A FIELD TRIAL OF ELECTRONIC INSECT MONITORING EQUIPMENT IN STORED GRAIN IN FLORIDA.

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Accurate monitoring of stored-product insects in stored commodities is required to effectively manage growing pest populations. This is true not only in situations where fumigants and other toxic compounds are prohibited or undesired, but also in situations where they can be used strategically and effectively. Alternatives to methyl bromide can be deployed with the greatest efficacy when there is early warning of the pest problem. Efficiency is also very important for pest management. Control strategies need to be implemented not only as early as possible, but also precisely where the problem is occurring. Elimination of wasteful regularly scheduled control procedures will occur only when it is practical to intervene on an "as needed" basis. An automated system that collects realtime data from an array of traps is the best way to accomplish such an objective. The collected count data can be viewed directly by a facility manager and can also be imported directly into computer-based expert systems that can aid in making and analyzing management options.

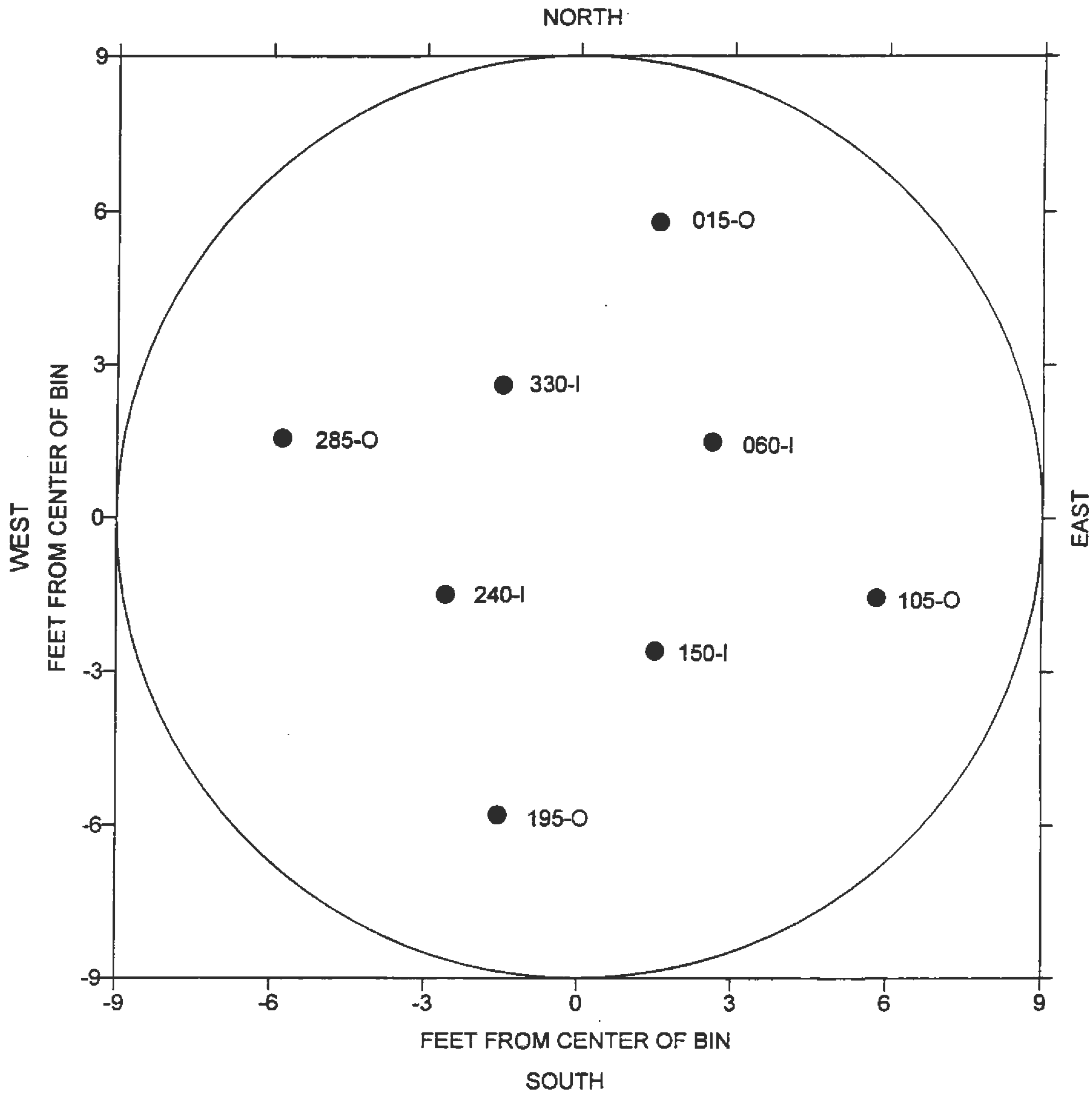
The Electronic Grain Probe Insect Counter (EGPIC) system uses modified grain probe traps to monitor insect capture automatically. The data are collected by a computer and can be most readily viewed as a summary of captures during the trapping interval for each probe trap. In addition, each insect count is recorded as an event with a time stamp to allow for assessment of diel patterns in insect activity within the stored commodity. The system uses an infrared beam which scores an event when interrupted, which occurs when an insect falls into the trap. For the purposes of this field test, the captured insects are collected in the standard trap receptacle, so that the number and type of insects captured can be compared to the computer counts at weekly intervals. Future designs will have an open bottom so that insects that fall through the beam are not collected and the traps will not need to be serviced on a regular schedule.

This is not the first field test of EGPIC. An earlier field test was conducted in a flat corn storage in Wisconsin in 1993. This field test revealed the potential of the system for automated monitoring, but also indicated that system accuracy was strongly impaired by a susceptibility to dust and insects that crawled into and remained in the vicinity of the infrared beam. The current design corrects for these vulnerabilities. The sensitivity of the system actually was reduced to prevent counting small objects. Current calibration detects a small insect such as the flat grain beetle at approximately 90% accuracy to reduce the chance of counting mites.

The current field test commenced on July 17, 1996 in a bin filled with seed oats. The bin was filled with newly-harvested oats on June 25 and fumigated with phosphine on June 27. The traps were deployed and the system started on the earliest date for which the level of residual phosphine was below an acceptable level. The bin is 18 ft in diameter and 18 feet high. The bin is approximately three quarters filled and eight traps are deployed as indicated in Figure 1. Each trap location is continually monitored for temperature, and moisture content is recorded for each trap location on a weekly basis.

The moisture contents of the oats has been approximately 12.5% throughout the test, which is still ongoing. The temperature of the oats at a depth of about one foot has been nearly constant at 30 degrees Celsius. Not surprisingly, the conditions have been ideal for insect population growth. The predominant insect species collected has been the foreign grain beetle, with nitidulids being next most abundant. Low numbers of most of the major beetle pests have been recorded at this point. Very few natural enemies have been trapped. The initial fumigation appeared to have a significant impact on pest numbers, because system counts and trap captures were very low. A gradual increase in both counts and captures occurred for approximately two months and we recommended a second fumigation to the manager. The oats were fumigated again on September 14.

In spite of unanticipated a.c. power loss to the system for nearly half of each day, we can still estimate the accuracy of the automatic counts. If we assume perfect agreement between automatic counts and insect capture, we would expect that: automatic counts/manual counts = time power on/total capture interval or 0.56. Our weekly data are quite close to this value (Figure 2), indicating a fairly high level of accuracy. In addition, because the system restarts automatically when power is restored and the approximate duration of the interruption is recorded, we were able to determine that the power loss was due to a single circuit breaker being used to control the lights each day and that our system was being controlled by the same breaker. The problem was then corrected. Finally, the EGPIC system can be used in conjunction with spatial analysis software to generate an estimate of the number of trappable insects in the upper 18 inches of the oats. Dividing this estimate by the volume of the layer, gave an estimated mean density of insects of approximately 7 insects per kg before the second fumigation, indicating that mean density had risen rapidly during the preceding weeks. Although the calculations were made using actual captures, it will possible to do the same thing with EGPIC counts in the future. This ability to do this type of analysis using automatically collected data should greatly increase the ability of grain managers to predict when it is necessary to take action against a growing insect problem.



Positions of probe traps, thermistors and moisture content samples in stored oats

Figure 1.

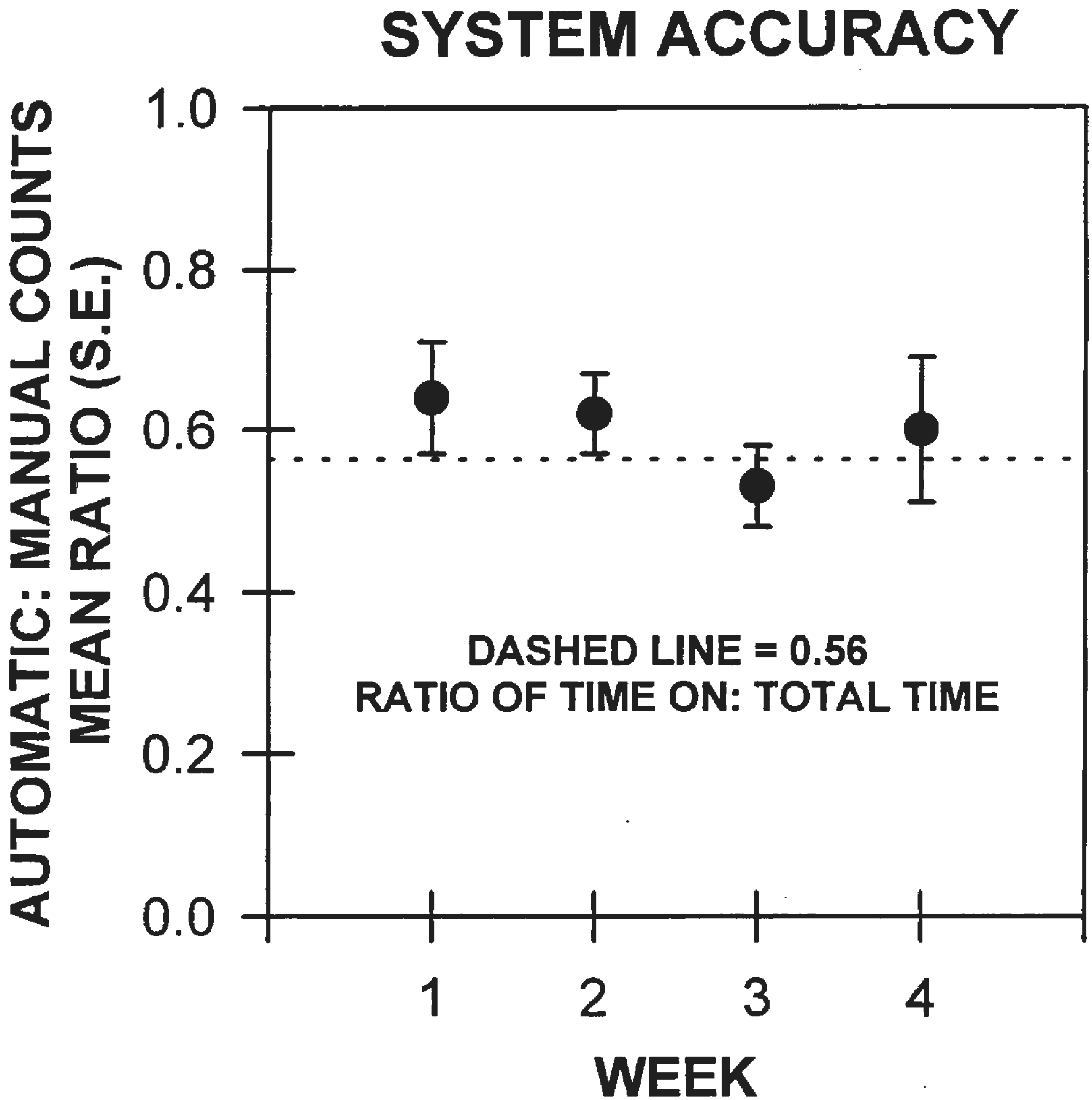

SYSTEM ACCURACY
AUTOMATIC: MANUAL COUNTS
MEAN RATIO (S.E.)
1.0
0.8
0.6
0.4
0.2
0.0
DASHED LINE = 0.56
RATIO OF TIME ON: TOTAL TIME
1
2
3
4
WEEK

Figure 2.