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Sustainable and Low Input Strip-Till and No-Till Vegetable Planting Tactics 2004-2006 Preliminary Report

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Introduction

During the past three years field trials have been conducted at the University of Maryland Research and Education Center in Upper Marlboro, Maryland, examining strip-till and no-till vegetable planting techniques. The studies utilized cereal rye, and German foxtail millet cover crops, winter and summer annuals, respectively. A sustainable and low input protocol was followed to maximize time and economic investments, and to include soil conservation benefits of reduced tillage regimes. The vegetables included in these trials were direct seeded with a Monosem® no-till planter, with or without the strip- tillage prior to planting. An aggressive strip-tillage 12" wide by 6" deep was provided by utilizing a single row Ferguson® Rip-Strip Till implement. Leafy green vegetable crops were planted in the spring into cereal rye, and in the fall into the German foxtail millet. A burndown application of Gramoxone® to stop the cover crop growth was applied as required. For the leafy vegetable plantings no residual herbicides were required, and an integrated pest management approach led to minimized usage of insecticide and fungicide applications. Full season summer planted vegetables were planted into a cereal rye cover, and followed similar study protocol with the addition of residual herbicides. The highlights of these studies will be reviewed, noting the benefits and challenges discovered during the investigations.

Methods

The research trials were conducted from 2004 to 2006 at the University of Maryland Research and Education Center in Upper Marlboro, Maryland, on a Monmouth fine sandy loam soil. The vegetable plantings were designed as randomized complete blocks, with four replications per treatment. The treatments consisted of the comparison of no-till verses strip-till of the following leafy greens and summer vegetables: Sugar snap peas var. *sugar bon*; collards var. *champion;* kale var. *blue curled Scotch*; turnips var. *purple top*; Chinese cabbage vars. *pak choy* and *michili*; radish vars. *red globe* and *icicle*; lettuce vars. *salad bowl* and *oak leaf*; Swiss chard var. *fordhook*; spinach var. *Tyee*; summer squash vars. *fortune straightneck* and *Seneca zucchini*; snap beans var. *jade*; sweet corn var. *Argent*; popcorn var. *South American yellow giant*; ornamental corn var. *Indian*; water melon vars. *crimson sweet, sugar baby* and *jubilee*; asparagus var. Martha Washington; and pumpkins vars. a*utumn gold, Cushaw striped, bird house, Jack-Be-Little,* and *ornamental gourd mix*.

The fields utilized for the spring and summer vegetable plantings were tilled and drilled in early October with a 1.75 bushels/acre of rye in order to establish a heavy cover crop. At greenup in early March the rye cover received 30 lbs/acre of nitrogen. Each year a German foxtail millet cover was established in early June for the fall planted vegetable plots. The millet was seeded at a rate of 25 lb/acre utilizing a Tye® *Pasture Pleaser* no-till drill. Four weeks after planting, 30 lbs/acre of nitrogen were broadcast applied to the millet cover crop plantings. The vegetables at planting received additional nitrogen, phosphorus and potassium fertilizers applied as required by soil test at rates recommended in the Extension Bulletin 236. Overhead sprinkler irrigation was supplied at planting and during the growing season as required to aid in stand establishment and avoid cessation of growth. All of the seed was treated at planting with Isotox® a planter box treater to control seedling damping of diseases, and soil insects.

In Table 1 the vegetable planting data guidelines for the study are provided. Included in this table were the study crop and variety selections; the in-row and between-row spacing; planting depths; and target planting dates for spring and fall as applicable. For the spring planted vegetables and leafy greens (includes the bassicas, lettuce, radishes and spinach) the rye cover was strip-tilled, planted and sprayed with .75 qts/acre of Gramoxone® on April 8, 2004, April 26, 2005 and

April 11, 2006. The spring plots were two rows alternating between strip-till and no-till, thirty-foot long, with four replications. The sugar snap peas were strip-tilled and planted into the rye cover without herbicides on March 4, 2006. For the sweet corn, popcorn and Indian corn plots the rye cover was strip-tilled, planted and sprayed with 0.75 qts/acre of Gramoxone® + 3.0 qts/acre of Bullet + 15 gal/acre of 30% UAN on April 30, 2004, May 6, 2005 and May 3, 2006. The corn plots consisted of six rows alternating between strip-till and no-till, thirty-foot long, with four replications. For the summer squash and snap bean plots the rye cover was strip-tilled, planted and sprayed with 0.75 qts/acre of Gramoxone® + 5.0 qts/acre of Prefar® + 1.5 pts/acre of Curbit® on May 14, 2004, May 11, 2005 and May 11, 2006. The rye cover was strip-tilled and sprayed with 0.75 qts/acre of Gramoxone® + 5.0 qts/acre of Prefar® + 1.5 pts/acre of Curbit® for the watermelon, pumpkin gourd and winters squash plots on May 14, 2004, May 17, 2005 and May 23, 2006, however, only the watermelons were planted on the same dates as strip-tilled and sprayed. The pumpkins, gourds, and winter squash were planted into the prepared cucurbit plots on June 16, 2004, June 6, 2005 and June 6, 2006. The summer squash bean plots, watermelons, pumpkins, gourds and winters quash plots were all two rows alternating between strip-till and no-till, thirty-foot long, with four replications. For the fall planted vegetables and leafy greens (includes the bassicas, lettuce, radishes and spinach) the German foxtail millet cover was strip-tilled, planted and sprayed with .75 qts/acre of Gramoxone® on August 20, 2004, August 19, 2005 and September 27, 2006. Insect and diseases were controlled as required utilizing integrated pest management techniques, which included sprays based upon scouting thresholds and disease forecasts. All of the cucurbits received Admire® at vining for control of cucumber beetles.

Table 1. Vegetable Planting Data

Crop	Variety	Row Spacing (inches)		Planting Depth (inches)	Target Planting Dates	
		In	Between		Spring	Fall
Sugar Snap Peas	*Sugar Bon*	1 3/4	36	1/2	3 /1-3/12	8/15-8/24
Collards	*Champion*	1 3/4	36	1/4	4/7-4/24	8/15-8/24
Kale	*Blue Curled Scotch*	1 5/8	36	1/4	4/7-4/24	8/15-8/24
Turnips	*Purple Top*	1 3/4	36	1/4	4/7-4/24	8/15-8/24
Chinese Cabbage	*Pak Choy&Michili*	1 5/8	36	1/4	4/7-4/24	8/15-8/24
Spinach	*Tyee & Melody*	1 5/8	36	1/4	4/7-4/24	8/15-8/24
Radish	*Red Globe & Icicle*	1 3/4	36	1/4	4/7-4/24	8/15-8/24
Lettuce	*Salad Bowl & Oak Leaf*	1 1/16	36	1/8	4/7-4/24	8/15-8/24
Swiss Chard	*Fordhook*	1 3/8	36	3/8	4/7-4/24	8/15-8/24
Sweet Corn	*Argent &Incredible*	8 1/3	36	1 1/4	4/28-5/8	NA
Popcorn	*South American Yellow Giant*	8 1/3	36	1 1/4	4/28-5/8	NA
Ornamental Corn	*Indian*	8 1/3	36	1 1/4	4/28-5/8	NA
Snap Beans	*Jade*	2	36	1 1/4	5/8-5/20	NA
Summer Squash	*Goldbar, Fortune Straightneck & Seneca Zucchini*	18	36	1 1/2	5/8-5/20	NA
Watermelon	*Crimson Sweet, Sugar Baby & Jubilee*	22	120	1 1/2	5/8-5/20	NA
Pumpkins & Winter Squash	*Autumn Gold, Cushaw Striped, Bird House, Jack-Be-Little & Gourd Mix*	22	120	1 1/2	6/7-6/20	NA

Observations

There were numerous observable and yield differences of note for this study. A summary in Table 2 highlights some of the yield measurements recorded to date. Yield measurements were taken in the portion of the plots where emergence was observed to be 85% or greater, therefore the difference associated may be attributed to the effect of tillage. Generally, the effect of weed control was similar between the strip-till and no-till plots except in 2004 more grass was present in the strip-till rows of the pumpkins.

Table2. Vegetable Strip-Till & No-Till Yield Averages 2004-2006

Crop	Variety	Yield lbs/acre	
		Strip-Till	No-Till
Kale	*Blue Curled Scotch*	11,315a	8,345b
Turnips	*Purple Top*	32,625a	26,100b
Chinese Cabbage	*Pak Choy*	15,950a	11,600b
Chinese Cabbage	*Michili*	20,300a	17,400b
Radish	*Red Globe*	4,644a	4,060b
Swiss Chard	*Fordhook*	7,975a	7,685b
Sweet Corn	*Argent*	8,350a	7,940a
Popcorn	*South American Yellow Giant*	4,900a	5,082a
Ornamental Corn	*Indian*	10,527a	8,258b
Summer Squash	*Goldbar*	15,518a	8,276b
Summer Squash	*Seneca Zucchini*	23,413a	22,596a
Watermelon	*Jubilee*	20,283a	16,063b
Pumpkins	*Autumn Gold,*	12,524a	12,251a
Gourds	*Mixed*	3,405a	3,367a
Gourds	*Birdhouse*	14,422a	14,520a

Preliminary Study Conclusions

- Response to strip-tillage may be variety sensitive.
- For most crops investigated in this study strip-tillage led to a 20% to 30% increased plant population at emergence than no-tillage.
- Strip-tillage warms the soil which provided a 15% to 35% yield increase in early spring planted leafy greens and vegetables.
- Strip-tillage eliminated the cover crop competition, which led to robust seedling growth.
- Early pre plant burndown (EPP) of the cover crop is recommended when soil moisture is limiting. During drought conditions EPP one week prior to planting for each foot of cover crop canopy.
- EPP of cover crop will also reduce the chance for seed germination inhibition due to allelopathy.
- No-tillage may be more cost effective than strip-tillage for summer vegetables with fast germination and quick seedling growth.