. Natl. Acad. Sci. Pub. 1695. 508 pp.

7. "Pest management is the reduction of pest problems by actions selected after the life systems of the pests are understood and the ecological as well as economic consequences of these actions have been predicted, as accurately as possible, to be in the best interest of mankind. In development of a pest management program, priority is given to understanding the role of intrinsic and extrinsic factors in causing seasonal and annual change in pest populations."

R. L. Rabb and F. E. Guthrie. 1970. Concepts of pest management. Proceedings. North Carolina State Univ., Raleigh, N.C. 242 pp.

8. "An approach that employs a combination of techniques to control the wide variety of potential pests that may threaten crops. It involves maximum reliance on natural pest population controls, along with a combination of techniques that may contribute to suppression- cultural methods,

pest-specific diseases, resistant crop varieties, sterile insects, attractants, augmentation of parasites or predators, or chemical pesticides as needed.”

Council on Environmental Quality (CEQ). 1972. Integrated pest management, U. S. Govt. Printing Office, Washington, D. C. 41 pp.

9. "Integrated Control- Applied pest control that combines and integrates biological and chemical control measures into a single unified pest-control program. Chemical control is used only where and when necessary, and in a manner that is least disruptive to beneficial regulating factors of the environment. It may make use of naturally occurring insect parasites, predators, and pathogens, as well as those biotic agents artificially increased or introduced.”

Subcommittee on Insect Pests (National Academy of Sciences). 1974. Integrated systems of pest management (Definition of integrated control, pp. 231- 232). In: Shepard, M. (ed.), Insect pest management: readings. MSS Information Corp. New York. 269 pp.

10. "Integrated Control- An ecological approach to pest management in which all available necessary techniques are consolidated into a unified program, so that populations can be managed in such a manner that economic damage is avoided and adverse side effects are minimized.”

Subcommittee on Insect Pests (National Academy of Sciences). 1974. Integrated systems of pest management (Definition of integrated control, pp. 231-232). In: Shepard, M. (ed.), Insect pest management: readings. MSS Information Corp. New York. 269 pp.

11. "Integrated Control- A program of arthropod-population management designed to keep pest populations below economic tolerance levels by maximizing environmental resistance and supplementing this by use of selective pesticides applications if economic tolerance levels are threatened.”

Subcommittee on Insect Pests (National Academy of Sciences). 1974. Integrated systems of pest management (Definition of integrated control, pp. 231-232). In: Shepard, M. (ed.), Insect pest management: readings. MSS Information Corp. New York. 269 pp.

12. "Integrated Control- Utilization of all suitable techniques to reduce and maintain pest populations at levels below those causing injury of economic importance to agriculture and forestry, or bringing together two or more methods of control into a harmonized system designed to maintain pests at levels below those at which they cause harm-a system that must rest on firm ecological principles and approaches.”

Subcommittee on Insect Pests (National Academy of Sciences). 1974. Integrated systems of pest management (Definition of integrated control, pp. 231-232). In: Shepard, M. (ed.), Insect pest management: readings. MSS Information Corp. New York. 269 pp.

13. "Integrated pest management is a strategy of pest containment which seeks to maximize natural control forces such as predators and parasites, and to utilize other tactics only as needed and with a minimum of environmental disturbance.”

- E.H. Glass. 1975. Integrated pest management: rationale, potential, needs and implementation. Entomol. Soc. Am. Special Publ. 75-2. 141 pp.
14. "Integrated pest management is an approach which maximizes natural controls of pest populations and utilizes man-initiated actions only when it is highly probable that a pest population will exceed an economic injury level."
- R. J. Sauer. 1977. Pest management: rationale, implementation and further needs. pp. 12-14. Proceedings of National Pest management Workshop 1977, Kansas City, Missouri. USDA and Missouri State Extension Service. 177 pp.
15. "Integrated pest control is a multidisciplinary, ecological approach to the management of pest populations, which utilizes a variety of control tactics compatibly in a single coordinated pest management system."
- R. F. Smith. 1978. History and complexity of integrated pest management. pp. 41- 53. In: Pest control strategies, E. H. Smith and D. Pimentel (eds.) Academic Press, N. Y. 334 pp.
16. "Integrated pest management is 'the use of multiple control measures which are compatible, economical, environmentally sound and culturally feasible for managing pest populations at an acceptable level.'"
- B. G. Tweedy. 1979. The role of chemicals in integrated pest management. pp. 19- 25. In: Pest Management in transition: with a regional focus on the interior west, Pieter de Jong (edit.), Westview Press/Boulder, Colorado. 141 pp.
17. "Integrated Control- Utilization of all suitable techniques to reduce and maintain pest populations at levels below those causing injury of economic importance to agriculture and forestry, or bringing together two or more methods of control into a harmonized system designed to maintain pests at levels below those at which they cause harm-a system that must rest on firm ecological principles and approaches."
- D.G. Bottrell. 1979. Integrated pest management. Council on Environmental Quality. U.S. Govt. Printing Office, Washington, D. C. 120 pp.
18. "Integrated Pest Management is the optimization of pest control in an economically and ecologically sound manner. This is accomplished by the use of multiple tactics in a compatible manner to maintain pest damage below the economic injury level while providing protection against hazards to humans, animals, plants, and the environment."
- J. L. Apple, P. S. Benepal, R. Berger, G. W. Bird, W. G. Ruesink, F. G. Maxwell, P. Santlemann and G. B. White. 1979. Integrated pest management, a program of research for the state agricultural experimental stations and the colleges of 1890. 190 pp.
19. "Integrated Pest Management is the selection, integration, and implementation of pest control based on predicted economic, ecological, and sociological consequences."

D. G. Bottrell. 1979. Integrated pest management. Council on Environmental Quality. U.S. Govt. Printing Office, Washington, D. C. 120 pp.

20. "Integrated pest management (IPM) is the optimization of pest control in an economically and ecologically sound manner, accomplished by the coordinated use of multiple tactics to assure stable crop production and to maintain pest damage below the economic injury level while minimizing hazards to humans, animals, plants, and the environment."

Office of Technology Assessment. 1979. Pest Management Strategies Crop Protection. Vol. 1. Congress of the United State. Washington. D. C. 132 pp.

21. "Integrated pest management (IPM) is an interdisciplinary approach incorporating the judicious application of the most efficient methods of maintaining pest populations at tolerable. Recognition of the problems associated with widespread pesticide application has encouraged the development and utilization of alternative pest control techniques. Rather than employing a single control tactic, attention is being directed to the coordinated use of multiple tactics, an approach known as integrated pest management."

FAO. 1980. Research Summary. Integrated pest management. EPA-600/8-80-044. 28 pp.

22. "A method of pest management which decreases (and perhaps even avoids) the use of non selective methods of suppression."

P. S. Corbet. 1981. Non-entomological impediments to the adoption of integrated pest management. *Protect. Ecol.* 3: 183-202.

23. "Integrated pest management (IPM) is an ecologically based pest control strategy that relies heavily on natural mortality factors such as natural enemies and weather and seeks out control tactics that disrupt these factors as little as possible. IPM uses pesticides, but only after systematic monitoring of pest populations and natural control factors indicates a need. Ideally, an integrated pest management program considers all available pest control actions, including no action, and evaluates the potential interaction among various control tactics, cultural practices, weather, other pests, and the crop to be protected."

M.L. Flint and R. Van den Bosch. 1981. Introduction to integrated pest management. Plenum Press, New York, 240 pp.

24. "Integrated Pest Management considers any and all combinations of various techniques for the management of weed, insect, disease, and animal pest problems within the context of the farming system."

Agricultural Experiment Station, International Plant Protection Center and Department of Agricultural and Resource Economics, Oregon State University. 1981. Economics of integrated pest management: an interpretive review of the literature. Oregon State University. 142 pp.

25. "IPM is defined as the use of two or more tactics in a compatible manner to maintain the population of one or more pests at acceptable levels in the production of food and fiber while providing protection against hazards to humans, domestic animals, plants, and the environment."

Council for Agricultural Science and Technology. 1982. Integrated pest management. Report No. 93, 105 pp.

26. "Integrated pest management (control) is a pest management system- a combination of arthropod and other pest control procedures. It is usually a system approach to pest management within the context of a particular environment, taking into account the population dynamics of a particular pest species."

W.H. Sill Jr. 1982. Plant Protection an integrated interdisciplinary approach. Iowa State. Univ. Press, Ames, Iowa. 297 pp.

27. "IPM means 'intelligent pest management'.

G. Zweig and A. Aspelin. 1983. The role of pesticides in developing countries. In: Formulation of pesticides in developing countries. United Nations Industrial Developing Organization."

28. "Integrated pest management (IPM) is a strategy for keeping plant damage within bounds by carefully monitoring crops, predicting trouble before it happens, and then selecting the appropriate controls- biological, cultural or chemical control as necessary."

R. B. Yepsen Jr. 1984. The Encyclopedia of Natural insect and disease control. Rodale Press, Penn. 490 pp.

29. "Integrated pest management (IPM) envisages the bringing down of pest damage to tolerable levels through logical and justified integration of diverse techniques such as the use of natural enemies, adoption of pest resistant varieties of crops, provision of inhospitable pest environment and optimum use of appropriate kind of chemical pesticide, if necessary."

Mohammed Ibrahim Bajwa. 1984. Integrated Pest Management in AJK. Govt. Press, MZD. 4 pp.

30. "Integrated Pest Management implies effective use of as many control measures as compatible, in order to suppress pest populations below damaging levels and optimizing yields with minimum disruption of, or damage to, the environment."

L. E. N. Jackai and R. A. Daoust. 1986. Insect Pest of Cow Peas. Annual Review of Entomology, 31: 95-119.

31. "The broadest definition of integrated pest management is 'the ecological approach to insect control'."

R. L. Metcalf. 1986. The ecology of insecticides and the chemical control of insects. pp. 251-297. In: Ecological theory and integrated pest management practice, Marcos Kogan (ed.) John Wiley & Sons, N. Y. 362 pp.

32. "Integrated pest management is a pest population management system that anticipates and prevent pests from reaching damaging levels by using all suitable techniques, such as natural enemies, pest resistant plants, cultural management and judicious use of pesticides."

National Coalition on Integrated Pest Management (NCIPM). 1987. Integrated pest management. Austin, TX. 60 pp.

33. "Integrated Pest Management (IPM) is a structured approach to ecosystem management based on a general understanding of the ecology, uses and interactions of the plant species within it."

K.L. Johnson. 1987. Sagebrush types as ecological indicators to integrated pest management (IPM) in the sagebrush ecosystem of western north America. pp. 1-10. In: Integrated pest management on rangeland: state of the art in the sagebrush ecosystem, J. A. Onsager (ed.) USDA. ARS-50. 85 pp.

34. "Integrated pest management is a multidisciplinary approach to the control techniques in a specific production management system and in a combination most acceptable from the sociological, environmental and economic view points."

P.J.U. Onate and M. R. Cariaso. 1988. Integrated pest management on major food crops in southeast Asia: an abstract bibliography (1977-1987). Agricultural Information Bank for Asia and National Crop Protection Center, Univ. Philippines, Los Banos. 173 pp.

35. "IPM is an ecologically-based pest control strategy that relies on natural mortality factors such as natural enemies, weather, and crop management and seeks control tactics that disrupt these factors as little as possible."

National Academy of Science, Board on Agriculture. 1989. Alternative Agriculture, 448 pp.

36. "A pest control strategy based on the determination of an economic threshold that indicates when pest population is approaching the level at which control measures are necessary to prevent a decline in net returns. In principle, IPM is an ecologically based strategy that relies on natural mortality factors and seeks control tactics that disrupt these factors as little as possible."

National Research Council, Board on Agriculture. 1989. Alternative Agriculture. National Academy Press, Washington, D.C.

37. "IPM is a comprehensive approach to pest control that uses combined means to reduce the status of pests to tolerable levels while maintaining a quality environment."

L.P. Pedigo. 1989. Entomology and pest management, Macmillan Publishing Co., Inc. NY.

38. "Integrated pest management, or IPM is a systematic approach to crop protection that uses increased information and improved decision-making paradigms to reduce purchased inputs and improve economic, social, and environmental conditions on the farm and in society. Moreover, the concept emphasizes the integration of pest suppression technologies that include biological, chemical, legal, and cultural controls."

W.A. Allen and E. G. Rajotte. 1990. Annu. Rev. Entomology, 35: 379-97.

39. "Integrated pest management, or IPM is an approach to pest control that utilizes regular monitoring to determine if and when treatments are needed and employs physical, mechanical,

cultural, biological and educational tactics to keep pest number low enough to prevent intolerable damage or annoyance. Least-toxic chemical controls are used as a last resort.”

W. Olkowski and S. Daar.1991. Common sense pest control. Taunton Press. 715 pp.

40. "Integrated pest management (IPM) is a pest management strategy that focuses on long-term prevention or suppression of pest problems with minimum impact on human health, the environment, and non-target organisms. Preferred pest management techniques include encouraging naturally occurring biological control, using alternate plant species or varieties that resist pests, selecting pesticides with lower toxicity to humans or non-target organisms; adoption of cultivating pruning, fertilizing, or irrigation practices that reduce pest problems; or changing the habitat to make it incompatible with pest development. Broad spectrum pesticides are used as a last resort when careful monitoring indicates they are needed according to pre-established guidelines.”

M.L. Flint, S. Daar and R. Molinar. 1991. Establishing integrated pest management polices and programs: a guide for public agencies. Univ. Calif. IPM Pub. 12. 9 pp.

41. "Integrated Pest Management is the coordinated use of pest and environmental information along with available pest control methods, including cultural, biological, genetic and chemical methods, to prevent unacceptable levels of pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.”

Proceedings of the National Integrated Pest Management Forum. 1992. American Farmland Trust, 86 pp.

42. "IPM is an ecologically-based pest control strategy which is part of the overall crop production system. 'Integrated' because all appropriate methods from multiple scientific disciplines are combined into a systematic approach for optimizing pest control. 'Management' implies acceptance of pests as inevitable components, at some population level of agricultural system.”

F.G. Zalom, R. E. Ford, R. E. Frisbie, C. R. Edwards and J. P. Telle. 1992. Integrated pest management: addressing the economic and environmental issues of contemporary agriculture. In: Food, crop pests, and the environment: the need and potential for biologically intensive integrated pest management, F. G. Zalom and W. E. Fry (Eds.), APS Press, St. Paul, MN.

43. "IPM is a system approach based on science and proven crop production and resource conservation practices. It uses all suitable techniques, such as natural enemies, pest resistant plants, cultural management, and pesticides in a total crop production system to anticipate and prevent pests from reaching damaging level.”

Consumer response to information on integrated pestmanagement. 1992. J. Food Safety, 12: 315-326.

44. "Integrated Pest Management, or IPM, involves the carefully managed use of an array of pest control tactics - including biological, cultural, and chemical methods - to achieve the best results with the least disruption of the environment.”

Environmental Protection Agency. 1993. EPA for Your Information. Prevention, Pesticides and Toxic Substances (H7506C). 2 pp.

45. "IPM is a management approach that encourages natural control of pest populations by anticipating pest problems and preventing pests from reaching economically damaging levels. All appropriate techniques are used such as enhancing natural enemies, planting pest-resistant crops, adapting cultural management, and using pesticides judiciously."

United State Department of Agriculture, Agricultural Research Service. 1993. USDA programs related to integrated pest management. USDA Program Aid 1506.

46. "Management activities that are carried out by farmers that result in potential pest populations being maintained below densities at which they become pests, without endangering the productivity and profitability of the farming system as a whole, the health of the family and its livestock, and the quality of the adjacent and downstream environments."

J. A. Wightman. 1993. Towards the rational management of the insect pests of tropical legumes crops in Asia: review and remedy. pp. 233-256. In: Crop protection and sustainable agriculture. CIBA Foundation Symposium 177. 285 pp.

47. "'Integrated pest management' means a coordinated decision-making and action process that uses the most appropriate pest control methods and strategy in an environmentally and economically sound manner to meet agency pest management objectives. The elements of integrated pest management include: (a) Preventing pest problems; (b) Monitoring for the presence of pests and pest damage; (c) Establishing the density of pest population, which may be set at zero, that can be tolerated or corrected with a damage level sufficient to warrant treatment of the problem based on health, public safety, economic or aesthetic threshold; (d) Treating pest problems to reduce population below those levels established by damage thresholds using strategies that may include biological, cultural, mechanical and chemical control methods and that shall consider human health, ecological impact, feasibility and cost effectiveness; and (e) Evaluating the effects and efficacy of pest treatments."

Oregon Statutes. 1993. ORS 262.1, Chapter 943.

48. "An effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interactions with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment. IPM take advantage of all pest management options possible, including, but not limited to the judicious use of pesticides."

A. R. Leslie. 1994. Preface. In: Integrated pest management for turf and ornamentals, Leslie, A. R. (ed.) Lewis Publishers, London. 660pp.

49. "IPM is a system that controls pests and contributes to long-term sustainability by combining judicious use of biological, cultural, physical and chemical control tools in a way that minimizes the risks of pesticides to human health and the environment."

- A. A. Sorensen. 1994. IPM in partnership with nature. Center for Agriculture in the Environment, American Farmland Trust, DeKalb, Illinois. 2 pp.
50. "Integrated Pest Management is the use of a variety of pest control methods designed to protect public health and the environment, and to produce high quality crops and other commodities with the most judicious use of pesticides."
- Cooperative Extension System, University of Connecticut. 1994. Integrated pest management programs. Univ. Connecticut. 22 pp.
51. "Integrated Pest Management is the judicious use and integration of various pest control tactics in the context of the associated environment of the pest in ways that complement and facilitate the biological and other natural controls of pests to meet economic, public health, and environmental goals."
- J.R. Cate and M. K. Hinkle. 1994. Integrated Pest Management: the path of a paradigm. The National Audubon Society Special Report. 43pp.
52. "Integrated Pest Management (IPM) is an approach to making pest control decisions with increased information and the use of multiple tactics to manage pest populations in an economically efficient and ecologically sound manner."
- W.G. Norton and J. Mullen. 1994. Economic Evaluation of integrated pest management programs: a literature review. Virginia Cooperative Extension Publ. 448-120, Virginia State Univ. Petersburg, VA., and Virginia Polytech. Instt. & State University, Blacksburg, VA. 112 pp.
53. "Integrated pest management is a sustainable approach to managing pests by combining biological, physical, and chemical tools in a way that minimizes economic, health, and environmental risks."
- NCIPM. 1994. Toward a goal of 75 percent cropland under IPM by 2000. Jan. Austin, TX.
54. "IPM, in its simplest form, is a control strategy in which a variety of biological, chemical, and cultural control practices are combined to give stable long-term pest control."
- F.S. Ramalho. 1994. Cotton pest management. *Annu. Rev. Entomol.* 39: 563-578.
55. "European Plant Protection Organization has defined integrated control as 'the use of all economically, ecologically and toxicologically justifiable means to keep pests below the economic threshold, with the emphasis on the deliberate use of natural forms of control and preventive measures'."
- H.W. Dehne and F. Schonbeck. 1994. Crop Protection- past and present. pp. 45-71. In: *Crop Production and Crop Protection*, E.C. Oerke, H. W. Dehne, F. Schonbeck and A. Weber (eds.), Elsevier, Amsterdam. Netherlands. 808 pp.
56. " 'Integrated Pest Management' means the selection, integration, and implementation of multiple pest control techniques based on predicted economic, ecological, and sociological consequences, making maximum use of naturally occurring pest controls, such as weather, disease agents, and

parasitoids, using various biological, physiological, chemical, and habitat modification methods of control, and using artificial control only as required to keep particular pests from surpassing intolerable population levels predetermined from an accurate assessment of the pest damage potential and the ecological, sociological, and economic cost of other control measures.”

Florida Statutes. 1995. Chapt. 482

57. "Integrated pest management is a pest management system that in the socioeconomic context of farming systems, the associated environment and the population dynamics of the pest species, utilizes all suitable techniques in as compatible manner as possible and maintains the pest population levels below those causing economic injury.”

D. R. Dent. 1995. Integrated pest management. Chapman & Hall, London. 356 pp.

58. "Real IPM: 'A crop protection system which is based on rational and unbiased information leading to a balance of non-chemical and chemical components moving pesticide use levels away from their present political optimum to a social optimum defined in the context of welfare economics'.”

H. Waibel and J. C. Zadoks. 1996. Institutional Constraints to IPM. XIIIth International Plant Protection Congress (IPPC), The Hague, July 2-7, Pesticide Policy Project, Publ. Series. No. 3. Institute of Hortic. Economics, Hannover, Germany. 63 pp.

59. "Integrated Pest Management (IPM) is a sustainable approach to managing crop pests. IPM combines the use of biological, cultural, physical and chemical tactics in a way that minimizes economic, health, and environmental risks.”

Florida Cooperative Extension Service- The Institute of Food and Agricultural Sciences, University of Florida. Fall 1996, IPM Florida. p. 2.

60. "Integrated pest management (IPM) is the judicious use and integration of various pest control tactics in the context of the associated environment of the pest in a way that compliment and facilitate the biological and other natural controls of pests to meet economic, public health, and environmental goals. Whenever possible, IPM uses scouting, pest trapping, pest resistant plant varieties, sanitation, various cultural control methods, physical and mechanical controls, biological controls, and precise timing and application of any needed pesticides.”

R. G. Adams. 1996. Introduction to Integrated Pest Management. pp. 1-7. In: Northeast Sweet Corn Production and Integrated Pest management manual, [R.A. Adams and J. C. Clark (eds.)], Cooperative Extension System, University of Connecticut. 120 pp.20.

61. "Biointensive IPM is a system approach to pest management based on an understanding of pest ecology. It begins with steps to accurately diagnose the nature and source of pest problems, and then relies on a range of preventive tactics and biological controls to keep pest populations within acceptable limits. Reduced risk pesticides are used if other tactics have not been adequately effective, as a last resort and with care to minimize risks.”

C.M. Benbrook, E. Groth III, J. M. Halloran, M.K. Hansen and S. Marquardt. 1996. p. 4. Pest management at the crossroads. Consumers Union of United States Inc. 272 pp. (ISBN 0-89043-900-1)

62. "The management of pests by integrating host resistance, cultural, biological and chemical controls in a manner that minimizes economic, health and environmental risks."

CPM Crop Protection Manager. 1997. In: Insect Management- Insecticides Do Have a Role in IPM. pp. 21-22.

63. "Integrated Pest Management (IPM) for agriculture is the application of an interconnected set of principles and methods to problems caused by insects, diseases, weeds and other agricultural pests. IPM includes pest prevention techniques, pest monitoring methods, biological control, pest-resistant plants varieties, pest attractants and repellents, biopesticides, and synthetic organic pesticides. It also involves the use of weather data to predict the onset of pest attack, and cultural practices such as rotation, mulching, raised planting beds, narrow plant rows, and interseeding."

James P. Tette. 1997. New York State Integrated Pest Management Program, New York State Department of Agriculture and Markets, Cornell University and Cornell Cooperative Extension. 60 pp.

64. "Integrated Pest Management (IPM) is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistance varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment."

University of California State-wide Integrated Pest Management Project. 1997. Annual Report, University of California State-wide Integrated Pest Management Project, California, USA.

65. "IPM is a decision support system for the selection and use of pest control tactics, singly or harmoniously coordinated into a management strategy, based on cost/benefit analyses that take into account the interests of and impacts on producers, society, and the environment."

Marcos Kogan. 1998. Integrated Pest Management: Historical Perspectives and Contemporary Developments. *Annu. Rev. Entomol.* 43: 243 – 270.

66. "Integrated Pest Management is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks."

Food Quality Protection Act. 1998. Food Quality Protection Act of 1996, P.L. 104- 170, Title II, Section 303, Enacted August 3, 1996. Codified in: Title 7, U.S. Code, Section 136r-1. Integrated Pest Management.

67. "An approach to the management of pests in public facilities that combines biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks."

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**IPM definitions and their citations are available through
a searchable, internet-based database available at:
<http://ippc.orst.edu/IPMdefinitions/> (Bajwa and Kogan, 1997)**