

INFLUENCE OF EIGHT COVER CROPS ON YIELD AND QUALITY OF CUCUMBER, EGGPLANT, PEPPER, SQUASH AND TOMATO

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OBJECTIVE:

To determine if cover crops have an influence on yield and quality of the five major vegetable crops grown in southwest Michigan. Also to evaluate how effective cover crops are as part of an IPM disease control program.

SUMMARY:

Cover crops increased total yield for tomato and eggplant. No total yield differences were observed for cucumber, pepper and squash. The best performing treatments overall were hairy vetch and hairy vetch/rye. Oil seed radish tended to decrease squash plant mortality and tomato fruit size. Cover cropping is a long term process and care should be used in interpreting results from only one year.

METHODS:

Fertilizer: Prior to planting, 0-0-60, 21-0-0, sulfur, and Solubor was applied at a rate of 200, 150, 25 and 5 pounds/acre, respectively. After planting, nutrients were supplied through the drip system using 4-0-8-2(Ca) at a rate of 1 pound nitrogen/a/day. Application began 4 June and continued through 10 September.

Herbicide: Prior to planting, 2 pints/a Curbit 3E was applied between the plastic.

Cover Crops: All cover crop treatments were planted 19 August, 2000 and were as follows:

1. Hairy vetch + rye (25# + 1 bu/A)
2. Oats + rye (1 bu + 1 bu/A)
3. Oilseed radish + rye (15# + 1 bu/A)
4. Hairy vetch (30#/A)
5. Oats (1.5 bu/A)
6. Oilseed radish (20#/A)
7. Rye (1 bu/A)
8. Control (no planted cover)

Planting: 'Vivaldi' pepper and 'Nadia' eggplant were started in a greenhouse 5 April, 2001 and 'Mountain Spring' tomato 17 April, 2001. Transplants were set 25 May, 2001. 'Tigress' zucchini and 'Greensleeves' cucumber were direct seeded 29 May, 2001. All plants were placed on 6" high by 24" wide, plastic-mulched beds spaced 5.5' between beds. Peppers were in double rows 14" between rows and 18" between plants in the row (10,560 plants/acre). 'Tigress', 'Nadia' and 'Mountain Spring' were placed in single rows, 18" between plants (5280 plants/acre). 'Greensleeves' was planted 18" in the row, two plants/hill (10,560 plants/acre). Each bed was irrigated as needed using drip irrigation. The trial was

planted 90° to the previous cover crop. It was analyzed as a randomized block design with three replications, 16 plants/replication for 'Vivaldi' and 'Greensleeves' and eight for 'Mountain Spring', 'Nadia' and 'Tigress'.

Harvest: 'Tigress' was harvested 11 times between 13 July and 13 August, 2001. 'Greensleeves' was harvested eight times between 23 July and 13 August, 2001. 'Vivaldi' was harvested 9 and 22 August, 12 September and 3 October, 2001. 'Nadia' was harvest nine times between 30 July and 19 September, 2001. 'Mountain Spring' was harvested five times between 15 August and 10 September, 2001. To determine mortality rate, plant counts of 'Tigress' were taken from 11 July to 17 August, 2001.

Commercial planting: The same treatments were evaluated in a commercial setting. The cover crops were planted 19 August, 2000 and 'Mountain Spring' tomato planted 90° to the cover crops on 8 June, 2001. Prior to planting, potash levels were brought to 300#/A with 0-0-60 and 18-46-0 and 46-0-0 were broadcast at 200#/A. After first fruit set 28-0-0 was applied at 2# nitrogen/A/day until 3 September, 2001. Data was taken from three harvest on 5, 13, and 24 September, 2001.

RESULTS:

Hairy vetch was among the leaders in total yield for all vegetable species (Tables 1 - 5). Hairy vetch/rye was among the leaders for all species except squash. Hairy vetch is the only cover crop species capable of providing additional nitrogen to the vegetable crop. The control was among the poorer performers for tomato and eggplant. Rye (a standard cover crop for most growers) gave poor performance on eggplant and cucumbers. No treatment significantly influenced pepper yield and quality. Oilseed radish had a negative influence on tomato fruit weight.

Oilseed radish tended to reduce plant mortality in squash (Figure 1). The influence, however, did not translate into significant increased yields over five other treatments. This agrees with other studies that indicate oilseed radish may be helpful in reducing plant death due to soil borne pests.

The commercial tomato setting produced differing results (Table 6). Only hairy vetch + rye had a lower total yield (1686 cartons/A) than the other treatments. In this situation, oats + rye had the highest total yield at 2200 cartons/A. Results may differ due more to later planting time and fewer harvests than cover crop treatments.

Table 1. Yield in 1 1/9 bushels/A of 'Greensleeves' cucumber following eight cover crop treatments at the Southwest Michigan Research and Extension Center. Plants were grown on raised, plastic-mulched beds with drip irrigation. Beds were 66" on center, plants were 18" in the row with two plants/hill (10,560 plants/A). SWMREC 2001.

| TRT | TY | No1Y | %TY | No2Y | CuY | PW |
|-----|-----|------|-----|------|-----|------|
| 4 | 925 | 380 | 41 | 223 | 323 | 1.6 |
| 8 | 770 | 310 | 40 | 192 | 268 | 1.6 |
| 5 | 760 | 319 | 42 | 147 | 294 | 1.7 |
| 3 | 736 | 288 | 39 | 133 | 315 | 1.5- |
| 2 | 694 | 260 | 37 | 145 | 290 | 1.6 |
| 1 | 686 | 241 | 34 | 121 | 324 | 1.7 |
| 6 | 667 | 201 | 29 | 152 | 314 | 1.3 |
| 7 | 661 | 219 | 33 | 141 | 301 | 1.6 |

LSD_(0.05)¹ ns 150 7 100 ns ns

¹Mean separation within columns according to Fisher's test for least significance. P <= 0.05. TRT = cover crop treatment; Ty = total yield; No1Y = number one yield; No2Y = number two yield; CuY = cull yield; PW = above ground plant weight in pounds after last harvest.

Table 2. Yield of 'Nadia' eggplant in 1 1/9 bushels/A following eight cover crop treatments at the Southwest Michigan Research and Extension Center. Plants were grown on raised, plastic-mulched beds with drip irrigation. Beds were 66" on center, plants were 18" in the row (5280 plants/A). SWMREC 2001.

| TRT | TY | No1Y | No2Y | CuY | PW |
|-----|------|------|------|-----|-----|
| 2 | 1538 | 1266 | 190 | 82 | 3.4 |
| 1 | 1402 | 1048 | 266 | 88 | 3.9 |
| 3 | 1371 | 1000 | 265 | 106 | 3.5 |
| 5 | 1342 | 1056 | 191 | 96 | 3.4 |
| 4 | 1262 | 996 | 184 | 82 | 3.1 |
| 7 | 1183 | 899 | 217 | 67 | 2.8 |
| 8 | 1118 | 858 | 183 | 76 | 3.1 |
| 6 | 1073 | 773 | 198 | 102 | 3.0 |

LSD_(0.05)¹ 340 245 ns ns 0.7

¹Mean separation within columns according to Fisher's test for least significance. P <= 0.05.

TRT = cover crop treatment; TY = total yield; No1Y = number one yield; No2Y = number two yield; CuY = cull yield; PW = above ground plant weight in pounds after last harvest.

Table 3. Yield of 'Tigress' zucchini in 1/2 bushels/A following eight cover crop treatments at the Southwest Michigan Research and Extension Center. Plants were grown on raised, plastic-mulched beds with drip irrigation. Beds were 66" on center, plants were 18" in the row (5280 plants/A). SWMREC 2001.

| TRT | TY | SmY | MedY | Lrg | CuY |
|---|------------|------------|------------|-----------|------------|
| 3 | 1684 | 292 | 308 | 641 | 443 |
| 4 | 1617 | 239 | 373 | 517 | 489 |
| 6 | 1562 | 371 | 341 | 549 | 301 |
| 8 | 1332 | 255 | 245 | 577 | 256 |
| 2 | 1151 | 182 | 150 | 345 | 474 |
| 7 | 1088 | 221 | 239 | 456 | 172 |
| 5 | 1043 | 223 | 251 | 299 | 269 |
| 1 | 872 | 164 | 255 | 347 | 105 |
| <u>LSD_(0.05)¹</u> | <u>632</u> | <u>150</u> | <u>154</u> | <u>ns</u> | <u>168</u> |

¹Mean separation within columns according to Fisher's test for least significance. P <= 0.05.

TRT = cover crop treatment; TY = total yield; SmY = yield small (<+ 6"); MedY = yield medium (6 - 8"); LrgY = yield large (8" +); CuY = cull yield.

Table 4. Yield of 'Mt. Spring' tomato in 25# cartons/A following eight cover crop treatments at the Southwest Michigan Research and Extension Center. Plants were grown on raised, plastic-mulched beds with drip irrigation. Beds were 66" on center, plants were 18" in the row (5280 plants/A). SWMREC 2001.

| TRT | TY | Yno1 | No1FW | Yno2 | YCRT | YCU | PW |
|---|------------|------------|-----------|------------|------------|------------|-----------|
| 1 | 3045 | 1713 | 324 | 629 | 166 | 538 | 6.2 |
| 4 | 2635 | 1516 | 302 | 470 | 299 | 350 | 7.6 |
| 7 | 2594 | 1397 | 317 | 554 | 298 | 345 | 6.7 |
| 5 | 2458 | 1352 | 331 | 467 | 192 | 446 | 7.2 |
| 6 | 2450 | 1312 | 235 | 407 | 227 | 504 | 7.1 |
| 8 | 2437 | 1347 | 322 | 514 | 191 | 384 | 7.2 |
| 2 | 2424 | 1507 | 324 | 355 | 214 | 348 | 6.2 |
| 3 | 2394 | 1463 | 323 | 385 | 189 | 357 | 6.9 |
| <u>LSD_(0.05)¹</u> | <u>519</u> | <u>400</u> | <u>80</u> | <u>179</u> | <u>126</u> | <u>189</u> | <u>ns</u> |

¹Mean separation within columns according to Fisher's test for least significance. P <= 0.05.

TRT = cover crop treatment; TY = total yield; Yno1 = number one yield (2 5/8 " + dia.); No1FW = number one fruit weight in grams; Yno2 = yield number two; YCRT = yield number one small (2 1/8 - 2 5/8" dia.); YCu = yield cull; PW = above ground plant weight in pounds after last harvest.

Table 5. Yield of 'Vivaldi' pepper in 1 1/9 bushels/A following eight cover crop treatments at the Southwest Michigan Research and Extension Center. Plants were grown on raised, drip irrigated, plastic-mulched beds. Beds were 66" on center, plants were in double rows 14" between rows and 18" in the row (10,560 plants/A). SWMREC 2001.

| Trt | TY | No1 Fruit | | | No2 | Cu | Jum | Xlg | Lrg | Med | Pw |
|-----|------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|----|
| | | Y | Fwt | | | | | | | | |
| 2 | 1188 | 903 | 251 | 162 | 123 | 592 | 218 | 63 | 28 | 3.2 | |
| 1 | 1147 | 879 | 244 | 159 | 109 | 568 | 182 | 100 | 28 | 3.3 | |
| 3 | 1118 | 816 | 245 | 193 | 109 | 561 | 160 | 73 | 22 | 3.4 | |
| 4 | 1116 | 838 | 244 | 197 | 81 | 533 | 226 | 47 | 33 | 3.1 | |
| 6 | 1103 | 837 | 250 | 153 | 113 | 529 | 185 | 89 | 34 | 2.9 | |
| 7 | 1103 | 876 | 247 | 130 | 97 | 558 | 201 | 96 | 20 | 3.1 | |
| 8 | 1080 | 824 | 244 | 153 | 103 | 515 | 185 | 96 | 28 | 3.0 | |
| 5 | 1060 | 794 | 252 | 145 | 121 | 549 | 166 | 60 | 20 | 3.3 | |

LSD_(0.05)¹ ns ns ns ns ns ns ns ns ns ns
 ns

¹Mean separation within columns according to Fisher's test for least significance. P <= 0.05. TRT = cover crop treatment; TY = total yield; Y = number one yield; Fwt = average number one fruit weight in grams; No2 = yield number two; Cu = yield cull; Jum = yield of jumbo (240 + grams); Xlg = yield extra-large (200 - 240 grams); Lrg = yield large (170 - 200 grams); Med = yield medium (<170 grams); PW = above ground plant weight in pounds after last harvest.

Table 6. Yield of 'Mt. Spring' tomato in 25# cartons/A following eight cover crop treatments in a commercial production situation. Plants were grown on raised, plastic-mulched beds with drip irrigation. Beds were 60" on center, plants 21" in the row (4978 plants/A).

| TRT | TY | Yno1 | Pno1 | No1FW | Yno2 | YCRT | YCU |
|-----|------|------|------|-------|------|------|-----|
| 2 | 2200 | 709 | 32 | 312 | 564 | 489 | 438 |
| 8 | 2087 | 707 | 35 | 311 | 417 | 757 | 205 |
| 5 | 1998 | 551 | 28 | 312 | 541 | 624 | 281 |
| 4 | 1987 | 683 | 35 | 294 | 503 | 511 | 290 |
| 3 | 1985 | 760 | 38 | 299 | 427 | 429 | 369 |
| 6 | 1894 | 658 | 35 | 315 | 383 | 649 | 205 |
| 7 | 1880 | 566 | 31 | 306 | 471 | 576 | 267 |
| 1 | 1686 | 539 | 32 | 299 | 325 | 492 | 330 |

LSD_(0.05)¹ 410 165 5 ns ns 219 141

¹Mean separation within columns according to Fisher's test for least significance. P <= 0.05. TRT = cover crop treatment; TY = total yield; Yno1 = number one yield (2 5/8 " + dia.); Pno1 = per cent number 1 fruit; No1FW = number one fruit weight in grams; Yno2 = yield number two; YCRT = yield number one small (2 1/8 - 2 5/8" dia.); YCu = yield cull.

Place Figure 1 here....