Final Project Report to the NYS IPM Program, Agricultural IPM 2003-2004

1. Title: Overcoming Barriers to Success in Reduced-Tillage Pumpkin Production: Implementing Effective Plant Establishment and Weed Management Strategies

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4. Type of Grant: Systems Comparison Trial

5. Project locations:

Lansings Farm Market, Colonie, Albany County, New York
Cornell Research Farm, Valatie, Columbia County, New York

6. Abstract:

Adequate weed control in pumpkins and squash is one of the most difficult practices for growers to obtain whether it is in a reduced-tillage system or conventional bare ground culture. Reduced-till pumpkin trials established in Albany County this year to evaluate a new post emergent herbicide called Sandea (halosulfuron-methyl, Gowan Company) were established. However, a poor stand of rye and high populations of perennial weeds not controlled with Round-Up applications, resulted in poor pumpkin establishment and poor annual weed control using Sandea. The cover crop trial to be established at the Valatie Research farm also had its share of problems. Due to the late funding of this IPM project, planting of spring oats was not able to be completed, the triticale plots were plowed and it was determined that there was not enough sorghum sudangrass residue to complete that treatment either. However, a bare ground winter squash trial comparing the effects of Sandea on transplant cell size, squash type and different varieties within a type was established.

7. Background and justification:

Reduced-tillage planting systems for pumpkins have for many years have been an area of interest for Capital District vegetable growers. Direct seeding into herbicide killed rye mulch has been the typical method of plant establishment. Growers often report that direct seeding of pumpkins results in poor plant stands. These reduced stands are a result of poor seed germination due to cold soils, seed to soil contact and heavy cover crop residues. Other factors include seed predation by mice and other animals and planter malfunctions. Research conducted in the Capital District supported by the IPM Program has evaluated the use of transplants. We have found that transplants allow greater control over plant populations in the field and offers greater flexibility over the timing of planting. Transplants can be planted later compared to direct seeding without adverse effects on yields. Poor germination, seed to soil contact, cold soil, seed predation and planter malfunctions can all be greatly reduced when transplants are used. Once a grower can establish a field of reduced-till pumpkins, weed control is the next priority. Mulch crops are rarely weed-suppressive for more than 4 to 6 weeks after pumpkin establishment.

Therefore, mid to late season weed management strategies need to be addressed. While there are several post-emergent grass herbicides labeled for pumpkins in NY, there are no post-emergent broadleaf herbicides labeled. Herbicide options are even further limited with the use of transplants as currently labeled products are either not labeled for transplants or are extremely limited by timing of application, weeds controlled and environmental factors. The introduction of a new herbicide called Sandea (halosulfuron-methyl, Gowan Company) and its registration in NY could become an important IPM tool in conventional and reduced-till systems. The ability of this material to be used post emergent on broadleaf weeds could be one of the missing links for reduced-till pumpkin systems to be used more widely in New York. Sandea may be used in conjunction with currently labeled post-emergent grass herbicides to control annual grasses. An IPM weed control strategy would entail the use of Sandea for post broadleaf control with or without the use of a labeled post-emergent grass herbicide.

Reduced-till research in the Capital District has traditionally used a fall planted winter rye that is killed in the spring with an herbicide as the source of mulch. In many cases, pumpkin growers do not have a chance to seed a fall cover crop because of harvesting and marketing of the current years crop, environmental conditions or non-availability of land because of a crop that has not been harvested. There have been a few attempts to evaluate a spring planted cover crop, but results have generally been poor. However, the continuous introduction of new cover crop materials may allow us to successfully utilize a spring planted cover crop. Another option that needs evaluation is the use of other fall planted cover crops with properties other then winter rye or the use of summer planted cover crops that fall killed or winter killed, left undisturbed and used the following spring as a reduced-till planting system. This flexibility of timing may allow a wider window of opportunity for growers to establish a cover crop and be able to utilize a reduced-till production system.

For several years now, the Capital District Vegetable Program in conjunction with the support of the IPM program, has been investigating the effects of different cell sizes on yield and quality of pumpkins and winter squash. Research funded by the IPM Program and conducted by the Capital District Vegetable Program suggests that there are no significant yield differences with pumpkins when 72 and 98 cell sizes are used. However, yields were significantly reduced when a 128 cell was used. All transplant yields were greater compared to direct seeded pumpkins. One of the problems that we have seen with using transplants is weed control, especially broadleaf weeds. We have used cultivation until the plants are too large to get through. Then we have relied on hand weeding or no weeding at all. Herbicides that are currently labeled for weed control on winter squash and pumpkins are for direct seeding. Command (clomazone) is labeled for transplant use, but must be applied prior to transplanting and the label is very specific that roots must be placed below the chemical barrier or injury will occur. This is sometimes difficult to accomplish as it is recommended that Command be incorporated and injury has been common and many growers have been reluctant to try transplants for this reason. However, the registration of Sandea herbicide allows growers to spray over the top of transplants and larger plants. Although the effects of Sandea applications on crops has been well documented by the supplying company, further trailing needs to be completed so that growers can see the positive or negative effects the material may have on their crops. The increase use of transplants for both pumpkins and winter squash in the Capital District in plastic and bare ground culture, is a prime example of how Sandea could become an integral part of an IPM system for these crops. Type of winter squash, varieties within a type and possibly the cell sized used for transplant establishment may all play an important role in how Sandea effects yield, fruit quality and overall weed suppression. The ability of Sandea to be used post emergent allows another option for broadleaf weed control not currently available for pumpkins and squash. However, proper timing and identification of weeds is still important for post emergent weed programs to work. Also, even though injury can still occur, the severity and duration is much less then other herbicide options and is a considerable savings in time and labor where cultivating hand weeding is used.

8. Objectives:

The overall objective of this work is to encourage increased grower use of effective reduce-tillage pumpkin production strategies. The two specific objectives of this project are as follows:

1) To demonstrate effective as-needed weed management strategies, integrating the use of a weed-suppressive cover crop (winter rye), a pumpkin planting strategy that causes minimal soil disturbance (using a no-till Water Wheel planter), weed scouting, and the as-needed use of post emergence herbicides.

2) To evaluate the post emergent use of Sandea herbicide on yield and fruit quality of two different butternut and acorn winter squash varieties, established as either 48 or 98 cell transplants in bare ground culture, treated with or without the herbicide.

9. Procedures:

Reduced-Till Herbicide Trial:

In late spring of 2003, a field of winter rye was located at the Lansing Farm in the town of Colonie, Albany County, New York. On May 22, rye was approximately 30" tall and just starting to head out. It was recommended to the grower that an application of Round-Up be applied as soon as possible to kill the rye and some perennial weeds found in the field. Round-up was applied on May 25, 2003 and a second application was applied on June 10.

Transplants of the pumpkin variety Oz were seeded by the grower and placed in his greenhouses. It was noted by the grower that many of his cucurbit transplants showed symptoms of Powdery Mildew. It was recommended that he treat these plants with a registered fungicide prior to planting. These plants were treated with azoxystrobin (Quadris) at the recommended rate. Prior to planting, the field was gone over using just the roller basket of a Perfecta, to lie the rye all in one direct and crimp any perennials weeds left. On June 23, the field was planted using a waterwheel transplanter. Plants were spaced 5' between rows and 4' in row. Plots were 3 rows wide and 90' long and replicated 3 times. Making plots 3 rows wide allowed us to use a tractor mounted boom sprayer with an 18' boom. Treatments included:

1.) Sandea applied after planting
2.) Sandea applied after planting and before pumpkin vining
3.) Hand weeded check.

The first application of Sandea was applied on July 15 at the recommended rate of 0.5 ounces per acre in 30 gallons of water per acre.

The field did not receive any broadcast fertilizer the previous fall or following spring and it was determined that the pumpkin crop to be established in the field would receive all the fertilizer needed through the use of trickle irrigation and fertigation throughout the season. Drip irrigation tape was laid on July 14, and plots were fertigated on July 25 with 40 pounds of a Peter's brand water soluble 20-20-20. Plots were again fertigated on August 1 and 11 with 40 pounds of 20-20-20 and 25 pounds of 20-20-20 respectively.

Cover Crop Trial, Valatie Research Farm:

The following cover crop treatments were to be implemented at the Cornell Research Farm in Valatie:

1.) Winter rye planted 2002
2.) Triticale planted Fall 2002
3.) Sorghum Sudan Grass residue planted Summer 2002, mowed Fall 2002
4.) Forage Oats planted Spring 2003
5.) Bare Ground

Winter rye was planted November 15, 2002 at a 6 bushel per acre rate. This late planting resulted in a poor stand of winter rye in the spring of 2003 at the Valatie Research Farm.

Due to late notification of IPM Grant Awards, the spring planted forage oat trial was not completed. No seed was purchased because it was to late to plant and expect a reasonable stand to plant through.

A field of sorghum sudangrass planted in the summer of 2002 was mowed in the Fall of 2002 leaving a thick layer of residue. Unfortunately, in the Spring of 2003, after evaluating the residues, it was determined that there was not enough sorghum sudangrass residue left on the field to warrant a proper treatment. This treatment was also abandoned.

A plot of triticale planted as a cover crop in the Fall of 2003 by another researcher at the Valatie research farm was also abandoned due to the fact that funding for the project was to late and another extension educator had already mowed and plowed the field to facilitate another project.

The Effects of Sandea, Cell Size and Variety on 2 Butternut and Acorn Winter Squash Varieties:

On June 10, 2003, the following plots were seeded out in the greenhouse located at the Blomgren Farm in Easton, Washington County, New York:

Variety	Type of Winter Squash	Cell Size
Autumn Delight	Acorn	48 and 98
Table Ace	Acorn	48 and 98
Avalon	Butternut	48 and 98
Waltham	Butternut	48 and 98

Plots located at the Valatie Research Farm were plowed and harrowed on June 13, 2003. A 19-19-19 fertilizer was broadcast at a rate of 300 pounds per acre on June 17 and disked in. Plots were re-disked July 10 and the above treatments were planted in bare ground using a water wheel transplanter on 6' centers and 2' in row spacing. A plot consisted of 16 plants and was replicated twice. Herbicide treatments were Sandea applied post emergent or a control with no herbicides. Sandea at the recommended rate of 0.5 ounces per acre in 25 gallons of water was applied on July 12 using a CO_2 backpack sprayer with a 5 foot boom in which the center of the boom was placed over the center of the row. Drip irrigation was laid on July 30 and plots were irrigated at least once a week or more if needed. Plots were fertigated on August 4 with 30 pounds of a Peter's brand water soluble 20-20-20. Plots were again fertigated on August 11 and 25 with 15 pounds Peters brand water soluble 10-10-10. On August 11, the entire trial was sprayed with Poast herbicide to control grass weeds at the 1.5 pints per acre rate plus 2 pints crop oil in 30 gallons of water, using a 3-point hitch boom sprayer. All plots were also sprayed with Sevin XLR Plus at a rate of 1 quart per acre to control Squash bugs. Plots did not receive any fungicide treatments. Plots were harvested and fruit was counted, graded and weighed on October 6.

10. Results and Discussion:

Reduced-Till Herbicide Trial

Due to unfortunate funding difficulties and timing, the reduced till herbicide trial at the Lansing Farm in Albany County was a disaster. A poor stand of rye coupled with large populations of perennial weeds such as marestail and wild lettuce, not controlled with Round-Up resulted in poor pumpkin establishment. Less then 20% of the plants survived and many of those that did survive, did not produce any fruit. It would have been preferred if a larger fruited variety such as Howden had been grown instead of Oz which is a semi vining pie type that has an average fruit size of 2 – 3 pounds. A larger fruited variety that would have been more aggressive may have been able to perform better then what was used.

As noted in the procedures section, many of the transplants at transplanting time exhibited symptoms of Powdery Mildew. They were treated in the greenhouse using a recommended fungicide and treated several times in the field with registered fungicides. However, symptoms could be found on nearly all the plants throughout the season. This could have impacted plant growth, vigor and yield.

With such poor plant stands and mostly perennial weeds, it is not possible to report what effect Sandea had on these pumpkin transplants. It was noted however that small (3-4 inches) common ragweed that could be found in many of the hand weeded plots was absent or dead in the Sandea treated plots while larger ragweed plants (2-3 foot) also exhibited some stunting and chlorosis, but did not die. Sandea did not affect any of the perennial weeds such as the marestail or wild lettuce found in this field.

The Effects of Sandea, Cell Size and Variety on 2 Butternut and 2 Acorn Winter Squash Varieties:

Visual observations made on July 22 found that plants sprayed with Sandea exhibited some early stunting and were slightly smaller then non-treated plants. However, any stunting or differences in plant size were unrecognizable when a second set of visual observations was made August 1. Although no actual weed ratings were taken, observations made on August 1 found that plots treated with Sandea had fewer broadleaf weeds, particularly Common Lambsquarters and Wild Radish than untreated plots.

When we looked at transplant cell size alone, it had the greatest impact on yield and smaller transplants resulted in fewer fruit and reduced yields for both acorn and butternut (Table 1 and 2). There was no interaction between cell size and herbicide treatment. However, we believe that this difference in yield is attributed to the late planting date of this trial (July 10).

We did not see a significant difference between Sandea treatments and untreated control plots (Table 3 and 4). In general Sandea treated plots resulted in slightly higher yields. Therefore, the stunting seen in Sandea treated plots did not adversely affect yield compared to untreated plots and the additional weed control observed with Sandea may have reduced resource competition and increased yields in treated plots.

Variety selection also influenced yields, particularly in the two butternut varieties grown in this trial. The newer hybrid variety Avalon resulted in higher yields when compared to Waltham in both the cell size and Sandea treatments. We believe that this variety is more vigorous from visual observations made in the field in growth and may be able to tolerate more stress than Waltham which has been the industry standard for many years. It was also noted that Avalon had better disease tolerance, particularly Powdery Mildew. Vines affected with Powdery Mildew were not as fast to die back as Waltham vines. This we believe can also be attributed to a more vigorous plant.

We believe that growers using transplants for their winter squash production can use Sandea herbicide for their herbicide program without adversely affecting yields, especially using a larger transplant and paying attention to some of the newer varieties that may be more vigorous or exhibit disease tolerance or resistance.

Table 1: Acorn yield response to transplant size.

Variety	Cell Size	Fruit Numbers	Fruit Weight(lbs)	Average Fruit Size(lbs)	Yield per Acre(lbs)
Autumn Delight	48	30.4	55.0	1.8	14, 970
Autumn Delight	98	26.9	48.4	1.8	13,180
Table Ace	48	36.0	61.5	1.7	13,480
Table Ace	98	23.8	38.7	1.6	10,540

Table 2: Butternut yield response to transplant size.

Variety	Cell Size	Fruit Numbers	Fruit Weight(lbs)	Average Fruit Size(lbs)	Yield per Acre(lbs)
Avalon	48	27.9	73.5	2.6	20,000
Avalon	98	24.0	57.4	2.4	15,630
Waltham	48	21.4	46.9	2.2	12,800
Waltham	98	20.5	42.2	2.0	11,500

Table 3: Acorn yield response to Sandea herbicide applied post emergent.

Variety	Herbicide Treatment	Fruit Numbers	Fruit Weight(lbs)	Average Fruit Size(lbs)	Yield per Acre(lbs)
Autumn Delight	Control	28.5	51.0	1.8	13,900
Autumn Delight	Sandea	28.8	52.3	1.8	14,200
Table Ace	Control	29.4	50.5	1.7	13,700
Table Ace	Sandea	30.4	49.6	1.6	13,500

Table 4: Butternut yield response to Sandea herbicide applied post emergent.

Variety	Herbicide Treatment	Fruit Numbers	Fruit Weight(lbs)	Average Fruit Size(lbs)	Yield per Acre(lbs)
Avalon	Control	27.8	69.0	2.5	18,800
Avalon	Sandea	24.1	61.9	2.6	16,900
Waltham	Control	20.4	41.8	2.0	11,400
Waltham	Sandea	21.5	47.2	2.2	12,900