Chapter 4

Arthropod Sampling and Decision Making

G. David Buntin and Leon G. Higley

Sampling to assess arthropod population levels is the cornerstone of integrated pest management (IPM). Sampling is done to estimate pest populations on a field-by-field basis or to survey pest incidence and distribution over a large area. Control decisions should be based on accurate and current information about pest populations and the cost of control relative to the expected loss in yield or product quality from pest damage.

Sampling Techniques

A sampling technique is the procedure by which pest numbers are measured. Numerous techniques have been developed, and no technique is efficient at sampling all pests. Choice of a sampling technique depends on the biology and characteristics of the pest, level of precision desired, intended use of the information, and technique cost (time and labor). Ideally, we would like to know pest numbers per unit area (an absolute estimate), but more frequently, we must relate numbers to the sampling technique (a relative estimate).

Sampling techniques in IPM must provide a reasonably accurate (close to the true number) and precise (repeatable) population estimate for a minimal cost. Some techniques may provide very accurate and precise estimates but are too time-consuming and expensive to be practical. Most arthropod pests in crops can be sampled by one of the following techniques: soil or aerial traps, sweep netting, vacuum netting, ground cloth, direct observation, and dissecting plant parts.

Foliage-inhabiting insects often are sampled by using vacuum netting or sweep netting. A vacuum net uses a net across a vacuum hose where insects are sucked into the net. A vacuum net has an opening that can be placed on the ground, thereby providing numbers per unit area. However, the suction often is only effective at collecting small insects or small stages of large insects and does not provide an absolute measure. Vacuum netting is time-consuming and expensive and thus is not widely used in IPM programs.

Sweep netting is the standard insect sampling technique for many crops. It is easy and inexpensive. A scout can sample a large area in a short time. Sweep netting probably is the best overall technique for sampling common and mobile insects. However, the net only covers the "top" of the plant canopy, thereby missing insects that dwell lower in the canopy. Sweep-netting results can be highly variable; they can be affected by weather conditions and sampler variability. One study showed a 50% difference in sweep net counts by different scouts sampling in a field at the same time. Sweep net samples are relative estimates, although some research has tried to calibrate sweep net samples to ground area measurements.

The ground cloth technique consists of placing a white cloth on the soil under a plant to be sampled and shaking the plant to dislodge insects, which fall on the cloth. In agronomic crops, a ground or shake cloth is placed between rows and a measured length of row is shaken over the cloth to dislodge arthropods. Once on the cloth, arthropods can be counted in the field or collected and counted at a remote site. Using a ground cloth generally requires more time per sample than sweep netting, but it provides more accurate and precise results. Ground cloth sampling is not suitable for highly mobile insects that often disperse before they can be accurately counted.

Direct observation is a commonly used technique for sampling arthropod pests. This involves a scout simply counting the numbers of a given pest on a selected number of plant samples such as leaves, stems, or fruiting structures. This provides a count per plant unit. Some pests such as armyworms, chinch bugs, and aphids on seedling plants are surveyed by inspecting a measured length of row and counting all observed insects. This provides a very good population measure, but it too can be time consuming if populations are large. In latter-stage plants, insects are counted on single or groups of stems or plants. For insects that tunnel in stems, a predetermined number of stems or plants can be collected and dissected to count the number per stem.

Traps are useful for surveys over a large area and for monitoring movement of pests into new areas. Many traps use an attractant such as light, sex pheromone, color, or some other device to attract the target pest. These traps catch the mobile stage of a pest, which must fly into the trap. Traps, especially traps with pheromone lures, are