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Strip Tillage for Sweet Corn Production: Yield and Economic Return

John M. Luna[1] and Mary L. Staben
Department of Horticulture, 4017 Agricultural and Life Sciences Building, Oregon State University, Corvallis, OR 97331

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Abstract. **Two strip tillage systems for sweet corn production were compared to conventional tillage systems in western Oregon. A power take-off rotary tiller configured to till six rows per pass was used in 1997 and 1998; a shank/coulter strip tillage machine was used in 1999 and 2000. A paired *t* test experimental design was used in field-scale, on-farm research with eight replications in 1997–98 and 12 replications in 1999–2000. Sweet corn was harvested using the participating growers' corn pickers and yield was determined. A subset of the participating growers recorded types of machinery and labor for tillage operations and total costs were computed for each tillage system. The rotary strip tillage system produced 900 kg·ha^{-1} greater corn yields ($P = 0.11$) than conventional tillage. The shank/coulter strip tillage system produced yields comparable to conventional tillage ($P = 0.95$). The rotary strip tillage system reduced total tillage costs by an average of $38.50/ha compared to conventional tillage ($P = 0.03$) and reduced machinery operating time by 0.59 h·ha^{-1} ($P = 0.01$). The shank/coulter strip tillage system reduced tillage costs by $36.50/ha compared to conventional tillage ($P = 0.003$) and reduced machinery operating time by 0.47 h·ha^{-1} ($P = 0.001$). Slugs damaged corn in several strip tillage fields requiring the use of slug bait to prevent economic damage. Herbicides used in conventional tillage systems were generally effective in the strip tillage systems. Mechanical cultivation with standard cultivating equipment was more difficult in some of the strip tillage fields with heavy cover crop residue.**

Conservation tillage practices have been widely adopted for agronomic crop production, yet most vegetable growers continue to use intensive tillage for seedbed preparation (Hoyt et al., 1994). Benefits of conservation tillage have been discussed in previous publications, including reduced equipment and labor costs, reduced soil erosion, improvements in soil quality, and in some situations, increased yields (Abdul-Baki and Teasdale, 1993; Blevins et al., 1983; Coolman and Hoyt, 1993; Johnson and Hoyt, 1999).

Strip tillage is a form of conservation tillage that involves cultivation of narrow bands, or strips in the row area, separated by bands of undisturbed soil. Strip tillage has the potential advantages of providing a suitable seedbed for vegetable crop establishment while leaving surface residues in the inter-row area to reduce soil erosion. Equipment for strip tillage has usually consisted of a modified rototiller (rotary strip tiller) (Petersen et al., 1986) or a subsoiling shank and fluted coulter system (shank/coulter system) (Wilhoit et al., 1990).

Yield response of vegetable crops to strip tillage has been variable. In a Pennsylvania study, Grenoble et al. (1989) reported that strip tillage systems reduced snap bean yields compared to the conventional tillage in all three years of the trial. Bottenberg et al. (1999) found that strip tillage also reduced snap bean yields by 20% compared to conventional tillage when planted into rye cover crop mulches in an Illinois study. These authors used a rototiller to prepare the strips and speculated that the tillage depth (10 to 20 cm) was not sufficient to ensure adequate root development. Comparing tillage systems for sweet pepper production in New Hampshire, Loy et al. (1987) reported yield losses from strip tillage. In studies involving cabbage in Virginia (Wilhoit et al., 1990) and tomatoes in Ontario, Canada (McKeown et al., 1988), no differences in yield were observed between strip and conventional tillage systems.

This study reported herein was conducted to develop and evaluate strip tillage systems for sweet corn production in the Willamette Valley of western Oregon. In an earlier Oregon study by Peterson et al. (1986), strip tillage reduced sweet corn yield from 7% to 16%. This experiment involved strip tilling into wheat straw residue and was conducted for 1 year. We conducted a replicated study at the Oregon State Univ. Vegetable Research Farm in 1993 to evaluate a rotary strip tillage system for sweet corn production. The strip tillage system produced comparable sweet corn yields to a conventional plow/disk tillage system (unpublished data).

We decided to continue our work using on-farm research methodology because of soil compaction resulting from commercial scale farm equipment and the wide array of soil types, cropping histories, and tillage systems used by Oregon vegetable growers. On-farm research is advantageous for studies that involve interactions of soil types, crop rotations, and farming equipment (e.g., compaction) and where the constraints of a working farm are needed to evaluate the performance of a system (Lockeretz, 1987). On-farm research is also useful to test new techniques under a range of conditions to encounter potential problems and limitations that might not be seen under experiment station conditions (Rzewnicki et al., 1988). We also wanted to actively involve farmers because of their practical experience with farm machinery. Because farmers are often skeptical about results that come from small plots in traditional experiment station field trials (Francis et al., 1986), we believed the adoption of strip tillage would also be accelerated through the process of collaborative on-farm research.

Materials and Methods

Farm fields were located in the central Willamette Valley of western Oregon and experiments were conducted over a 4-year period, 1997–2000. The experimental design was a paired *t* test, with two tillage treatments, 1) strip tillage and 2) conventional tillage. Each field served as a replicate, with eight total fields in the 1997–98 experiment and 12 total fields in the 1999–2000 experiment. Fields were selected with relatively uniform soil type and vegetative cover for the field, but soil types and cropping histories varied among the fields (Table 1). Plot areas were selected in portions of the field and the tillage treatments randomly assigned. In 1997–98, tillage treatment plot sizes were typically 0.5 to 1 ha; in 1999–2000 plot areas were typically 3 to 6 ha. The term "conventional tillage" will be used in this paper to describe the various forms of tillage used by the cooperating growers to produce a residue-free seedbed. The kinds of machinery and number of passes across the field varied among farms and years. These practices typically consisted of moldboard plowing or ripping, disking, and rotovating or field cultivating. Each cooperating grower, however, used specific combinations of tillage equipment based on soil conditions.

1997–98. A Northwest Farm Tillers® rotovator was used to till six strips ≈20 cm wide × 20 cm deep on 75-cm centers (Fig. 1). The typical "L"-shaped rotovator tines were replaced with curved "saber" tines, and metal shields were mounted within the tub of the rotovator to contain soil within the tilled strip. Row-markers were added to the tiller to facilitate row alignment with subsequent passes of the machine in the field. In 1998, this machine

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[1]Associate Professor; to whom reprint requests should be addressed. E-mail: lunaj@science.oregonstate.edu

Table 1. Predominant soil type, cover, previous crop, and sweet corn variety for fields in 1997–2000 tillage experiments.

Year	Field	Soil series and family	Cover crop	Previous crop	Sweet corn cultivars
1997	C-1	Cloquato silt loam (coarse-silty, mixed, mesic Cumulic Ultic Haploxeroll)	Mondia oat and common vetch	Sweet corn	GH 2684 *se*
1997	B-1	Wapato silty clay loam (fine-silty, mixed, noncalcareous, mesic Fluventic Haplaquol)	Cayuse oat and common vetch	Snap beans	Santiam sh_2
1997	B-2	Clackamas gravelly silt loam (fine-loamy, mixed, mesic Typic Argiaquoll)	Winter killed Cayuse oat and annual ryegrass regrowth	Snap beans	Jubilee *su*
1997	B-3	Nekia silty clay loam (clayey, mixed, mesic Xeric Haplohumult)	Winter killed Cayuse oat and annual ryegrass regrowth	Fine fescue	GH 2684 *se*
1997	A-1	Cloquato silt loam (coarse-silty, mixed, mesic Cumulic Ultic Haploxeroll)	Steptoe barley	Snap beans	Jubilee *su*
1998	F-1	Amity silt loam (fine-silty, mixed, mesic Cumulic Ultic Haploxeroll)	Monida oat	Snap beans	Northern Xtra-Sweet sh_2
1998	D-1	Salem gravelly silt loam (fine-loamy, over sandy or sandy-skeletal, mixed, mesic Pachic Ultic Argixeroll)	Winter wheat	Snap beans	Jubilee *su*
1998	E-1	Cloquato silt loam (coarse-silty, mixed, mesic Cumulic Ultic Haploxeroll)	Volunteer winter wheat	Winter wheat	Jubilee *su*
1999	F-2	Chehalis silt loam (fine-silty, mixed, mesic Cumulic Ultic Haploxeroll)	Winter wheat	Snap beans	Northern Xtra-Sweet sh_2
1999	B-4	Sifton Variant gravelly loam (sandy-skeletal, mixed, mesic Andic Xerumbrept)	Walken oat and common vetch	Snap beans Jubilee sh_2	Supersweet
1999	B-5	Saturn Variant silt loam (fine-loamy, mixed, mesic Andic Xerumbrept)	Perennial ryegrass	Perennial ryegrass	Jubilee *su*
1999	B-6	Chapman loam (fine-loamy, mixed, mesic Cumulic Ultic Haploxeroll)	Walken oat and common vetch	Perennial ryegrass	Jubilee *su*
1999	B-7	Abiqua silty clay loam (fine, mixed, mesic Cumulic Ultic Haploxeroll)	Celia triticale and common vetch	Perennial ryegrass	Jubilee *su*
1999	D-2	Sifton gravelly loam (medial, over sandy or sandy-skeletal, mixed, mesic Umbric Vitrandept)	Winter wheat	Snap beans	Jubilee *su*
2000	G-1	Aloha silt loam (fine-silty, mixed, superactive, mesic Aquic Haploxerept)	Cayuse oat	Broccoli	Jubilee *su*
2000	G-2	Woodburn silt loam (fine-silty, mixed, mesic Aquultic Argixeroll)	Cayuse oat	Table beets	Jubilee *su*
2000	H-1	Concord silt loam (fine, montmorillonitic, mesic Typic Ochraqualf)	Perennial ryegrass	Perennial ryegrass	GH 2684 *se*
2000	H-2	Amity silt loam (fine-silty, mixed, mesic Cumulic Ultic Haploxeroll)	Walken oat, common vetch and Austrian field peas	Snap beans	GH 2684 *se*
2000	F-3	Amity silt loam (fine-silty, mixed, mesic Cumulic Ultic Haploxeroll)	Monida and Cayuse oats	Snap beans	Jubilee *su*
2000	B-8	Clackamas gravelly silt loam (fine-loamy, mixed, mesic Typic Argiaquoll)	Tall fescue	Tall fescue	GH 2684 *se*

was modified to till strips ≈30 cm wide × 30 cm deep because participating growers believed a wider and deeper tilled strip would improve corn growth and development. A smooth cylinder press wheel was also added to the tiller behind each strip to firm and smooth the seedbed.

In 1997 five field trials were established on three farms; four trials were established in 1998 on three farms. All fields contained either winter annual cereal or cereal/legume cover crops. Glyphosate herbicide was used to kill cover crops and existing vegetation in the fields several weeks prior to strip or conventional tillage. Although fertilization, insect, and weed control practices varied among farms over the 4 years of the project, within a single field these production practices were generally the same in the strip tillage and conventional tillage blocks. In a few fields, however, weed problems occurred in the untilled middle areas in the strip tillage blocks that required mechanical cultivation. Sweet corn was planted using the growers' six-row planting equipment and standard commercial pickers were used for harvest.

1999–2000. In 1999, the group of growers participating in this project decided to build a new strip tillage machine using a shank/coulter system to replace the PTO-driven strip rotovator. In this system, a front disk coulter with a depth wheel cuts through crop residue and vegetation, followed by a subsoiling shank

Fig. 1. A rotary strip tillage machine used in the 1997 and 1998 experiments configured to till six rows 20 cm wide on 75-cm centers.

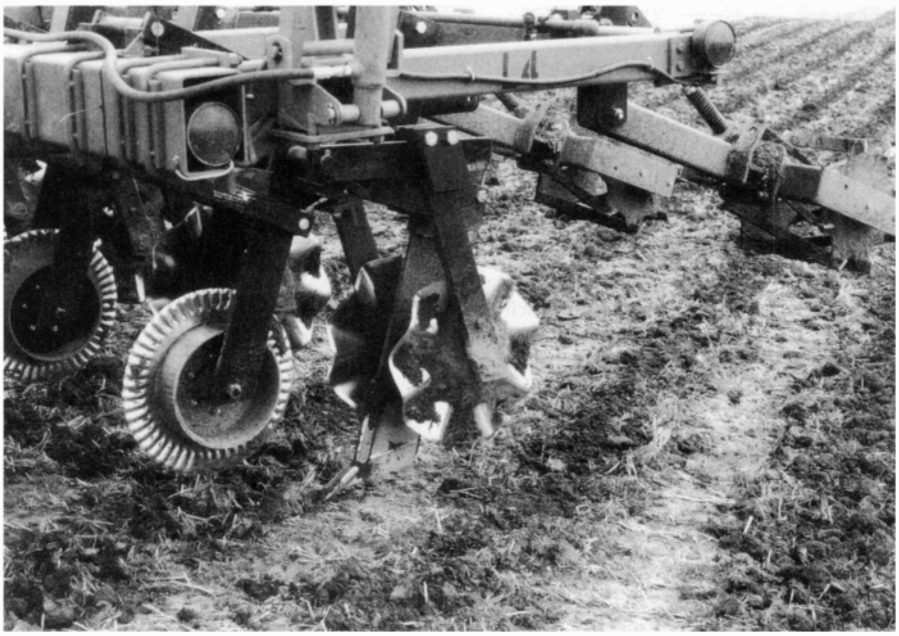

Fig. 2. A shank/coulter strip tillage machine used in the 1999 and 2000 experiments.

that operates to a depth of ≈35 cm. A double set of fluted coulters mixes and chops the soil, and a clod-crushing basket follows (Fig. 2). This machine was developed in an effort to increase the speed of the strip tillage operation. The rotary strip tillage machine used in 1997–98 was operated at ≈2.9 km·h^{-1}, where the new shank/coulter strip tillage machine could be operated up to 9.6 km·h^{-1}. A "Ripper-Stripper" strip tillage machine (Unverferth Mfg. Co., Kalida, Ohio) with a similar shank/coulter design was also used in some of the 1999–2000 trials. Six tillage trials were established each year in 1999 and 2000. All growers except one (Field F-3) made a second pass with the shank/coulter strip tillage machine in 2000 to improve seedbed conditions. The cooperating growers used their equipment to plant, manage, and harvest the crop.

Corn stand establishment. Corn stand establishment was estimated in all tillage blocks in 1999 and 2000 by counting the number of corn plants in a 2-m length of row at 20 randomly selected locations in the field. This sampling occurred ≈3–4 weeks after planting when plants were typically 8 to 12 cm tall. Corn stand establishment data were not taken in the 1997–98 trials.

Corn yield, grade, and crop value. Sweet corn was hauled to the processing facility where truck weights and crop grades and percent usable ears were determined for each load. Sweet corn grade, or maturity, is based on the percent kernel moisture and was calculated by taking two 20-kg samples of corn per truckload. Grades (maturity) of the sweet corn are based on a scale of one to five, where one is highest value as the corn is less mature and five is lowest value as the corn is more mature. Prices paid to growers for "Jubilee" corn in 2000 were used to calculate crop values for all 4 years. A measuring wheel was used to measure plot length and width in 1997 and 1998. In 1999 and 2000 a global positioning system (GPS) receiver (CMT, Corvallis, Ore.) and geographic information system (GIS) software were used to determine the area of each plot for yield calculation. Crop value was calculated from yield and price paid for each grade.

Tillage costs. To estimate tillage costs, data on machinery use and labor were collected from several of the cooperating growers who had interest in this aspect of the project. Growers recorded information after each tillage operation. Horsepower rating and wheel drive of each tractor, implement type and width, number of passes and operation speed were recorded. Labor rates for the equipment operators were standardized across farms at $14/h based on average labor rates paid in the Willamette Valley. Smathers and Willet (1997) provided estimates of machinery operating costs. Tractor and implement operation cost per hour were based on annual tractor use of 700 h and annual implement use of 200 h, which were from a survey of the growers involved in the project. Operating costs were combined with tractor speed, equipment efficiency ratings (Rotz and Bowers, 1991), and labor costs to produce a cost per hectare for each combination of tillage passes. For our calculations, we used a constant price of $0.22/L for the price of off-the-road diesel purchased in bulk. The cost of diesel in the Willamette Valley in Oct. 1999 was $0.20/L, but by Aug. 2000 it was $0.32/L.

Data analysis. Data were combined across both years of the rotary strip tillage treatments and both years of the shank/coulter strip tillage treatments. A paired *t* test was used to compare yield, grade, stand counts, and costs from tillage treatments.

Results

Corn stand establishment. Tillage treatments had no effects on the average density of corn plants in the 1999–2000 trials ($P = 0.76$) (Table 2).

Yield and crop value. The rotary strip tillage system increased sweet corn yields by 900 kg·ha^{-1} over the conventional tillage system 1997 and 1998 trials ($P = 0.11$) (Table 3). There was no tillage effect on crop grade ($P = 0.90$). Average crop value was increased by $95.00/ha ($P = 0.11$) (Table 3). The shank/coulter strip tillage system produced the same average yields as the conventional tillage system in 1999 and 2000 ($P = 0.95$) (Table 4). Neither crop grades ($P = 0.95$) nor crop values ($P = 0.93$) were significantly different between tillage treatments (Table 4).

Table 2. Impact of tillage treatment on sweet corn stand establishment, 1999 and 2000.

Year	Field	Corn plants (plants 10 m^2) Strip till	Conv till
1999	B-4	59.3	57.6
	B-5	59.0	52.3
	B-6	48.7	54.0
	B-7	59.3	57.6
	D-2	67.2	61.5
	F-2	68.9	67.6
2000	B-8	66.6	63.3
	F-3	67.2	52.7
	G-1	61.3	62.9
	G-2	55.3	63.3
	H-1	54.6	61.6
	H-2	58.0	61.6
Mean		60.5	59.7
P value of *t* test		0.76	

Table 3. Comparison of rotary strip tillage and conventional tillage systems on sweet corn yield, crop grade, and value, 1997 and 1998.

Field	Year	Graded yield ($Mt{\cdot}ha^{-1}$) Strip till	Conv till	Crop grade[z] Strip till	Conv till	Crop value ($/ha) Strip till	Conv till
A-1	1997	19.3	17.9	3.0	1.0	1937	1972
B-1	1997	16.4	15.9	2.0	3.0	1735	1678
B-2	1997	19.6	18.2	2.5	3.0	2021	1819
B-3	1997	20.0	18.3	2.5	2.9	2056	1846
C-1	1997	17.4	19.6	2.5	3.0	1792	1960
D-1	1998	19.8	17.6	3.5	4.5	1925	1638
E-1	1998	22.6	21.6	5.0	4.0	2073	1982
F-1	1998	25.6	24.6	[y]---	---	2817	2708
Mean		20.1	19.2	3.0	3.1	2045	1950
P value of *t* test		0.11		0.90		0.11	

[z]Crop grade values: #1 $110.20 Mt; #2 $105.70 Mt; #3 $100.19 Mt; #4 $94.17 Mt; #5 $91.67 Mt.
[y]Sweet corn was contracted to other processing companies who paid on yield basis only.

Tillage costs. The rotary strip tillage system reduced total tillage costs by an average of $38.50/ha compared to conventional tillage ($P = 0.03$) and reduced machinery operating time by 0.59 $h{\cdot}ha^{-1}$ ($P = 0.01$) (Table 5). The shank/coulter strip tillage system reduced tillage costs by an average of $36.50/ha compared to conventional tillage ($P = 0.003$) and reduced machinery operating time by an average of 0.47 $h{\cdot}ha^{-1}$ ($P = 0.001$) (Table 6).

Discussion

The strip tillage systems evaluated here clearly have the potential to produce sweet corn yields equal to or greater than yields from conventional tillage systems with a significant savings of tractor and equipment operating expenses and labor. However, not all fields will respond favorably to strip tillage because of soil type, previous soil compaction, cropping history, or surface residue. Most of the fields involved in these tillage system comparisons were planted following a winter annual cover crop, usually a cereal grain or a cereal/legume mixture. Spring management of this cover crop appears to be an important aspect of the strip tillage system. Because cover crops can keep the soil wetter in the spring than soil without cover crops (thereby delaying tillage operations), many farmers kill the cover crop with glyphosate early in the spring (February to March). Because of the relatively low cover crop biomass at this time, there is little cover crop residue left on the soil surface by the time the field is planted in late May or June. Weed growth during this time period usually requires a second application of glyphosate prior to planting. Conversely, if the cover crop is killed too late, an excessive quantity of cover crop biomass makes tillage equipment difficult to use. And, if the cover crop is relatively mature with a high C:N ratio, there is potential for nitrogen immobilization in the soil when it is incorporated.

The shank/coulter strip tillage system used in 1999 and 2000 generally produced a rougher, less uniform seedbed than the rotary strip tillage system. This was particularly noticeable in 2000 in two fields where perennial ryegrass grown for seed was the previous crop for 4 years. Grass in these fields was sprayed with glyphosate in the spring prior to tillage; however, intact grass crowns created somewhat rough seedbed conditions in the strip tillage blocks. This may have resulted in poorer seed-to-soil contact, possible corn root "air pruning" from encountering air pockets in the soil, nonuniform water movement within the soil profile, and inadequate access to nutrients from applied fertilizers. In an Ontario, Canada, study of strip tillage corn, Vyn and Raimbault (1992) found that strip tillage treatments had a lower percentage of soil aggregates smaller than 5 mm compared to conventional tillage. They cited earlier work (Vyn et al., 1982) that correlated corn yields with proportion of fine aggregates.

The need for improved seedbed quality in the strip tillage systems was apparent to the cooperating growers in 2000 who decided to make a second pass over the field with the shank/coulter machine. Although the second pass made some improvement in seedbed quality, we believe a second pass with a strip rototiller or other specialized tool would produce a seedbed with smaller, more uniform aggregates. A light-duty strip rototiller commonly used for between-row weed cultivation could be operated using a smaller tractor, reducing the overall cost of the operation. Three farmers using the strip tillage system used this type of light-duty rototiller for second-pass operations in 2001 to improve seedbed quality.

Adding a second pass for the strip tillage system clearly increases the tillage cost. For example, in 1999 and 2000, single-pass operations (Fields D-2, F-2, and F-3, Table 6) averaged $25.52/ha in tillage costs. Fields that received two passes with the shank/coulter machine (Fields G-1 and H-1) averaged $50.13/ha in tillage costs. Interestingly in this study, the results that cooperating farmers were having with strip tillage during the 1997 and 1998 trials influenced the number of tillage operations used in the conventional tillage blocks in 1999 and 2000. For example, in 1997–98, conventional tillage averaged $90.11/ha (Table 5), whereas in 1999–2000, conventional tillage costs averaged only $71.86/ha (Table 6). As one farmer said at a group discussion meeting, "We've learned a lot about conventional tillage by doing strip tillage."

We have not found any increase or decrease in insect pest damage associated with strip tillage in the 20 paired tillage system comparisons reported in this study (data not reported). However, in two paired trials in 2001 (data not reported), outbreaks of the garden symphylan (*Scutigerella immaculata*) damaged sweet corn in the strip tillage blocks. Winter and Spring 2001 were exceptionally dry, which may have allowed greater symphylan survival and population growth. Also, tillage has historically been used as a cultural method to suppress symphylan populations (Umble et al., 2001).

Table 4. Comparison of shank/coulter strip tillage and conventional tillage systems on sweet corn yield, crop grade and value, 1999 and 2000.

Field	Year	Graded yield ($Mt{\cdot}ha^{-1}$) Strip till	Conv till	Crop grade[z] Strip till	Conv till	Crop value ($/ha) Strip till	Conv till
B-4	1999	17.9	15.0	2.9	2.4	1811	1554
B-5	1999	21.1	22.1	2.6	2.6	2155	2268
B-6	1999	18.6	19.4	3.0	3.2	1861	1922
B-7	1999	18.4	14.7	3.0	2.8	1846	1483
D-2	1999	17.7	17.3	2.7	2.8	1806	1759
F-2	1999	21.2	23.0	---[y]	---	2333	2535
B-8	2000	17.8	17.7	2.6	2.3	1819	1838
F-3	2000	17.3	21.9	2.2	3.6	1816	2110
G-1	2000	21.0	21.4	3.2	3.4	2076	2100
G-2	2000	18.7	14.7	3.5	1.3	1831	1601
H-1	2000	16.0	17.1	1.0	2.0	1767	1806
H-2	2000	17.7	18.6	---	---	1572	1658
Mean		18.6	18.6	2.7	2.6	1891	1886
P value of *t* test:		0.95		0.95		0.93	

[z]Crop grade values: #1 $110.20 Mt; #2 $105.70 Mt; #3 $100.19 Mt; #4 $94.17 Mt; #5 $91.67 Mt.
[y]Sweet corn was contracted to other processing companies who paid on yield basis only.

Table 5. Comparison of tillage costs and machinery operating time for rotary strip tillage and conventional tillage practices in 1997 and 1998.

		Tillage costs[z] ($ ha)		Machinery operating time[y] (h·ha⁻¹)	
Field	Year	Strip till	Conv till	Strip till	Conv till
A-1	1997	99.07	101.07	1.21	1.34
B-2	1997	45.21	111.87	0.60	1.41
C-1	1997	37.68	100.97	0.50	1.41
D-1	1998	47.05	115.41	0.62	1.59
E-1	1998	40.74	55.84	0.52	1.03
F-1	1998	39.95	55.51	0.53	0.73
Mean		51.62	90.11	0.66	1.25
P value of *t* test		0.03		0.01	

[z]Based on machinery operating costs from Smathers and Willett (1997).
[y]Based on machinery operation data acquired from the cooperating growers.

Table 6. Comparison of tillage costs and machinery operating time for shank/coulter strip tillage and conventional tillage practices in 1999 and 2000.

		Tillage costs[z] ($ ha)		Machinery operating time[y] (h·ha⁻¹)	
Field	Year	Strip till	Conv till	Strip till	Conv till
D-2	1999	24.19	66.25	0.36	0.85
F-2	1999	25.60	44.05	0.40	0.72
F-3	2000	26.78	53.89	0.53	0.88
G-1	2000	41.53	90.51	0.58	1.13
H-1	2000	58.74	104.59	1.03	1.65
Mean		35.37	71.86	0.58	1.05
P value of *t* test		0.003		0.001	

[z]Based on machinery operating costs from Smathers and Willett (1997).
[y]Based on machinery operation data acquired from the cooperating growers.

Slugs damaged corn seedlings in several strip tillage fields requiring the use of slug bait to prevent economic damage. Herbicides used in conventional tillage systems have generally been effective in the strip tillage systems. Depending on specific weed situations, some changes in herbicide materials and application timing may be required for effective weed control. A second application of glyphosate just prior to planting may be essential for controlling vegetation in the untilled strips, but this increased herbicide use will offset potential savings in tillage costs. Mechanical cultivation with standard cultivating equipment was more difficult in some of the strip tillage fields with heavy cover crop residue.

Although this study focused on using strip tillage for sweet corn production, Oregon growers have successfully used this system for squash and transplanted broccoli. In 2001, eight vegetable growers purchased or manufactured strip tillage machines and planted more than 1200 ha of vegetable crops using strip tillage. The rapid adoption of strip-tillage systems in western Oregon has demonstrated the potential for vegetable production. However continued research is needed on the impact of strip tillage on soil moisture, irrigation requirements, and symphylan populations.

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