Progress Report to Gerber Products, Inc.
Organic Squash Trials
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Introduction

Organic agriculture experienced a 20% annual growth rate in 2002, and is currently listed as an $8-10 billion industry in the U.S. (OTA, 2002). Organic acreage in Iowa has increased from 13,000 in 1995 to 150,000 in 1999 (IDALS, 2000). Our research focuses on best management practices for enhancing soil quality and pest management for transitioning and certified organic farmers. Through timely weed management and crop rotations, we have demonstrated comparable organic corn, soybean, oat, alfalfa, pepper, broccoli, and medicinal herb yields compared to conventional crops (Delate, 1998–2002).

Most pest problems in organic systems are managed through cultural and biological control techniques. Management strategies for the cucumber beetle, squash bug, and squash vine borer in cucurbits (squash, melons, cucumbers) are key to successful organic production for vegetables destined for the organic baby food market (Tender Harvest™). When we began this research in 2000, the cucumber beetle, which transmits bacterial wilt in cucurbit plants, and the squash vine borer had been reported as some of the more serious pests in Iowa vegetable production. In 2001, low pest populations were observed in these trials, with populations of squash bugs exceeding cucumber beetle populations.

In the first year of the trial (2001), squash bug management was achieved most successfully through the use of row covers, which reduced populations by a factor of 10 on Pratt's Farm (Nashua, IA) and on Abbe Hills Farm (Mt. Vernon, IA). Other treatments consisted of buckwheat, planted as an intercrop treatment to enhance populations of the natural enemy, *Trichopoda pennipes* (a tachinid fly that parasitizes the squash bug), by supplying nectar and pollen. This treatment resulted in a significant reduction in squash yield, due to inter-plant competition. A third treatment, Surround™, a kaolin clay product (Engelhard Corp. Iselin, NJ), was sprayed on squash plants every two weeks to repel pest insects. There was no significant difference, however, between squash bug populations on control plants (no spray) and treated plants.

It has been reported that the health of the soil may be correlated with natural plant resistance or tolerance to pest organisms. A separate trial was conducted in 2002 at Abbe Hills Farm to examine plant and pest performance in squash grown with compost.

In 2002, the on-farm site for this research and demonstration project was located at Laura Krouse's Abbe Hills Farm in Mt. Vernon, Iowa. The objectives of this project in 2002 included the following:

- Continue the on-farm organic vegetable research and demonstration site in Mt. Vernon;
- Study potential pest management in organic squash systems;
- Determine plant performance and yield under each management system; and
- Study the effects of compost applications in organic winter squash production.

Materials and Methods

Pest Management Trial

'Zenith' squash seeds were planted in rows on 14 June 2002, but re-planted on 2 July 2002, after excessive rainfall and inadequate plant stands. Treatments were assigned in a randomized complete block design to plots (8 x 30 ft) separated by 10-ft borders to prevent interactions among treatments. Each plot contained 3 rows of squash (on 3-ft centers). Treatments included Surround™, applied bi-weekly from 10 July to 23 August; Remay™ row covers, secured on plants on 16 July after plants were fully established and removed at the time of flowering on 8 August; and a control (no spray/no row covers). Four replications of each treatment were established.

Plant growth was monitored throughout the season by recording number of leaves, leaf shoot length, and number of flowers/fruit on 10 random plants per plot. Insect and diseases were also monitored on these plants. On 23 August and 9 September, a disease rating was recorded based on the following scale: 1 = 0-20% diseased leaves; 2 = 21-50% diseased leaves; and 3 = 51-100% diseased leaves. Mature squash from all treatments was harvested on 11 October 2002. Squash harvest weight and number of squash were recorded.

Compost Trial

'Ultra' butternut squash seeds were planted on 14 June and re-planted on 2 July, as described above in the Pest Management Trial. Four replications each of two treatments: compost, applied at 100 lb. N/acre and a control (no compost), were established in a completely randomized design in 3 x 25-ft plots. Plots contained 2 rows of squash and were separated by 5-ft borders.

On 23 August, plant growth, insects, and diseases were rated on 10 plants per plot. Squash was harvested on 11 October. Squash harvest weight and number of squash were recorded. All data from both experiments were subjected to analysis of variance and mean separation (Fisher's PLSD test at p • 0.05; SAS, 1988).

Results and Discussion

In 2002, excellent organic squash yields were obtained in both experiments. 'Ultra' squash yields averaged 26,095 lb./acre, with 'Zenith' yielding an average of 19,960 lb./acre (Tables 1 and 3). 'Ultra' yields were twice as high in 2002, compared to 2001 yields. Although there were no significant differences in yield or fruit number among treatments in either experiment, yields from Surround™-treated squash plants were 17% greater than the controls in the Pest Management Trial. Fruit number averaged 4,604 squash/acre in 'Ultra' and 7,073 'Zenith' squash/acre. 'Ultra' fruit averaged 5.7 lb/squash compared to 2.8 lb/squash ('Zenith'). While the 'Ultra' squash are acceptable for the processed vegetable market, the large size may not be desirable for fresh markets.

There were no significant differences in pest (squash bugs and squash vine borers) populations or beneficial insects (lady beetles, minute pirate bugs, and nabids) among pest management treatments (Table 2). Overall, plants were very healthy, with no differences in disease ratings among treatments (Table 2).

In the compost trial, no significant yield differences were obtained between plots treated with compost and the controls (Table 3). With squash yields averaging 27,663 lb./acre in the unamended soil, one can assume a high level of soil fertility on this site at Abbe Hills Farm. There was also no difference in the number of fruit per acre between treatments, averaging 4,614 squash per acre. Although there were no differences in yield or fruit number, benefits derived from compost applications, including the enhancement of soil microbial life (Carpenter-Boggs et al., 2000), disease suppression (Goldstein, 1998), and maintaining soil quality (Manna et al., 2001), cannot be discounted. Over time, compost applications may also be required for essential nutrients on more continuously cropped lands.

Table 1. Squash pest management trial: harvest parameters, 2002.

Treatment	Yield (lb)/acre ± SE	Fruit/acre ± SE
Control	17,650 ± 1,280	6,025 ± 442
Surround™	21,250 ± 1,788	7,031 ± 566
Row cover	18,625 ± 2,329	7,375 ± 667
$LSD_{0.05}$	NS	NS

Table 2. Squash pest management trial: insect pests and disease rating, 2002.

Treatment	Squash bugs & Vine borers/plant ± SE	Beneficial insects/plant ± SE	Disease Ratingz ± SE
Control	0.28 ± .15	0.08 ± 0.03	1.60 ± 0.15
Surround™	0.29 ± 0.10	0.08 ± 0.02	1.63 ± 0.16
Row cover	0.60 ± 0.14	0.03 ± 0.02	1.40 ± 0.14

$LSD_{0.05}$	NS	NS	NS

[z] 9 September 2002 disease rating: 1 = 0-25% diseased leaves; 2 = 26-50% diseased leaves; and 3 = 51-75% diseased leaves; 76-100% diseased leaves per plant (n = 10 plants/plot).

Table 3. Compost Trial: squash harvest parameters, 2002.

Treatment	Yield (lbs)/acre ± SE	Fruit/acre ± SE
Compost	24,556 ± 3,055	4,408 ± 678
No compost	27,633 ± 2,035	4,800 ± 325
$LSD_{0.05}$	NS	NS

References

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