Integrated Pest Management (IPM) is a concept that encourages the use of a variety of strategies in the management of crop pests. It is very important to have an in-depth understanding of the crop production system when implementing an IPM program. An IPM program is dynamic requiring a continual evaluation of the status of the crop, the associated pest complex, the effects of the pests and the biological deterrents to those pests. If a pest population gets "out of hand" and begins to cause economic damage, pest management techniques may need to be applied. These pest management measures may be biological, mechanical, chemical or cultural or combinations of these types of controls.

The Kentucky Alfalfa IPM Program is divided into a research component and an extension component. Each component is comprised of several facets, all of which are closely interrelated.

Research Alfalfa IPM

A strong IPM program is dependent on reliable basic research data. The Kentucky Alfalfa IPM Program is built on a foundation of data developed in on-going research programs here in Kentucky and in other states.

Currently, Alfalfa IPM research efforts are being coordinated by Dr. B. C. Pass, the project leader of the alfalfa section of the Consortium for Integrated Pest Management project. The alfalfa section of this project involves researchers from five states (California, Illinois, New York, Wisconsin, along with Kentucky) who have research responsibilities in agronomy, entomology, plant pathology, weed science, plant biology, agricultural economics and mathematical biology.

The researchers in the CIPM project have coordinated multidisciplinary objectives designed to evaluate the effects of pests within the context of the alfalfa production system. These objectives can only be accomplished by gaining a greater understanding of pest organisms and their behavior after which the biological and economic impact of the pest on the crop can be determined.

The ultimate goal of all IPM research is to develop a practical management system that can be implemented by the crop producer. The development of the alfalfa weevil pest management program is a good example of research that has achieved this goal. The alfalfa weevil invaded Kentucky and the mid-west in the early 1960's. This pest had a devastating effect on first cutting alfalfa and little was known about its biology and control.
Entomologists and other researchers in Kentucky and other states worked together under the "umbrella" of another multi-state research project during the early 1970's to study the biology and effects of this pest. The scope of these studies included biological studies of the weevil and its life cycle; evaluation of biological control agents such as larval, adult and egg parasites; studies to determine the population dynamics of the insect and the economic effects of the weevil, as well as the evaluation of mechanical, cultural and insecticidal control measures.

The final result of these combined research efforts was the development of a series of alfalfa weevil management charts designed to help alfalfa producers to economically manage this pest while still producing a quality crop. These charts have been used extensively in the alfalfa weevil section of the extension aspect of the Alfalfa IPM Program for the past seven years.

In the past, much of the work on insects, weeds, and plant diseases has been done independently by researchers with responsibilities for those disciplines. Of course, pests occur together in complexes (i.e., several species of insects, weeds, and pathogens present together at the same time and in the same field). The damage caused by one kind of pest may affect the amount of damage caused by another; similarly control measures directed at a given target pest may have repercussions on other pests. For example, recent studies at the University of Kentucky have shown that herbicide treatments applied in March for broadleaf weed control can lead to significantly higher alfalfa weevil populations. This result has been corroborated by similar findings in California. The cause is (as yet) unknown.

Alfalfa IPM research at the University of Kentucky is currently addressing the kinds of damage caused by and control methods for, complexes of pests. Recent studies have demonstrated in the field that naturally-occurring clover root curculio larvae populations can reduce yield by feeding on alfalfa roots. This effect is even more important when root-rot pathogens are present, because the feeding lesions on the roots provide entry sites for the pathogens. Combined effects from clover root curculio feeding and pathogens is more severe than the sum of either alone (yield reduction—i.e., synergism). Presently, there is no effective insecticidal control method available for the clover root curculio in established alfalfa. Researchers are currently investigating cultural and biological control tactics to use against this pest.

Considerable research is being done on serious broadleaf and grass weeds in Kentucky, and the combined impact of weeds and insects on alfalfa yield and stand longevity is being investigated. Work on the alfalfa weevil, particularly the fungal pathogen which kills alfalfa weevil larvae, is also being performed.
Results of these studies, augmented by those from cooperating scientists in other states, will benefit Kentucky alfalfa producers.

**Extension Alfalfa IPM Program**

The Alfalfa Integrated Pest Management program has three objectives: 1) To improve the efficiency and profitability of alfalfa production; 2) to increase the number of natural controls of alfalfa insect pests; and 3) to provide a system to help alfalfa growers to control alfalfa pests in a more timely and environmentally sound manner.

The program has seven components designed to accomplish these objectives: 1) To monitor alfalfa insect pest populations; 2) to introduce new parasites of alfalfa insect pests; 3) to make weed surveys and control recommendations; 4) to monitor alfalfa for imminent disease problems; 5) to provide soil sampling and fertilizer recommendations; 6) to evaluate taproot heaving damage and provide control recommendations; and 7) to provide a computerized field history summary annually.

The University of Kentucky College of Agriculture initiated its integrated pest management program for alfalfa in 1975. In 1978 the alfalfa pest management program was incorporated into the Multi-Disciplinary, Multi-Crop Integrated Pest Management Program (IPM) that provides services for soybean, corn, small grain and alfalfa producers.

The integrated pest management program is a farmer supported information gathering service that provides input from county and state level personnel. Fields are visited at least weekly by "scouts" trained by University of Kentucky extension specialists. These scouts sample for pests using specific sampling procedures and leave a written report of their findings after each visit with the farmer cooperator and the county extension agent and/or IPM supervisor.

The magnitude of severity of pest problems are evaluated by comparing field collected data with research based "economic threshold" information for each pest. If control is necessary, the farmer cooperator is contacted by the county extension agent or IPM supervisor and given the appropriate management recommendation. The farmer can then apply the recommended control procedures if he chooses.

Field scouting begins in the spring when fields are visited to determine the severity of winter damage. Evidence of taproot heaving is evaluated and recommendations for severely heaved fields are made. Weed evaluation and control recommendations for broadleaf weeds are made at this time as well. Additional weed control evaluations and control recommendations for grasses are made after the first cutting.
Field sampling for alfalfa weevil larvae begins as soon as a critical number of growing degree days have been accumulated. Fields are then visited at least weekly and sampled for alfalfa weevil larvae. Management recommendations are made using the Alfalfa Weevil Pest Management Charts. Management options suggested in these charts include short or long residual insecticides (depending on the stage of the alfalfa's growth), early harvest or reliance on natural controls.

Potato leafhopper sampling begins after the first cutting is removed, because this pest first arrives in Kentucky from further south about the end of May each year. This sampling is continued weekly until the end of the season. Management recommendations are made using the Potato Leafhopper Economic Threshold Tables. Disease evaluations are made during each field visit. The diseases that are monitored depend on the time of season and physiological stage of the crop's development. Management recommendations relating to diseases are oriented toward cutting management and variety selection.

All field information is extracted from farmer report forms and incorporated into the computerized IPM data base at the University of Kentucky, a data storage program that is unique in the United States. At the end of the season, individual field summaries are generated for each producer which details the field events for the past growing season, including pest populations, pesticides used, soil and fertility information and crop yield.

Parasites of the alfalfa weevil have been well established in alfalfa research plots in Lexington. These parasites have also been released in alfalfa fields throughout the state using alfalfa weevil parasite nurseries established on the farms of cooperating alfalfa producers.

The IPM program is partially supported and administered by the participating farmers. Farmer organizations, usually non-profit corporations, assess acreage charges for each crop in their program. These funds are used to pay scouting costs. In several counties, the farm organization has hired a full time IPM supervisor to coordinate the program in that county.

The Alfalfa IPM Program has expanded from one county in 1975 to sixteen counties in 1982. Currently 2,500 acres are enrolled in the program. The program costs each producer approximately $2.00 per acre. Participating farmers have been able to more accurately manage alfalfa pests often reducing or eliminating the need for costly pesticide control measures.
University of Kentucky personnel including county agents and subject matter extension specialists and researchers in agronomy, entomology, plant pathology and public information are involved in helping to coordinate the program, to educate scouts and supervisors and to prepare printed and audiovisual materials.

Alfalfa producers interested in establishing an IPM program in their county should contact their county extension agent.