DATCP'S 2003 INSECT SURVEY RESULTS AND OUTLOOK FOR 2004

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EUROPEAN CORN BORER

DATCP's annual fall European corn borer survey measures the average number of corn borer larvae per plant in grain corn fields throughout Wisconsin. Survey results are used to estimate the density of the fall corn borer population and forecast the potential magnitude of the first flight of moths the following spring. Establishing where heavy corn borer infestations occur in fall indicates where excessive populations may lead to economic loss next summer.

The corn borers present during the fall survey will pass the winter as full-grown (5th instar) larvae in corn residue, pupate once temperatures exceed 50°F next spring, then emerge as adults in late May of 2004. The reproductive potential for emerging female corn borer moths is high. When conditions are favorable, each female can lay in excess of 400 eggs; thus, a sizeable fall population may develop into an economic threat in the following growing season.

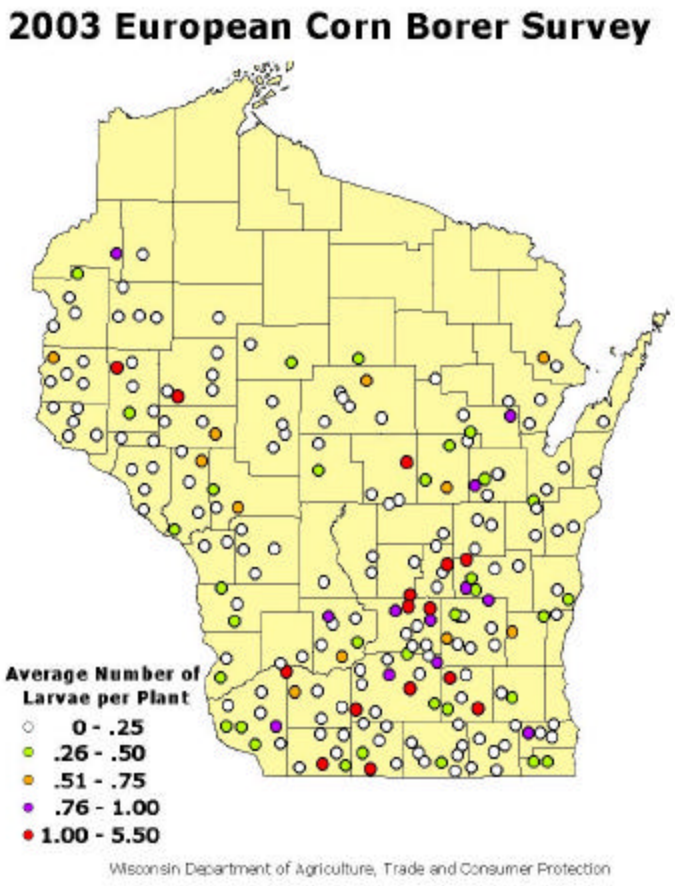

Figure 1. 2003 European corn borer fall survey results.

Survey Protocol

To determine the fall population size, DATCP's pest survey staff visit approximately 220 fields in 60 counties from early September to mid-October, returning to approximately the same sites from year to year. At each site the surveyor examines 25 consecutive plants for signs of infestation, including leaf feeding injury, entrance/exit holes, or frass, and records the percentage of infested plants. Next he or she dissects two consecutive infested plants, counts the number of larvae found within the two stalks, and calculates the average number of borers per plant.

What can be considered a heavy infestation? The answer varies from state to state. Several other Midwestern states which conduct similar fall surveys use thresholds ranging from 0.60 to 1.0 borers per plant. University of Illinois-Extension maintains that 1.0 borer per plant may cause 4% to 6% yield loss, depending on the time of attack. Here in Wisconsin our estimate is slightly more conservative. Traditionally we have used 0.75 corn borer per plant as the threshold, meaning that a population in excess of 0.75 larvae per plant may result in economic loss.

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Survey Results

This year's survey documented a statewide average of 0.30 borers per plant, a 36% decrease in comparison to last year's average. Results from the fall 2003 survey compare to 0.66 per plant in 2002, 0.40 in 2001, and a 10-year average of 0.54 borers per plant. In relation to 50 years of survey data, the 2003 overwintering population is 19% below average. All agricultural districts showed population decreases. Noteworthy are those documented in the central (1.21 to 0.44 borers per plant), west central (0.61 to 0.17 borers per plant), and northeast (0.75 to 0.23 borers per plant) districts, where averages fell by 0.77, 0.55 and 0.52 borers per plant, respectively.

The raw data (see Fig. 1), in contrast to district averages, shows that there were some scattered hotspots, particularly at sites in Marquette, Green Lake, Columbia, Dodge and Fond du Lac Cos. The highest average individual densities detected during the survey were 5.5 borers per plant in a Columbia Co. field, 3.36 borers per plant in Marquette Co., and 2.2 per plant in a Green Co. field. In total, 12% of the fields included in the survey had average densities at or above 0.75 borers per plant, while 7% of the fields surveyed had densities exceeding 1.0 borers per plant.

District	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	10 Yr Ave
NW	0.20	0.10	0.32	0.03	0.02	0.15	0.24	0.33	0.44	0.20	0.20
NC	0.08	0.17	0.41	0.26	0.01	0.03	0.04	0.05	0.26	0.14	0.15
NE	0.10	0.53	0.47	0.18	0.01	0.18	0.03	0.07	0.75	0.23	0.26
WC	0.45	1.21	0.80	0.15	0.02	0.30	0.31	0.67	0.71	0.16	0.48
C	0.92	1.23	1.02	0.09	0.02	0.30	0.41	0.48	1.21	0.44	0.61
EC	0.28	2.49	0.65	0.26	0.03	0.25	0.19	0.33	0.44	0.22	0.51
SW	1.10	6.31	0.51	0.39	0.17	0.57	0.39	0.87	0.65	0.35	1.13
SC	1.01	2.65	0.83	0.35	0.10	0.61	0.33	0.48	0.86	0.52	0.77
SE	1.07	3.08	0.79	0.35	0.10	0.31	0.16	0.36	0.61	0.17	0.70
State Ave	**0.58**	**1.97**	**0.64**	**0.23**	**0.05**	**0.30**	**0.24**	**0.40**	**0.66**	**0.30**	**0.54**

Figure 2. European corn borer fall survey summary 1994-2003 (by district).
Average number of borers per plant

Outlook for 2004

A statewide average of 0.30 borers per plant suggests there are fewer larvae headed into the winter of 2003-2004 than have been documented in the last few years. In view of that, there exists a relatively small overwintering population that is likely to develop into next summer's first flight of moths. This however, does not guarantee that the European corn borer will not become an economic threat in 2004. Spring weather conditions will determine the fate of the first generation. If favorable conditions prevail during the period when corn borers are mating and reproducing, the first generation population could increase dramatically.

Growers near the hotspots, sites with averages near or exceeding 0.75 larvae per plant, are encouraged to pay particularly close attention to the first flight of moths, growing degree day accumulations, and scout for injury caused by first generation larvae next spring. Results of the 2003 fall European corn borer survey are presented in Figures 1 and 2.

SOYBEAN APHID

Perhaps the most unanticipated insect event of 2003 was the soybean aphid outbreak that burdened the state's soybean fields in July and August. After seeing mostly only low-level aphid densities in 2002, an aphid outbreak of this magnitude was not in the forecast. Soybean aphids reappeared during the week of June 13 in Dane and Rock Cos. and in the following weeks grew to the highest densities since first being detected in Wisconsin in 2000. Peak aphid densities were observed during the R2-R4 stages of growth, between July 21 and August 19.

Survey Protocol

The survey began during the third week of July, just as soybeans in the southernmost counties were reaching the R2 stage of growth. Soybeans between R2 and R4 were targeted because aphid levels were expected to peak during those stages. Counts taken when aphid densities were at peak levels could then be compared across the state to see where the heaviest infestations ocurred. The survey included 289 sites (see Fig. 3). At each site 20 plants were examined thoroughly and the number of aphids per plant was determined. The aphid counts were totaled, and the final number recorded from each field was the average number of aphids per plant.

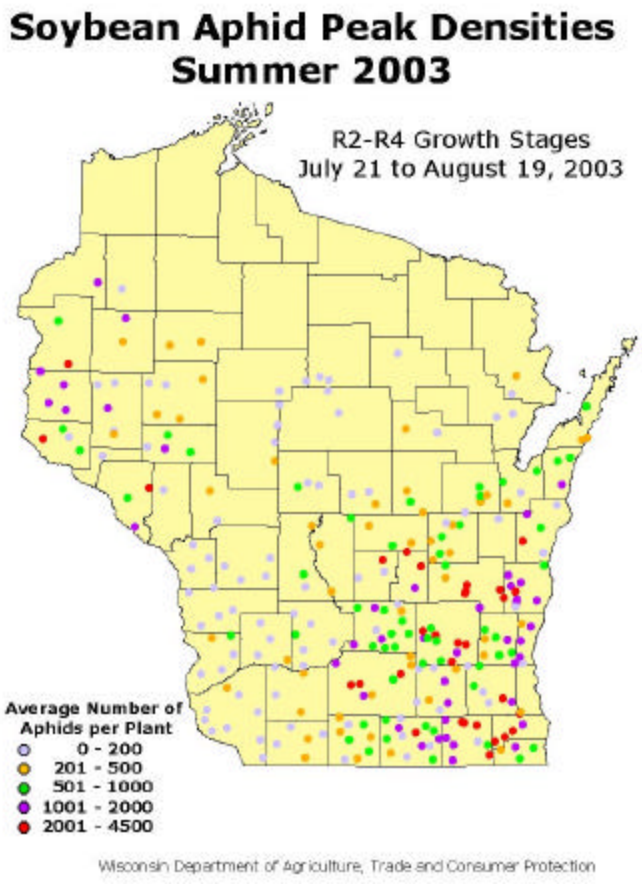

Fig 3. 2003 Summer Soybean Aphid Survey Results

Survey Results

Soybean aphids were widespread across several Wisconsin districts in 2003, but the highest densities were observed in the south central (1006 aphids/ plant) and southeast (1268 aphids/plant) districts. While these averages are high, they don't tell the complete story. Many fields included in the survey had significantly higher densities. In fact, 11% of the fields surveyed had average densities exceeding 2000 aphids per plant, and nearly 5% had densities of more than 3000 per plant. Fields in the south central and southeastern districts were so saturated with aphids that most growers sprayed fields at least one time, while many decided that two applications were warranted.

Not all districts had aphid densities intense as those in the south central and southeast. Rather low numbers were recorded in the north central (93 aphids/plant), northeast (170 aphids/plant), and southwest (149 aphids/plant) districts. Evident from Fig. 3 is a wide swath of relatively low averages, less than 200 aphids per plant, stretching from the southwest to the northeast corner of the state. Survey results indicate that most fields in these districts did not develop intense aphid populations. It is not immediately apparent why this was the case. One theory suggests that aphid popualions were not as dense in regions where buckthorn, the overwintering host of soybean aphids, is not prevalent. Nonetheless, there are likely several factors factors that influence aphid severity from year to year.

At this time, the specific number of aphids that a plant can sustain and still successfully produce seed is not known, but an average density exceeding 500 aphids per plant can probably be considered high. In the 2003 soybean aphid survey, 47% of the fields surveyed had average densities at or above 500 aphids per plant, and a total of 27% of the fields surveyed had densities exceeding 1000 aphids per plant.

Outlook for 2004

Significant soybean yield losses were reported at the end of the 2003 season, but the extent to which soybean aphid was a factor is unclear. Heavy aphid populations are known to cause a reduced seed weight and fewer pods per plant, but the low yields in 2004 may not have been due exclusively to soybean aphid. Disease and drought conditions also undoubtedly had a large impact. After a light aphid season in 2002, followed by outbreak levels in 2003, it remains difficult to forecast what to expect from soybean aphid in 2004. Will growers have to endure the same intense aphid densities in 2003, or will densities decline as they did in 2002? We'll have to wait and see.

BEAN LEAF BEETLE

In the last few years years bean leaf beetle populations in Wisconsin have reached record high levels, rapidly elevating bean leaf beetle to one of the leading insect pests to soybean production. The current consensus is that mild winters and earlier planting dates probably had the greatest influence on this recent increase in abundance. Although bean leaf beetles can be economically important as defoliators and pod feeders, the real concern about these beetles relates to their role in bean pod mottle virus (BPMV) transmission. Bean leaf beetles vector BPMV, a virus that causes significant yield losses and may contribute to green stem, the problematic condition where plant stems remain green through harvest.

Losses associated with BPMV tend to be higher in plants that are infected early on, especially in plants that become infected in the seedling stage. One of the first routes through which plants become infected in the seedling stage is through overwintered bean leaf beetles that move into early-emerging soybean fields to feed and reproduce. With those variables in mind, several new questions emerged, adding to an already confusing situation. Should growers facing bean leaf beetle/BPMV problems employ a control strategy that focuses on reducing numbers of beetles, preventing virus transmission, or both? Would spraying in spring to kill overwintered bean leaf beetles be an effective way of reducing virus transmission later in the season? Further, would a single strategy be effective each season, and work for all Wisconsin soybean growers? Having more questions than answers prompted us to develop this survey to better assess the overwintered bean leaf beetle/BPMV situation in Wisconsin.

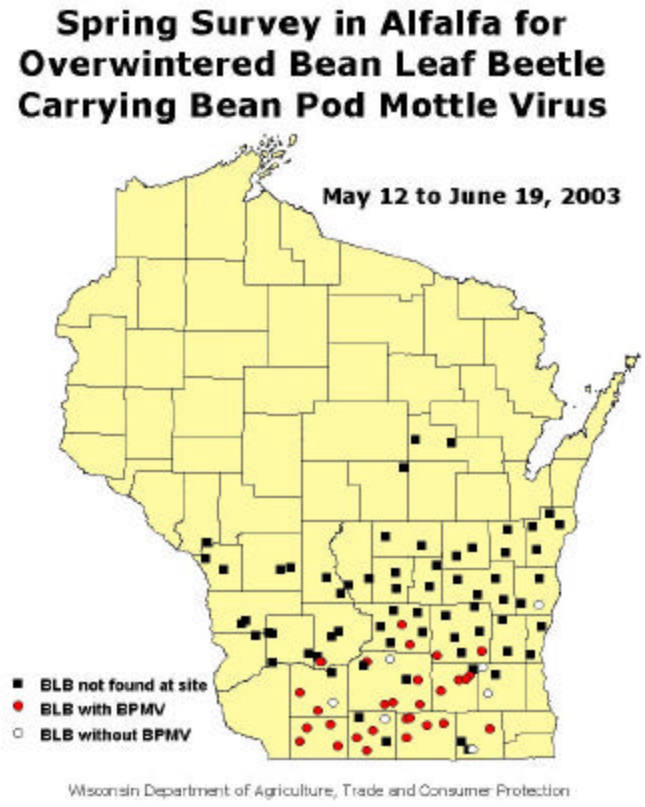

Fig 4. 2003 Bean Leaf Beetle/BPMV Survey Results

Survey Protocol

With the understanding that overwintered beetles carrying BPMV would be the first path of virus transmission to soybean seedlings, we began a survey for overwintered beetles in alfalfa. Bean leaf beetle is a soybean pest; however, we targeted alfalfa fields because that is where

overwintered bean leaf beetles feed in the springtime before soybeans emerge. At each alfalfa field the surveyors took 200 sweeps (50 sweeps in 4 separate areas) and saved any bean leaf beetles obtained in the sweeps.

The initial plan was to survey approximately 175 alfalfa fields throughout the southern two thirds of the state, then test the overwintered beetles collected for BPMV using the ELISA method. This would provide us with an estimate of the percentage of BPMV-carrying beetles in the overwintertered population, as well as the distribution of overwintered bean leaf beetle in Wisconsin. It might also indicate whether early-season control of overwintered bean leaf beetles would be an appropriate or effective strategy.

The first overwintered adults were swept from alfalfa fields in Rock and Walworth Cos. on May 12, marking the beginning of the survey. The survey was completed on June 19, just as soybean seedlings began emerging and overwintered bean leaf beetles started migrating to soybean fields.

Survey Results

The survey found that a high percentage of the overwintered population carried BPMV, but, that the percentage of the bean leaf beetle population that overwintered in Wisconsin in 2002-2003 was relatively small. During the survey, 107 alfalfa fields were assessed. As mentioned above, the original survey plan included more sites, but surveyors stopped after the southern third of the state was surveyed as no more beetles were found in fields further north of Juneau and Adams Counties. A total of 152 overwintered beetles were collected from 41 of the 107 survey sites (38%). Individual beetles were tested for BPMV and 72% of the beetles (109/152) were positive. The beetles carrying BPMV were mostly distributed in Lafayette, Iowa, Dane Green, Rock, Walworth, and Jefferson Counties, but a small number of BPMV-positive beetles were found at sites in Columbia, Dodge and Sauk Counties as well.

While a high percentage of the beetles collected carried BPMV, it is important to recognize that bean leaf beetles were not found over most of the state. Overwintered beetles were found at less than half of the sites surveyed (41/107), and those sites were confined exclusively to the southern three tiers of counties.

Outlook for 2004

The survey findings suggest two things. First, because beetle distribution appears mostly confined to the southern three tiers of counties, the bean leaf beetle/BPMV complex may only be a concern to growers in southern Wisconsin. Accordingly, farmers in the far southern part of the state might benefit more from early season bean leaf beetle control, to reduce virus transmission early on. Next, the fact that so few overwintered bean leaf beetles were recovered in the central and northern parts of the state, suggests that early-season virus transmission may not be an issue in those regions. In counties north of the Vernon to Ozaukee line, an early season bean leaf beetle control strategy may not prove effective, or even necessary. Instead, a strategy that focuses on late-season control of second generation beetles might be the best one to employ.

Keep in mind these results are based on a single survey. Although we are learning more about bean leaf beetle/BPMV complex with each passing season, we still have a long way to go. Winter temperatures and weather conditions will also affect the survivorship of bean leaf beetles from year to year, as will the prevalence of BPMV. It is clear that bean leaf beetle populations can fluctuate substantially from one year to the next; therefore, a single strategy might not be effective for all growers, every year. For now the best strategy may be to know the available options and follow bean leaf beetle advisories in April and May editions of the Wisconsin Pest Bulletin, available online at: http://www.datcp.state.wi.us/arm/environment/insects/pest-bulletin/.