

Final data report NE-SARE FNE11-733 for First Field

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Supported as part of NJ SARE PDP, Improving coastal plain soil health

This NE-SARE project sought to answer a complex of grower questions. Can we:

- ❖ successfully grow local processing tomatoes on Coastal plain soils;
- ❖ at competitive high yields while minimizing inputs;
- ❖ while improving soil health using the roller crimper no-till practice;
- ❖ mechanically harvest without fouling commercial machinery; and
- ❖ potentially reduce late season splash disseminated diseases?

Is this too much for farmers or process tomato customers to ask for? Sustainable or organic farming practices involve compromises. These cropping trade-offs are the tensions involving cash cropping vs. long fallow cover crop rotations to build soil health; damage to soils from organic tillage weeding vs. using herbicides; and successfully using mechanized commercial farm practices vs. scale-limited production methods (e.g., hand weeding labor) too inefficient to satisfy farm family livelihood and lifestyle demands. Similarly, whole field studies are hard to conduct while controlling variables introducing bias into our observations and results.

This evaluation comparing bare ground process tomato production with roller crimper use was supported in part by USDA NE-SARE Grower Grant FNE11-733 to [First Field](#) ketchup company, Princeton, NJ owned by first generation farmers Terri Viggiano and Patrick Leger.

Materials Methods and Equipment

With whole field variables in mind, Table 1 provides a list of all major field operations on both production fields with their dates. 2012 Tomato production took place at the Rutgers Agricultural Research and Extension Center 305-acre farm in fields designated for Sustainable Organic Alternatives Research (SOAR) training under support from the NE-SARE Professional Development Program (PDP).

Fields had been transitioned to organic production in 2003, and received USDA NOP Organic Certification in 2006. As this was the final year of farming organically, there were no restrictions on input products used.

Soils were gravelly sandy loam/Chillum silt loam testing 2 to 2.5% organic matter and CEC meq varying from 5 to 7. In mid-Sept. 2011, the field was disked, limed at 1 ½ t/a per acre, and prepared with an Unferverth minimum-till field cultivator pulling double rolling harrow baskets for one-pass seedbed soil conditioning. Rye cover crop (Seedway Canada, min. 85% germination, 98% purity, no noxious weeds) was seeded on Sept. 22, 2011 at ~ 2 ¼ bu/a. with a Case IH 5300 grain drill. In 32 days a dense rye stand was established, outcompeting emerging winter annual weeds.

Table 1. Dates, farming operations, and supplemental hand weeding time performed in adjacent roller crimper and bare ground fields planted to processing tomato.

Date & Field Activity	Roller crimper field	Bare ground field
Sept. 22 2011	Seed rye cover crop @ 2 ¼ bu/a, dry composted poultry manure applied June	
May 22 2012	Roller crimp mature rye followed by Roundup @ 1qt/a	
May 24		Flail mow rye disk incorporate
June 8		Field tillage
June 18		Disk tillage, preemergence Devrinol 50DF @ 3lb/a
June 18	Transplant Heinz H5108, 60 x~15 inch spacing, transplant water 100 ppm 20-20-20	
June 19	Set up drip irrigation	
June 20, 22, 27	Irrigation for 1-4 hr	
June 26	Late blight fungicide protectant + translaminar, Bravo WS @ 1qt/a + Presidio 4SC @ 4 oz/a	
July 9, 16, 19, 23, Aug. 8	5-0-10 fertigation; 2, 1, 1.5, 1.5, 1.5 gals, respectively	
July 13	Bravo Weather Stik @ 1 qt/a; Voliam Xpress @ 9 oz/a, one CPB defoliated plant/1,200 row ft observed	
July 5, 26	Irrigation for 1-4 hr	
July 16 Hand weeding assessment per 200 ft row (x 3)	~ 30 min/row = 22 hr/a easy removal but all weeding required bending to pull: ivyleaf morning glory, redroot pigweed	~ 43 min/row = 31 hr/a removal a combination of standing hoeing and bending: ivyleaf morning glory, jimsonweed, lambsquarters, redroot pigweed
July 18		Cultivation tillage
July 19		Postemergence Matrix 25DF @ 1 oz/a + Metribuzin (Sencor) @ 8 oz/a
July 27, Aug 3	Bravo Weather Stik @ 24 oz/a + Quadris @ 15 oz + Kocide 3000 DF @ 1 lb/a	
July 30 Hand weeding assessment per 200 ft row (x 3)	~ 22.5 min/row = 16.4 hr/a easy removal but all bending to pull: ivyleaf morning glory, redroot pigweed	~ 3.3 min/row = 2.4 hr/a removal by hoeing: ivyleaf morning glory
Aug 8 Hand weeding assessment per 200 ft row (x 3)	~ 4 min/row = 2.9 hr/a Mow off ivyleaf morning glory over roller crimped field borders, minor hand weeding	
Aug 9, Sept. 6	Voliam Xpress @ 8 oz/a for CPB or Lepidoptera	
Aug 10, 17, 23, 30 Untreated strips	Bravo Weather Stik @ 24 oz/a + Quadris @ 15 oz + Kocide 3000 DF @ 1 lb/a	
Aug. 23, 27, 31	Irrigation for 1-4 hr	
Sept. 6, Untreated strips	Bravo Weather Stik @ 24 oz/a + Kocide 3000 DF @ 1 lb/a	
Sept. 25	Hand-harvested yield and foliar disease visual ratings	
Oct. 2	Mechanical harvest to determine if roller crimped rye residue fouled or interfered mechanical harvest operations.	

Rye was rolled on May 22 with an 8' roller crimper from I&J Mfg., weighing 1,400 lb. Weight was added by filling the 16" cylinder with water, adding 75 lb per linear foot, for an operating weight of 2,000 lb. We rear 3-point hitched mounted the roller crimper and drove in reverse. We do not own a Laforge front 3-point hitch, and driving forward with the roller crimper rear-mounted would reduce crimping efficacy when tractor tires push rye down before contact with the crimper blades.

Rolling was followed by a same-day burndown herbicide application of Roundup at 1 qt/a to speed cover crop termination and kill already emerged weeds. There are differing views on whether supporting burndown herbicide applications are needed with roller crimping cover crops, and whether the application should be made before or after rolling. Roller crimpers were designed to enable organic farmers to participate in no-till agriculture without support from herbicide applications. Our multiple previous years of experience was that roller crimping alone—in the absence of burndown herbicide support (either Roundup or OMRI approved herbicide)—has never maintained a sufficient critical weed free period for crops on our Coastal plain soils. Moreover, without burndown herbicide to speed cover crop termination, evapotranspiration continues for about 3 weeks and results in early stand establishment moisture competition.

HeinzSeed variety H5108 transplants were grown in standard 338-cell 13x26 inch trays by a local process tomato grower. An early maturing high yielding variety with good color for multi-use peel/products, H5108 is recommended for regions in Canada, US Midwest, and Australia/New Zealand.

Transplanting took on June 18 in roller crimped and bare ground fields using an RJ plug transplanter (RJ Equipment Ontario, CN). The planter was modified on a heavy single row toolbar frame 3-point hitch for no-till with an extra large front coulter blade to cut through residues and a double disk opener in front of the planter shoe. Occasional fouling of the opener occurred during transplanting tomato in roller crimper field, and further modifications would be needed for efficient use. 100 ppm 20-20-20 Peters Professional soluble fertilizer was added to transplant water. Drip irrigation lines, and filter system with fertigation injector were installed within 2 days, and tomatoes watered as needed during the season. Bulk liquid fertilizer, 1:2 ratio N:K 5-0-10, was donated by Plant Food Co. for this project.

Three insect control applications were made. The first application was made after observing some defoliation from a light Colorado potato beetle (CPB) infestation. The other two applications could have been skipped, but were performed as part of routine maintenance sprays on neighboring tomato fields. Infestations were low and the rolled crimped cover crop may present a physical barrier reducing the ability of overwintering CPB adults from finding and colonizing host crops.

There were many neighboring tomato and potato fields in the area, with high risk of aerial Late blight, based on Northeast US experiences since the [Late Blight Pandemic of 2009](#). Not treating presented unacceptable risk to our fields as well as neighbors. Fungicide treatments, which also suppress common diseases (Alternaria Early blight or Anthracnose), began on June 26 with

recommended practices. On Aug 3, we discontinued treating randomly assigned strips across both fields to observe later any differences in late season foliar or fruit diseases.

Results and Discussion

Table 2 provides hand harvested yields from random 5-row feet sections in subplots. Table 4 further breaks down yield performance by subplots where later season fungicide applications were maintained or discontinued.

Table 2. Mean tomato yield on Sept. 25, expressed in t/a, average of six hand-harvested 5-row feet subplot samples (25 ft²).

	Roller crimped rye avg. tomato yield t/a	Bare ground avg. tomato yield t/a
Red	23.8	24.8
Green	19.9	15.3
Total healthy fruit	43.7	40.1
Percent ripe	54.4%	61.8%
Rots/culls	0.8	0.5

Divide by t/a yields by 0.87 to convert back to lb per 25 ft².

Mechanical harvesting on Oct 2 with a Pik-Rite harvester with an on-board electronic eye color assessed whether roller crimped rye residue would foul harvester operations or fruit sorting. The operation was successful. Rye straw residues did not bind the harvester cutting head, clog the vine shaker or trash separator, and did not leave significant residues on the sorter belt.

Harvest occurred 106 days after transplanting, which is late for an early variety. The delay in maturity of the early H5108 variety was due in part to a mid-summer heat wave causing some split-set in the field. As the crop appeared healthy, and we wanted to observe whether rolled crimped cover affected late season splash disseminated foliar or fruit diseases, we let the field continue to mature to recover the highest yield. Mechanical harvest one week later increased maturity and resulted in a higher overall total red fruit yield of 32 t/a (8,830 lb from 6,000 ft²).

Table 3. Foliar and fruit disease visual ratings on Sept. 25, 1 to 10 (worst to best), from 3 maintenance treated and 3 untreated after Aug 3 subplot strips across fields.

	Unsprayed after Aug 3	Mean rating	Maintenance Fungicide cont'd Aug 10 to Sept 6	Mean rating
Tomato roller crimped rye	7, 7.5, 7	7.2	7, 7.5, 8	7.5
Tomato bare ground	6, 5.5, 6.5	6.0	6.5, 8, 8	7.5
Leaf symptoms and fruit rots observed: Alternaria early blight, Late blight, bacterial spot, negligible Anthracnose				

No statistics nor conclusions can be drawn from a small dataset in one season. It does make sense that Sept. 25 visual disease ratings would be similar across field areas receiving maintenance sprays from Aug 10 through Sept. 6. We have no way to trust whether our 7.2

rating vs. 6 on bare ground is due to random chance and benefit. Overall disease pressure on plants and fruit during the season was very low. These fields did not have tomato production for many years. The long rotation may have more impact on low overall disease pressure than the rolled rye cover crop physical barrier, or there may have been residual fungicide suppression from earlier treatments ending on Aug 3, which bias our ratings.

Table 4. Separating yield from subplots where regular maintenance fungicide applications were discontinued after Aug. 3, or continued from Aug. 10 through Sept. 6.

Fruit harvest	Roller crimped rye avg. tomato yield t/a		Bare ground avg. tomato yield t/a	
	Unsprayed after Aug 3	Maintenance spray cont'd	Unsprayed after Aug 3	Maintenance spray cont'd
Red	20.9	26.7	24.9	24.7
Green	19.7	20.2	13.7	16.9
Total healthy fruit	40.6	46.9	38.6	41.6
Percent ripe	51.5%	56.9%	64.5%	59.4%
Rots/culls	1.0	0.6	0.3	0.6

Divide by t/a yields by 0.87 to convert back to lb per 25 ft².

Even with establishing a strong rye cover crop, dense rolled mat, and Roundup burndown application after rolling, annual ivyleaf morningglory and redroot pigweed were not satisfactorily suppressed and required significant hand weeding support. The rolled cover prevents hoeing; therefore this work was conducted bending. We logged minutes to weed 200-foot rows, converted the times to hours per acre, and placed the results in Table 1. While the roller crimper offers promise, it does not permit 'rescue' we suppression options.



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