plant. Thus, at this stage, a presence-absence sampling plan accurately indicated the need for treatment.

With 30 aphids per plant as a threshold, and 90 percent confidence levels, the potential for contamination began when about 30 percent of the plants were infested with aphids on the oldest trifoliates. At population levels below 10 aphids per plant, the relationship between percent oldest trifoliates infested and aphid density per plant was no longer linear. However, at such low densities, no more than 20 percent of the plants had aphids on the oldest trifoliates, and either the presence-absence or the sequential sampling plan provided for rapid decisions.

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The strawberry aphid is the primary cause of unmarketable fruit.

Sampling and statistical analysis

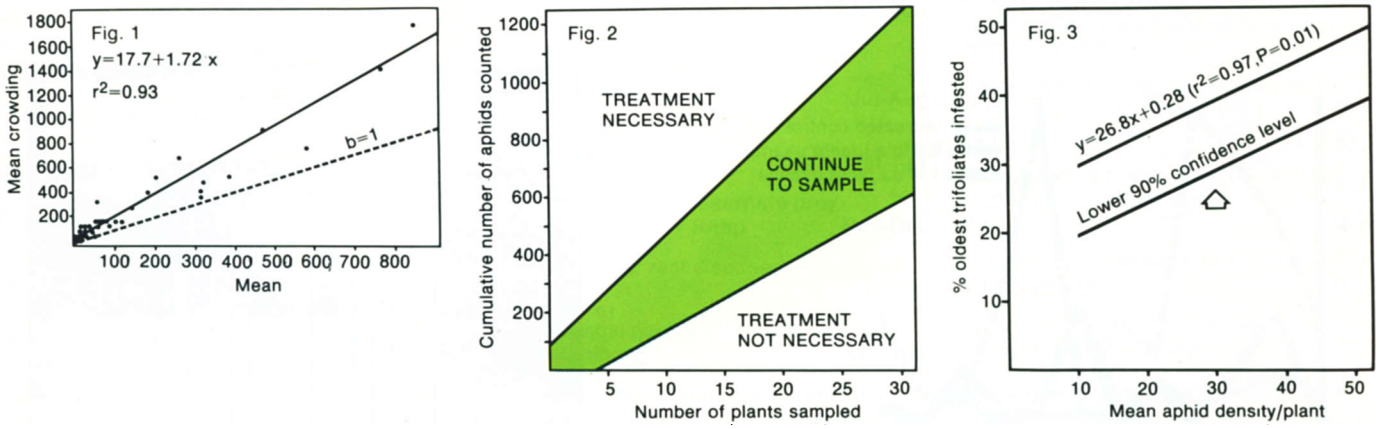
The strawberry plantings monitored consisted of 15 and 12 double-row, 60-meter-long beds in 1981 and 1982, respectively. In 1981, 144 plants were sampled each week in a stratified-random sampling plan. Data were not collected on May 21. In 1982, 118 plants per week were sampled from January 12 until March 2, and 72 plants per week from March 9 to May 11; data were not collected on March 16 or May 3.

To determine the within-field distribution of aphids, we used a statistical technique developed by the late Professor Iwao of Nagoya University in Japan, which basically called for a regression of mean crowding ($=\text{mean}+[\frac{\text{variance}}{\text{mean}}]-1$) on the mean.

This technique provided valuable information on whether an individual or a group of individuals was the basic unit of the population (from the y axis intercept), and how these units were distributed in the field (from the slope). Using data from a rapidly increasing aphid population (fig. 1), we determined that a group of aphids was the basic unit of the population. Also, these groups were found to be aggregated in the field, since the slope of the regression line in figure 1 was greater than one (see dotted line).

Fortunately, this technique also provides the foundation for a sequential sampling plan (fig. 2) (upper and lower threshold lines were developed at the 90 percent confidence level). This sequential sampling plan, which is based on the regression of mean crowding on the mean, has the advantage of including the concepts of a group or cluster of aphids, as the basic unit of the population, occurring in an aggregated fashion in the field.

When strawberry plants became too large to sample effectively with the sequential technique, our analysis showed that a simple binomial, or presence-absence, sampling plan (fig. 3) would accurately indicate when to start control measures.



Aphid distribution: Fig. 1. Regression of mean crowding on the mean number of aphids per plant for an increasing population. Fig. 2. Sequential sampling plan for aphids infesting strawberry plants. Fig. 3. Linear relationship between mean aphid density per plant and percentage oldest trifoliates infested. When about 30 percent of oldest trifoliates are infested (arrow), action must be taken to prevent fruit contamination.