

INTEGRATED PEST MANAGEMENT

Integrated pest management (IPM) is the approach emphasized in this guide; some aspects of IPM are incorporated throughout, although this guide mainly deals with the chemical component of IPM. IPM combines biological control from predators with selective chemical application for maintaining pest populations below economic threshold levels. This approach requires that growers give careful consideration to the selection, application rate and timing of chemical sprays. The degree of integration achieved will vary according to the management ability, training and objectives of the orchardist. Inadequate monitoring or implementation of IPM practices will lead to unsatisfactory results. In order to encourage the biological control components of the program, growers must consider the **toxicity of chemicals to predators** (Table 8, page 49) in addition to their **efficacy against fruit pests** (Tables 6 and 7, pages 45-47).

To be successful, IPM requires *careful management, systematic orchard scouting and well-calibrated spray equipment*. Some growers have been following the IPM approach, and have experienced benefits through reduced pesticide application, improved fruit quality and an increased awareness of the orchard situation. Insecticide application has been reduced as a result of the elimination of some cover sprays for codling moth control because of low population levels. Biological control of mites has also resulted in fewer miticide applications. Improved fruit quality has occurred as a result of better timing of insecticide applications for the control of fruit feeding insects.

Spray timing can be improved for codling moth, tufted apple bud moth and oriental fruit moth through the use of **degree-days**. Degree-days (DD) are approximated by the mean temperature of a given day, minus the developmental threshold (the minimum temperature at which a species can develop). Tables are provided that facilitate accumulation of DD for these pests. Knowing the maximum and minimum temperatures, growers can use these tables to accumulate the DD starting at a **biofix** (first sustained capture of males in pheromone traps; i.e. the capture of moths in at least 2 traps for at least 2 consecutive days).

Biofix dates and DD accumulations from biofix for codling moth, oriental fruit moth and tufted apple budmoth for the northern areas of Virginia and the eastern panhandle of West Virginia are posted at www.vaes.vt.edu/winchester/treefruitpm and www.caf.wvu.edu/Kearneysville/pheromon.html. These data for selected other Virginia sites are given in the weather pages of the Virginia Fruit web site, <http://www.virginiafruit.ento.vt.edu/VAFS-weather.html>. Pheromone trap data for these and other species can be found at the same sites and at www.virginiafruit.ento.vt.edu/apple-fruit-ipm.html#traps.

Codling moth. Control is necessary in orchards where the pheromone trap capture exceeds 5 moths/trap/week. Spray timing for optimal codling moth control, based on DD accumulations from biofix (base 50°F, Table 26), will differ according to the material used. Insect Growth Regulators (IGRs) (e.g. Esteem, Intrepid, Rimon) and neonicotinoids (Assail, Calypso, Clutch) should be applied just before egg hatch starts, whereas other recommended materials should be applied soon after egg hatch has begun. Sprays for codling moth should be initiated as follows. *First brood:* Rimon at 50-150 DD, then after about 2 weeks, if needed, at 400 DD. Assail, Calypso, Clutch, Esteem, or Intrepid at 150 DD, then after about 2 weeks, if needed, at 450 DD. Organophosphates, carbamates, pyrethroids, Altacor, Belt, Delegate or Avaunt at 250 DD, then at 550 DD, if needed. *Second brood:* Rimon at 1050-1150 DD, then after about 2 weeks if needed, at 1450 DD. Assail, Calypso, Clutch, Esteem, or Intrepid at 1150 DD, then at 1450-1500 DD, if needed. Organophosphates, carbamates, pyrethroids, Altacor, Belt, Delegate or Avaunt at 1250 DD, then at 1550-1600 DD, if needed. For the third brood, control should be initiated if the pheromone trap capture exceeds the threshold (see above).

Tufted apple budmoth. Intrepid, Proclaim, Altacor, Belt, Delegate and SpinTor will provide the best control in most situations. For first brood control, these products should be applied as a complete spray at 585-640 DD from biofix (base 45°F, Table 27), or as two alternate-row-middle applications 7 days apart beginning at 530 DD. An additional application may be needed (in 14 days for complete, in 7 and 14 days for alternate-row-middle) in high pressure situations. For all other materials, control first brood with two complete applications at 530-585 DD and 805-855 DD. Alternate-row-middle applications should commence 50-75 DD earlier and be repeated every 7 days for a total of up to four applications, depending upon insect pressure. For second brood control, apply Intrepid, Proclaim, Altacor, Belt, Delegate or SpinTor as two complete sprays at 2355-2435 DD and 2665-2740 DD, or as four alternate-row-middle applications, 7 days apart, beginning at 2280 DD after spring brood biofix. For all other materials, control second brood with two complete applications at 2280-2355 DD and 2665-2740 DD, or four alternate-row-middle applications at 7-day intervals, beginning 50-75 DD earlier.

Oriental fruit moth. Recommended trap thresholds for the **first flight** of oriental fruit moth differ for apple and peach. In peach, control of first brood is recommended if more than 15 moths/trap/week are captured. In apple, control is warranted if trap capture exceeds 30 moths/trap/week. **After the first flight**, thresholds for apple and peach are the same, at greater than 10 moths/trap/week. Optimal spray timings for oriental fruit moth control in apple and peach differ through the season and are based on accumulated DD from separate biofix dates established for each crop at the beginning of each season (See Table 27). Timings are as follows, and are based on recommendations from The Penn State University, Fruit Research and Extension Center, Biglerville, PA.

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Peach – First brood: Intrepid or Assail at 70-100 DD, then at 250-275 DD, if needed. Organophosphates, carbamates, pyrethroids, Altacor or Delegate at 170-195 DD, then at 350-375 DD, if needed.

Peach – Second brood: Intrepid or Assail at 1050-1100 DD, then at 1350-1400 DD, if needed. Organophosphates, carbamates, pyrethroids, Altacor or Delegate at 1150-1200 DD, then at 1450-1500, if needed.

Peach – Third brood: Intrepid or Assail at 2000-2100 DD, then at 2350-2400 DD, if needed. Organophosphates, carbamates, pyrethroids, Altacor or Delegate at 2100-2200 DD, then at 2450-2500 DD, if needed.

Apple – First brood: Rimon at 200-250 DD. Assail, Calypso, Clutch, or Intrepid at 250-275 DD. Organophosphates, carbamates, pyrethroids, Delegate, Altacor or Avaunt at 350-375 DD.

Apple – Second brood: Rimon at 1300-1350 DD. Assail, Calypso, Clutch, or Intrepid at 1350-1400 DD. Organophosphates, carbamates, pyrethroids, Delegate, Altacor or Avaunt at 1450-1500 DD. These timings target the middle of egg hatch of second brood.

Apple – Third brood: Rimon at 2300-2350 DD. Assail, Calypso, Clutch, or Intrepid at 2350-2400 DD, then at 2800-2900 DD, if needed. Organophosphates, carbamates, pyrethroids, Delegate, Altacor or Avaunt at 2450-2500 DD, then at 2900-3000 DD, if needed. Control of the fourth and fifth broods should be maintained in orchards where the pheromone trap-capture threshold is exceeded.

PESTICIDE SAFETY AND APPLICATION EMPHASIS

INTRODUCTION

The orchard owner or manager is directly and legally responsible for the effective and safe use of pesticides. Pesticides, as a whole, are relatively safe when used as recommended, but they can become a potential liability in the hands of a careless operator or an inexperienced person. Pesticides vary in their toxicity to humans and other animals, and all should be used with care. Ask your Extension Agent to help you become a certified applicator. **PROCEED CAUTIOUSLY AND LIMIT THE ACREAGE TREATED UNTIL YOU HAVE GAINED FIRST-HAND EXPERIENCE IN THE USE OF PESTICIDES.**

PESTICIDE APPLICATOR CERTIFICATION AND TRAINING

Applicators of restricted use pesticides must be trained and certified in their state of residency to purchase or use these chemicals. Fruit growers using restricted use pesticides are required to be certified private pesticide applicators. Certified applicators in Virginia are required to be recertified every two years. In West Virginia and Maryland, recertification is required every three years. If you have any questions about certification or training, please contact your Extension agent or State Department of Agriculture.

CHANGES IN FEDERAL REGULATIONS

Ongoing changes in federal pesticide laws will continue to affect the ways in which you apply, store, and dispose of pesticides. These include the Food Quality Protection Act (FQPA), the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the Worker Protection Standard (WPS), record-keeping rules, and laws affecting storage, disposal, non-target species, and water quality.

HANDLING AND STORAGE OF PESTICIDES

READ THE LABEL

Before using pesticides, always read all directions and follow them exactly. Pesticide labels may change during the growing season; thus, read the label on each new container purchased and before each use. Note warnings and precautions before opening the container. Repeat the process every time, no matter how often you use a pesticide. Apply pesticides only on crops specified, in amounts required, and at times indicated on the latest manufacturer's label.

STORE PESTICIDES WISELY

Keep pesticides out of the reach of children, pets, irresponsible persons, and livestock. All pesticides should be stored in a specifically designated area that can be securely locked. The designated building or area should be clearly marked on the outside to indicate that dangerous chemicals are stored within. The local fire department and your local emergency response council (see section on "Community Right to Know") should be notified of the location of the storage area and the nature of the stored materials. Proper records should be maintained at all times to aid in identification in emergencies as well as on a routine basis. Good ventilation, lighting, and neatness are most helpful in preventing accidents. Liquids must not freeze if stored over winter. All pesticides should be protected from extreme temperatures to maintain their shelf life. Always store