2005 Precision Cultivation Evaluations

University of California Cooperative Extension, Monterey County
Richard Smith, Farm Advisor and Tiffany Bensen, Research Assistant

Summary: Close cultivation requires great precision. The EcoDan® guidance system provides technology and an opportunity to cultivate closer than traditionally practiced in the Salinas Valley. One advantage of this practice would be to improve weed control. It stands to reason that by cultivating closer more weeds can be mechanically removed which could reduce subsequent hand weeding costs. The disadvantage is that more damage may be caused to the stand of the crop being cultivated by the cultivation knives. These studies examined cultivating lettuce and broccoli at cultivation widths as low as 2 inches wide. Trials one and two were conducted on Romaine lettuce and in these trials two inch cultivation strips reduced weeds by >50% over the standard four inch wide cultivation strip and reduced hand weeding time by 9.8 and 26.7%, respectively. No reduction in the stand of lettuce was observed in either trial and in trial 2 no difference in commercial yield was observed between close and standard cultivation. Trial 3 was conducted on broccoli. The field was particularly cloddy and it was determined that moving the cultivation knives close to 2 inches would be too damaging to the crop, so cultivation strips of 3, 4 and 5 (grower standard) inches were examined. The 3 and 4 inch wide cultivation widths reduced weeds by 44.1 and 35.3%, respectively. Both of these closer cultivation treatments significantly reduced weeding time. The stand and yield were not reduced in any of the cultivation treatments. These data indicate that a precision guidance system such as the EcoDan® can accurately guide the cultivation rig and achieve a reduction in weeds and provide safety of the stand and yield of lettuce and broccoli.

Methods: Three trials were conducted utilizing the EcoDan® guidance system connected to a cultivation rig. ***Trial No. 1:*** The trial was conducted in cooperation with Israel Morales at American Farms in Chualar. The trial was conducted on Romaine lettuce grown on 6 seedline, 80 inch wide beds. A one-bed cultivation rig was used and two sets of cultivation knives were set to cultivate two seed lines at three widths: 2, 3 and 4 inches. The cultivator cultivated two beds the length of the field in this configuration and all evaluations were conducted of the cultivated strips on these two beds. Weed counts were made prior to cultivation of the 6 inch wide band marked by the planter press wheel. After cultivation, weed counts were made of the live weeds surviving in the uncultivated strip. Evaluations of hours per acre were made by hand hoeing the uncultivated strip to remove all weeds and timing how long it took to weed the strips. Each evaluation was of a 100 foot strip in the field and replicated four times down the row. Stand counts were made one month later. ***Trial No. 2:*** The trial was conducted with Israel Morales at American Farms in Chualar. The trial was conducted on Romaine lettuce grown on 5 seedline, 80 inch wide beds. A three-bed cultivation rig was used and all sets of cultivation knives were set to cultivate a two inch wide cultivation width. The cultivator cultivated three beds the length of the field at this configuration. All evaluations were conducted of the three beds cultivated at two inches and with three beds immediately adjacent cultivated at the normal 4 inch wide cultivation. Weed counts, hours per acre to

weed evaluations and stand counts were made as described above. Harvest evaluation was made by a commercial crew that conducted both bulk and box harvests in the test area and compared the yield with the rest of the field. ***Trial No. 3:*** The trial was conducted with John Bramer of Merrill Farms on the Airport Ranch south of Salinas. The trial was conducted on broccoli grown on 4 seedline, 80 inch wide beds. A three bed cultivation rig was used and two sets of cultivation knives were set to cultivate two seed lines at three widths: 3, 4 and 5 inches. The five inch cultivation treatment was the grower practice in this field and the field was too cloddy to go to narrower cultivation widths. Weed counts were made prior to cultivation of the 6 inch wide band marked by the planter press wheel. After cultivation, weed counts were made of the live weeds surviving in the uncultivated strip. Evaluations of hours per acre were made by hand hoeing the uncultivated strip to remove all weeds and timing how long it took to weed the strips. Stand counts were made one month later. Yield evaluations were made on November 4 by counting all harvestable heads in five 50 foot long strips in each cultivation strip. Ten marketable heads were harvested at random from each strip and weighed to estimate harvestable weight of heads.

Results: ***Trial No. 1:*** Cultivation at 2 and 3 inches reduced the number of weeds in the uncultivated strip by 68.6 and 51.6% respectively as compared with the 4 inch cultivation which reduced weeds by 30.6% (Table 1). Hours per acre were significantly reduced in the 2 inch cultivation strip relative to the 4 inch cultivation and there was no reduction in the stand. ***Trial No. 2:*** Weed pressure was spotty in this trial however, in spite of this issue, the two inch cultivation treatment reduced weeds by 56.8% vs the four inch cultivation treatment which reduced weeds by 25.0% (Tables 2 and 3). There was no reduction in the stand and no difference in a large-scale commercial harvest. ***Trial No. 3:*** Weed control in the 3 inch and 4 inch cultivation treatments reduced weeds by 59.7 and 51.6, respectively vs the 5 inch cultivation treatment which reduced weeds by 26.8% (Table 4). Weeding time was reduced in both the 3 and 4 inch cultivation treatments. Stand count was not reduced by any of the cultivation treatments and the yields of all treatments were equivalent.

Acknowledgements
Niels Andrews, Local Positioning Systems, Salinas
Israel Morales, American Farms, Chualar
John Bramer, Merrill Farms, Salinas

Table 1. Trial No. 1: Pre and post cultivation weed counts, hours to weed and stand.

Cultivation Band Width	Pre Cultivation Weeds/6" band (100 foot strip – 50 ft^2) June 7		Post Cultivation Weeds/cultivated band[1] June 7		Weed Control Percent June 7	Hours/A to weed June 7	Stand Count 100 ft of seedline July 7
	Shepherds Purse	Total Weeds	Shepherds Purse	Total Weeds			
2 inches	9.2	10.5	3.3	3.3	68.6	24.8	107.5
3 inches	8.3	9.5	4.2	4.6	51.6	26.1	106.3
4 inches	9.9	11.1	6.7	7.7	30.6	27.5	104.3
LSD (0.05)	NS	NS	3.2 @ 10%	4.1	19.7	2.0	NS

1: 2 inch band = 16.6 ft^2; 3 inch band = 25.0 ft^2; and 4 inch band = 33.3 ft^2.

Table 2. Trial No. 2. Pre and post cultivation weed counts on July 28.

Cultivation Band Width	Pre Cultivation Weeds/6" band(100 foot strip – 50 ft^2)				Post Cultivation Weeds/cultivated band[1]			
	Shepherds Purse	Sow Thistle	Other Weeds	Total Weeds	Shepherds Purse	Sow Thistle	Other Weeds	Total Weeds
2 inches	23.3	19.8	11.6	54.7	8.8	10.1	6.8	25.7
4 inches	39.2	42.4	4.0	85.7	18.1	38.3	4.3	60.8
LSD (0.05)	NS	13.8	5.3	NS	NS	13.6	NS	6.1

1: 2 inch band = 16.6 ft^2 and 4 inch band = 33.3 ft^2.

Table 3. Trial No. 2. Weed control, hours to weed, stand count and commercial yield.

Cultivation Band Width	Weed Control Percent July 28	Hours/A to weed July 28	Stand Count/100 ft Seedline* Sept. 6	Bulk Harvest Lbs/A Sept. 14	Carton Harvest Boxes/A Sept. 14
2 inches	56.8	22.2	118.2	37,256	2,178
4 inches	25.0	30.3	117.2	38,569	2,178
LSD (0.05)	18.7	3.5	NS		

* Percent Sclerotinia Infection: <2% for both treatments (NS).

Table 4. Trial No. 3. Pre and post cultivation weed counts, hours to weed, stand count and yield per 50 feet of one seedline.

Cultivation Band Width	Shepherds Purse		Weed Control (Percent)	Weeding Time (Hours/A)	Stand Count 50 ft of one seedline	Crown Quality Heads[2] (Number)	Harvestable Heads (Number)	Mean Head Weight (lbs)
	Pre Cultivation/5" band (50 foot strip – 21 ft^2)	Post Cultivation/ Cultivated Band[1]						
	August 24	August 24	Aug. 24	Aug. 24	Sept 26	Nov 4	Nov 4	Nov 4
3 inches	84.9	36.5	59.7	7.8	97.1	12.8	71.0	0.48
4 inches	82.5	42.3	51.6	8.4	97.3	13.0	68.2	0.47
5 inches	87.1	65.4	26.8	12.0	94.8	13.4	71.2	0.48
LSD (0.05)	*NS*	*12.8*	*18.7*	*2.2*	*NS*	*NS*	*NS*	*NS*

1: 3 inch band = 12.5 ft^2; 4 inch band = 16.6 ft^2; and 5 inch band = 20.8 ft^2

2: Export quality crowns (1^{st} pick)