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# Insect Monitoring Techniques

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## Insect Monitoring Techniques for Row Crops

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IPM utilization in row crops would be increased significantly if there was more use of monitoring techniques for pest and beneficial species. Tree crop growers and their PCA's have successfully utilized monitoring systems in their IPM programs for many years. However, many row crop growers have seen very little utility in monitoring systems. Unlike tree crops, the rapid turn-around time (generally only 60-120 days from planting to harvest) and very low threshold of tolerance for damage (especially for aesthetic blemishes) has created in growers and their PCA's a sense of urgency and the necessity to use pesticides in more of a prophylactic or preventative strategy than in a curative or reduction fashion.

In reality, there are many opportunities in row crops to implement monitoring techniques. Detection devices such as sticky traps or bands and pheromone traps can alert growers to pest populations migrating into new fields from adjacent crops. In-field pest populations generally develop at the same rate as tree crop pest populations and allow ample time for monitoring and decision making to take place. This can be accomplished by a number of techniques including timed-search sampling, whole plant samples, beating trays, stationary trays and traps.

Most sampling techniques can be rather simple to use and are quite efficient when considering the information they provide, generally requiring no more than 20-30 minutes to develop the information necessary for each decision-making unit, block or field. For example, on a newly emerging field of lettuce or newly transplanted celery field, a timed-search or whole plant inspection can be utilized weekly or biweekly, depending on insect pressure. The timed-search technique involves searching over as much plant tissue as possible within a given amount of time, usually 2 minutes, for the target pest. This is repeated 4-5 times across the field as the grower or PCA walks the field making general observations on weed species and levels, crop stand, soil moisture, evidence of disease, or other potential or developing problems. When the inspection is complete, the grower or PCA has information on the distribution of the target organism (eg. only 2 out of 5 locations in field "A" vs 5 out of 5 locations in field "B"), the life stages present (eg. eggs and 1$^{st}$ instar larvae and winged aphids in field "A" vs 4$^{th}$ instar larvae and aphid nymphs in field "B") as well as its relative abundance (relative to the last inspection or to other fields in the area).When this technique is used for worm pests such as beet armyworm (BAW) or corn earworm (CEW), the threshold is usually one half (1/2) larva per inspection station. This technique is generally used before thinning-to-stand when there are many small seedling crop plants close together in the row.

After the crop has been thinned or when a crop has been planted to stand, whole plant sampling is the technique generally used. With this technique, a given number of plants (a minimum of 10 per field) are thoroughly inspected for the target organism providing information on the number of organisms per plant. For example, studies by Dr. John Trumble have indicated the threshold for treatment of BAW in celery is when an average of 0.5 BAW larva is found on a 10 plant sample. Again, plants are sampled randomly and organisms encountered recorded as the grower or PCA walks a random general inspection pattern across the field.

Another technique which provides information on a variety of organisms, both pests and beneficials, is the use of a beating tray. A simple tray such as a plastic fast food restaurant serving


tray can make a valuable sampling tool. The beating tray is best utilized when the crop to be sampled is 3 or more inches tall. At this point, the plants can easily be tapped over the tray as it is positioned against their stems in the plant row. Generally 3-4 plants can be accommodated along one side of a standard food serving tray in a crop row. These plants are vigorously tapped over the tray and then the tray is repositioned over to the opposite row across the furrow where another set of 3-4 plants is tapped over the other edge of the tray. A great advantage of the beating tray, besides the fact that it is a rapid technique, is that many small insects such as aphids, thrips, springtails, newly hatched worms, parasites and other beneficials that would normally be difficult to see in a plant search due to their cryptic nature are easily discovered and recorded with this technique. Larger specimens are also dislodged. In addition., using a beating tray allows the grower or PCA to collect a larger pest sample very quickly when a parasitism assessment is desired. For example, with worm pests such as BAW, CEW or cabbage looper, larvae that are dislodged onto the tray can be pulled apart to check for *Hyposoter exiguae* larvae inside (a primary internal parasite of these noctuids). In this way an estimate of larval parasitism can be obtained. It has often been the experience in processing tomatoes that early season infestations of BAW are so heavily parasitized that insecticide treatments are not needed, further optimizing the effects of early season biological control agents. Leafminer parasites in celery are easily encountered using a beating tray.

Leafminers can also be easily monitored using a stationery styrofoam supermarket food tray. With this technique, developed by Dr. John Trumble at UCR, a small (4x8") food tray is placed on the berm in the row between the bases of the plants to catch leafminer pupae as they drop from the crop leaves above. Generally a small stone is used to weight the tray down in windy areas. In celery, a level of 10 pupae per tray per week is considered a treatment threshold. In fields using softer pesticides this level is usually never reached. Early season leafminer monitoring in celery is accomplished by using whole plant counts (20 plants) for larvae with a threshold of 1 larva per plant.

Sticky traps and pheromone traps are other tools for monitoring pest and beneficial populations in row crops. Although these tools generally don't give a quantitative measure of pest density due to the migratory nature of the species they catch, they can give a relative measure of pest pressure form field to field such that they are helpful in determining treatment priorities whenever treatments are deemed necessary. They are also quite useful as a first line of defense by providing an early warning of pest presence in the area. Sticky traps and pheromone traps may be fastened to wooden stakes or hung in plant foliage. Placement is usually critical to optimize their trapping efficiency. This generally means placement at the top of the canopy. Many pheromone traps drop drastically in efficiency or sensitivity when placed only a few inches to a foot above the canopy. Diamondback moth, for example, will not fly into traps more than about 2 feet above the plant's canopy and maximum catches are right at or just into the canopy.

Ultimately, the most important factor with any monitoring system or method is consistency through time. In row crop farming where multiple fields are planted over the season, the same system should be used in each field all season long so that counts can be compared from field to field. Equally important is the use of the same technique in the same field each week over the season. Only in this way can the necessary distribution and life stage information be developed to permit treatment decisions regarding timing, choice of material and rate. Finally, consistency in monitoring technique coupled with precise record keeping permits the assessment of treatment efficacy and comparisons between treatments.