2004 Progress Report to the Northeast Soybean Promotion Board - 4/15/04 – 4/14/05

Evaluation of economic injury level, biological control, and host plant resistance for soybean aphid in NY.

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Objectives:

1. Evaluate soybean yield loss at different aphid densities in a field cage experiment and in field surveys in order to define an economic injury level (EIL) for New York.
2. Conduct a survey of soybean variety trials to determine relative abundance and yield impacts of soybean aphid, *Aphis glycines* Matsumura on commonly grown soybean varieties in New York.
3. Conduct a survey to determine the identity of natural enemies (predators, parasitoids and fungal pathogens) affecting soybean aphid in New York State. Evaluate the importance of these natural enemies for controlling soybean aphids while soybean plants grow and soybeans develop.
4. Enhance cooperative extension outreach efforts, communication, networking, regarding soybean aphid, optimize rapid and early detection of this exotic pest: Continue to increase awareness of soybean aphid and its importance NY field personnel (producers, crop consultants, agricultural industry, field crop extension educators). Utilize electronic technology and traditional approaches to strengthen timely communication and convey survey activities and findings to Northeast region clientele, and other appropriate stakeholders.
5. Share survey findings with appropriate soybean IPM workers in the Northeast and north central US (Northeast IPM and NC 502), state and federal agencies (USDA National Agricultural Pest Information System (NAPIS), USDA Cooperative Agricultural Pest Survey (CAPS), and USDA Animal Plant Health Inspection Service (APHIS)).

Progress on Objectives:

Objective 1. A field experiment was initiated to study the relationship between soybean yield loss and aphid density and start to define an economic injury level (EIL). Treatments were field cages (6 x 3 x 3ft high), containing equal densities of soybean plants, and seeded with soybean aphids for low, medium, and high density. We had a range of aphid levels to regress against yields, however, aphid populations did not reach extremely high levels. Soybean aphids per plant averaged 30, 87, and 280 in low, medium and high cages, respectively. Soybean yields averaged 246, 292, and 186 grams per cage, in cages with low, medium, and high numbers of aphids, respectively. Soybean yields were not significantly different between aphid levels because of high variability. However, the means show a trend towards reduction of yield at 280 aphids per plant (Figure 1, Table 1).

Objective 2. Soybean variety trials were surveyed as in 2002 and 2003. In 2004, the Northeast Region Soybean Promotion Board funded biweekly surveys for soybean aphid in New York. Surveys were conducted at two locations in soybean variety trials that included 30 different varieties. Variety trials were conducted in the central (Aurora) and western (Mt Morris area) soybean growing regions of New York. In each soybean variety plot, we measured the relative abundance and yield impacts of the soybean aphid. In general, soybean aphid populations were similar to 2003 (Figure 2, Table 2). The highest average number of aphids per forty plants, on one date when plants were R2-R4, was 98 aphids per plant. Soybean yields per acre were average in NY fields, slightly lower than in 2003.

Our preliminary analysis of 2004 soybean aphid populations and yield data shows that there were differences in both soybean aphid levels and yields between locations. Within each location, yields differed between varieties and on dates of peak aphid numbers there were significant differences in aphid ratings between some varieties. Overall, Group 1 early varieties had lower aphid numbers than Group2 later varieties.

With 3 years of data we have a picture of aphid population change over time, and under different weather conditions. Aphid populations at the Aurora farm have not reached a threshold level of 250 per plant. Since aphids peaked to damaging levels in only a few pockets of soybean acreage in NY in 2003 and 2004, we will continue to monitor aphids to see whether gradually populations rise to damaging levels or are controlled by existing natural enemies and abiotic factors.

Objective 3. Each time sites were visited, 4 sets of ten sweep samples were taken in each variety and three 3-minute visual transects was be taken to assess predator density and diversity. Voucher samples were brought back to the laboratory.

In 2003, Coccinellid species were the most abundant of numerous predators but only a few parasitoids were found. On 3 dates (Aug. 8, 25 and Sept. 17), aphids were collected from severely infested fields and reared on soybean leaves to evaluate infection by fungal pathogens in the laboratory. Five species of pathogens were found (*Lecanicillium lecanii*, *Pandora neoaphidis*, *Neozygites fresenii*, *Entomophthora chromaphidis*, and *Conidiobolus thromboides*), the latter four belonging to the Order Entomophthorales. None of these pathogens have previously been reported from this aphid species in the literature. Aug. 8 collections from one field in North Rose, NY that had been planted early yielded 84% infection by *P. neoaphidis* over the 3 days after collection. Although the plants were sensitive to damage because they were just past flowering, the grower (Mr. Donald Ballagh) decided not to spray with insecticides. Soon after, aphid populations were observed to decline precipitously on their own, as we had predicted based on the high rates of infection in our samples. Samples collected late in the season (Sept. 17 in Seneca Co.), when aphid populations probably had little effect on yield, had 78-89% infection, once again predominantly due to *P. neoaphidis*. While these late season infections contributed little to immediate aphid control, they may be important for longer-term regional suppression of aphid populations through development of a reservoir of overwintering inoculum that would infect aphids the next spring.

During 2004, we sampled soybean fields in Tompkins, Cayuga and Wayne Counties, NY

weekly, from 28 June-29 Sept. We found abundant fungal infection in all fields and were excited to find another species of fungal pathogen, possibly a species not previously reported from North America (*Pandora kondoiensis* but exact identity is presently being resolved by molecular means). Also, in 2004 *P. neoaphidis* was the dominant pathogen.

Objectives 4 and 5. Cooperative extension, consultants, agricultural business field personnel, producers and other appropriate clientele were kept informed of soybean aphid survey activities and were engaged to contribute information to help identify soybean fields at risk.

Our 2004 SBA outreach efforts:
2/3/04 NWNY Soybean Congress, Batavia, NY. Soybean IPM – Soybean aphid update (110 people)

2/4/04 NWNY Soybean Congress, Waterloo, NY. Soybean IPM – Soybean aphid update (120 people)

2/12/04 CNY Soybean Congress, Auburn, NY. Soybean IPM – Soybean aphid update (93 people)

3/8/04 Northeast ESA Branch Meetings, New Haven, CT. Soybean aphid in NYS an update (31 people, extension professionals)

7/29/04 Musgrave Farm Field Day, Aurora, NY. Soybean aphid, Field Crop IPM Demo (120 people)

10/26-29/04 Field Crop Dealer Meetings, Clifton Park, New Hartford, Batavia, and Auburn, NY. "Soybean Aphid: New pest, new concern? " (220 people)

11/30-12/2/04 Certified Crop Advisor Training, Waterloo, NY. Soybean IPM Updates (60 certified crop advisors)

12/15/04 Richfield Springs, NY. CCE. Soybean Pests: SBA and SB Rust (24 growers)

Created Soybean Aphid informational poster - used at Cornell Musgrave Farm Field Day (Aurora NY, 120 people), Empire Farm Day (Seneca Falls NY, 600 people), Oneida County CCE Field Crop Workshop (130 people).

Soybean aphids added to the soybean pest management section of Cornell University Guide for Integrated Field Crop Management (See: www.fieldcrops.org).

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Figure 1. Yields Soybean Aphid Caged Studies (Field J), Aurora NY 2004.

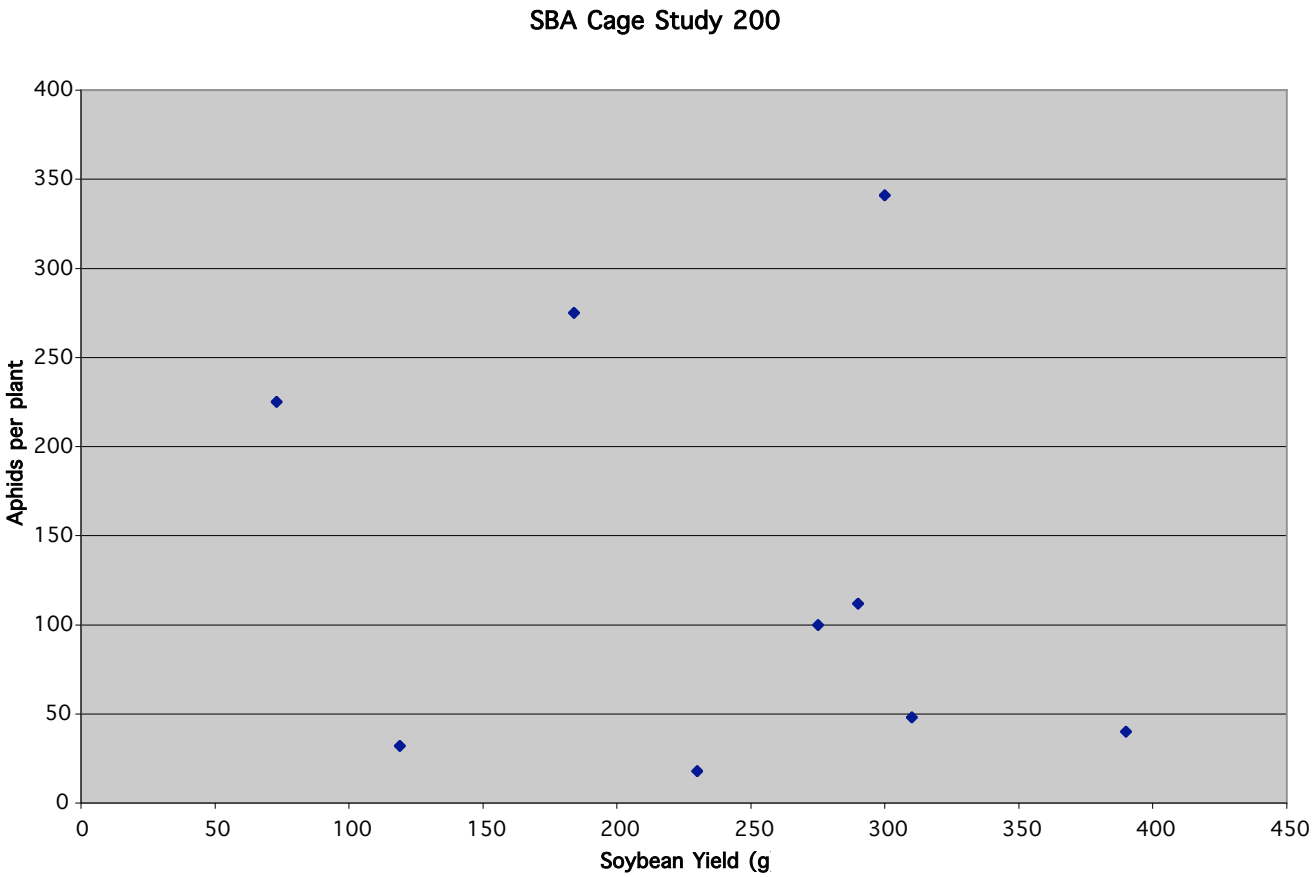

Table 1. SOYBEAN VARIETY TRIALS AURORA: Cage Study 2004 Field J

Cage	Yield Total Grams	Aphids per plant	L M H
1	184	275	H
2	290	112	M
3	390	40	L
4	73	225	H
5	119	32	L
6	275	100	M
7	230	18	L
8	310	48	M
9	300	341	H

Mean Yield Low Cages = 246 Mean aphids = 30
Mean Yield Medium Cages = 292 Mean aphids = 87
Mean Yield High Cages = 186 Mean aphids = 280

Figure 2. Soybean Aphid Means, Caged Studies, Aurora NY 2004.

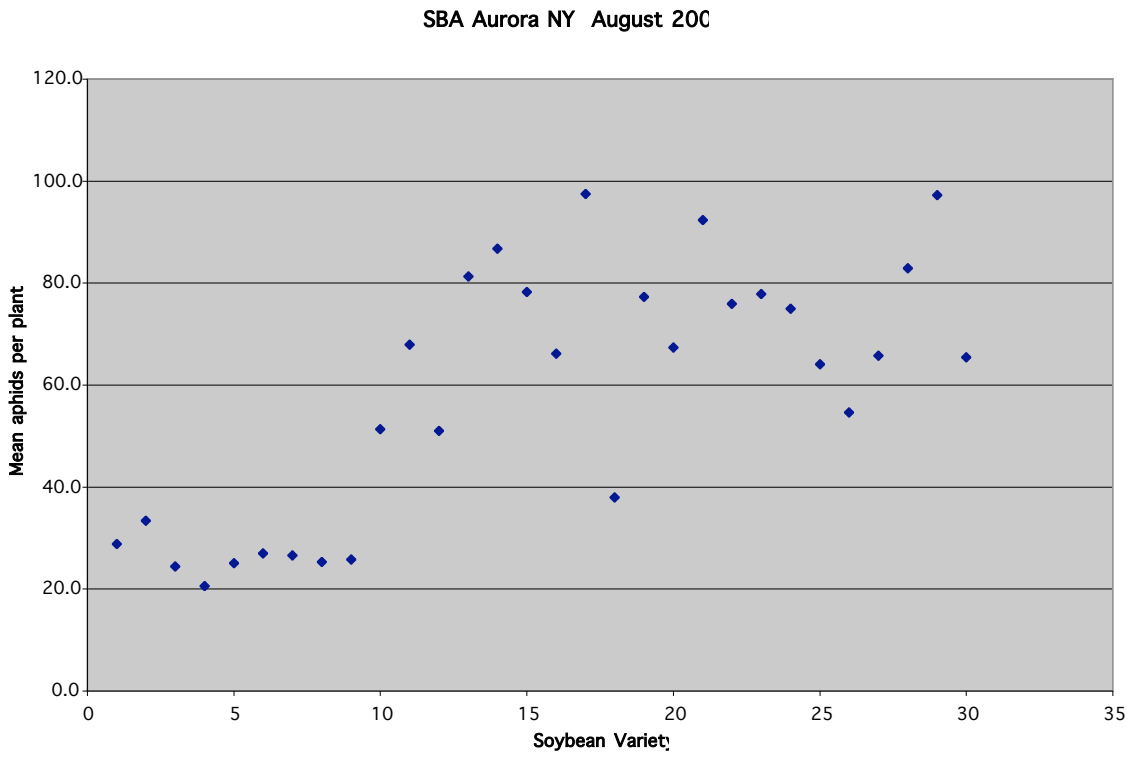

Table 2. SOYBEAN VARIETY TRIALS AURORA, AVERAGE SOYBEAN APHIDS PER PLANT PLANTS AT R2-R4 AUG 3 2004

Group 1 early varieties				Group 2						
No.	Variety	SBA/Plnt		No.	Variety	SBA/Plnt		21	2237RR	92.3
1	Razor	28.8		11	Rodney	67.9		22	2111RR	75.9
2	Richochet	33.4		12	Renwick	51.0		23	S21H3	77.8
3	DKB15-51	24.4		13	T2100RR	81.3		24	S24K4	75.0
4	AG1603	20.6		14	FS200	86.8		25	SG2405	64.1
5	AG1903	25.1		15	FS237	78.3		26	SG2704	54.7
6	S19-R5	27.0		16	DKB2252	66.2		27	SG2205	65.8
7	TS1500RR	26.6		17	DKB2852	97.5		28	EXP274	82.9
8	FS122	25.3		18	AG2403	38.0		29	P92B38	97.3
9	FS199	25.8		19	AG2107	77.3		30	H2659	65.4
10	SG1919	51.3		20	AG2703	67.3				