


# Winning the Battle Against Weeds: an Integrated Approach to Sustainable Weed Control



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An aerial photograph of the UK Horticulture Research Farm. The farm is situated between a residential area on the left and a road on the right. It features several large, rectangular agricultural plots, some of which are outlined in blue. A central area contains several buildings and structures. The text "UK Horticulture Research Farm" is overlaid in the upper left, and "Organic Farming Unit" is overlaid in the center, pointing to a specific area within the farm.

UK Horticulture  
Research Farm

Organic  
Farming Unit

# UK Organic Farming Unit

- Started in 2003 with  $\frac{1}{4}$  acre
- Currently 30 acres
- Maury silt loam soil
- Research – applied and basic science on 3-5 acres, High Tunnel Research Facility
- Extension – e.g. GAP/FSMA training, CSA Bootcamp
- Education – apprenticeship
- Highly diversified
- Small to medium scale
- Intense weed pressure



## SAG 397: Apprenticeship in Sustainable Agriculture

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- 200 hours of farm work
- Weekly classes
- 2007: 4 Apprentices and 42 Shareholders
- 2017: 12 Apprentices and 225 Shareholders; two farm stands
- ~12 acres in production in 2017



## Join UK's Organic Vegetable CSA!



UNIVERSITY OF KENTUCKY  
**SUSTAINABLE  
AGRICULTURE**

Members will receive local USDA-certified organic produce from the University of Kentucky's **COMMUNITY SUPPORTED AGRICULTURE (CSA)** project, now entering its 9th season.

- Membership is open to UK faculty, staff, and students
- All produce is grown by sustainable agriculture students at the UK Horticulture Research Farm
- Over 200 varieties of vegetables, fruit, & herbs are given to members over 22 weeks
- Pick-up is on campus or at the farm every Thursday
- Online registration (see website below)
- Installment payment plans are available
- Credit card or check accepted

### FOR MORE INFORMATION

To register and learn more, go to our website: <http://sustainableag.ca.uky.edu/csa>

Visit our blog for pictures, stories, recipes, and more: <http://ukcsa.wordpress.com/>

Have any other questions? Contact us at: [uk.csa@uky.edu](mailto:uk.csa@uky.edu)



### WHAT OUR MEMBERS SAY:



- I love it so much! It has changed the way I eat and the way I think about the food! ... It has made me passionate about sustainable farming methods, quality food, real tomatoes, community, everything. I seriously can't say enough good things. The CSA here has changed my life!! Thank you!!!
- This was an awesome experience for our family! Thank you from myself, my stomach, my husband and my kids. You are making a difference by providing healthy foods to our community!

- We're healthier because of you
- The quality of the veggies is tremendously good
- I especially like that the students are involved in the process and gaining a real understanding of their possible future professions
- We truly enjoyed the potluck and the you-pick option. Thanks a lot! Looking forward to participating again next year!



# Wholesale Production – approx. 1-2 acres



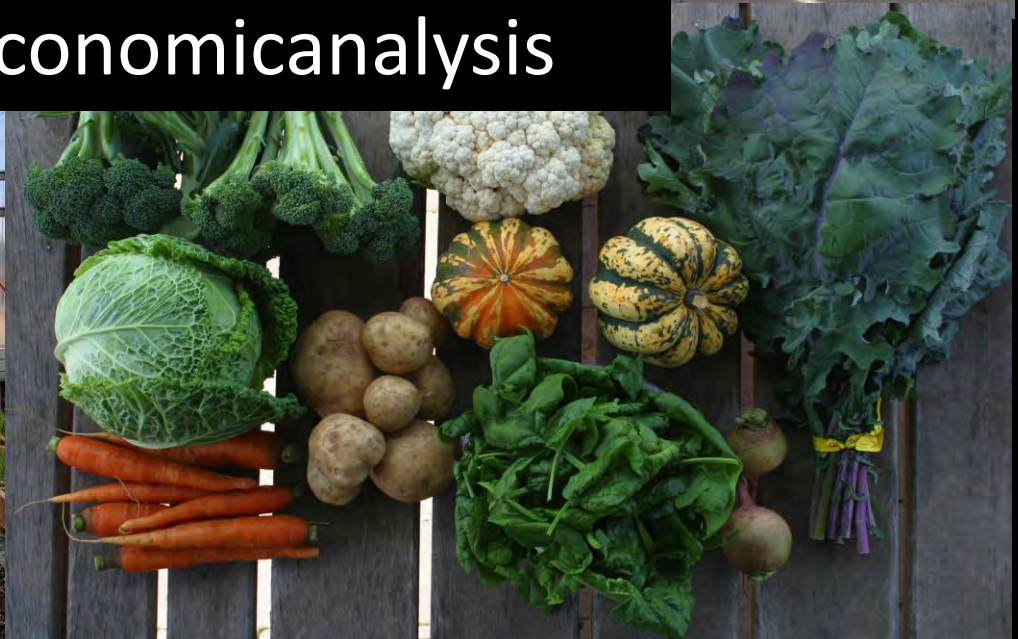




1. <https://ukcsa.wordpress.com>

2.

<http://www.uky.edu/ccd/tools/budgets/ukcsaeconomicanalysis>

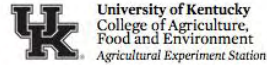




# University of Kentucky Center for Crop Diversification

<http://www.uky.edu/ccd/tools/budgets/ukcsaeconomicanalysis>

SR-111



## Economic Analysis of the University of Kentucky Community Supported Agriculture Organic Vegetable Production System

*Tiffany Thompson and Mark Williams, Department of Horticulture; Tim Woods and Carl Dillon, Department of Agricultural Economics; Ric Bessin, Department of Entomology*

July 2017



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**TABLE 2: Start-Up Costs**

**MACHINERY**

	<b>Purchase Year if Known</b>	<b>Purchase Price</b>	<b>Comparable New List Price</b>
<b>Tractors</b>			
95-HP Kubota M9540	2011	\$43,707	\$55,000
50-HP Kubota L5030	2004	\$20,850	\$26,609
17-HP Kubota B1700	1999	\$10,992	\$9,971
Zero-turn mower	2015	\$5,000	\$8,699
<i>Subtotal</i>		<b>\$80,549</b>	<b>\$100,279</b>
	<b>Purchase Year if Known</b>	<b>Purchase Price</b>	<b>Comparable New List Price</b>
<b>Implements by Category</b>			
<b>Soil Management</b>			
H & S manure spreader model 125	2005	\$4,975	\$8,699
Tye Pasture Pleaser no-till grain drill	2007	\$3,000	\$8,500
Edwards 8' flail mower	2010	\$5,000	\$10,000
12' tandem disc harrow	2000	\$1,800	\$4,000
Maschio 7.75' B-230 rototiller with rear-basket depth control	2013	\$9,735	\$10,000
Imants 5.9' 27-series spader	2008	\$19,139	\$25,000
Monroe Tufline 2-shank subsoiler	2015	\$1,915	\$1,915
Custom 8' field cultivator	2000	\$1,000	\$1,200
<b>Plasticulture Production System</b>			
Rain-Flo model 2600 plastic mulch layer	2008	\$6,545	\$6,600
Rain-Flo model 1600 water wheel transplanter & 9 planter wheels	2005	\$3,420	\$3,500
IH Farmall 140 with straight-tooth cultivators, small hilling discs, and Danish S-tines	1974	\$4,500	\$4,500
Rain-Flo Challenger model 1800 mulch lifter	2005	\$1,950	\$2,000
BCS + flailmower	2011	\$6,858	\$6,900



	Purchase Price	Quantity	Total Cost	Useful Economic Life (yrs) <sup>1</sup>
<b>FIELD HAND TOOLS</b>				
T-Post driver	\$31	3	\$93	15
T-Post puller	\$90	2	\$180	15
Digging forks	\$83	4	\$332	15
Loppers	\$50	2	\$100	15
Soil-knives	\$22	6	\$132	15
Hand-weeders (A.M Leonard Horticultural Tool and Supply Company, Piqua, OH)	\$29	6	\$174	15
Wheel-hoes	\$400	2	\$800	15
Scuffle-hoes	\$55	10	\$550	15
Grub-hoes	\$50	2	\$100	15
Shovels	\$36	6	\$216	15
Specialty hoes	\$40	4	\$160	15
Spyker model P20-9010 broadcast spreader	\$219	1	\$219	15
Andersons SSD drop-spreader	\$250	1	\$250	15

<b>TOTAL FIELD HAND TOOLS</b>			<b>\$3,306</b>	
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	Purchase Price	Quantity	Total Cost	Useful Economic Life (yrs) <sup>1</sup>
<b>DELIVERY SUPPLIES</b>				
2 12' x 12' Swift Instant Shelter Pop-Up EZ-Up Tents	\$103	2	\$206	3
6 folding tables	\$40	6	\$240	3
Signs and sign clips	\$3	30	\$90	3

<b>TOTAL DELIVERY SUPPLIES</b>			<b>\$536</b>	
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<b>TOTAL PURCHASE PRICE</b>	<b>\$326,056</b>
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<b>TOTAL COMPARABLE NEW LIST PRICE</b>	<b>\$465,910</b>
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**TABLE 5: Crop Production Costs Required for 225 CSA Members**

<b>Crop</b>	<b>Pounds per Member</b>	<b>Pounds per 225 Members</b>	<b>Average Yield (lbs / row foot)</b>	<b>Acres Grown</b>	<b>Crop Production Costs</b>
Beans, Green	9	2,025	0.4	0.2	\$2,499
Beets	14	3,150	1.2	0.1	\$1,280
Broccoli	16	3,600	0.6	0.3	\$2,881
Brussels Sprouts	4	900	0.5	0.1	\$1,240
Cabbage	14	3,150	1.5	0.1	\$1,108
Carrots	15	3,375	0.7	0.3	\$3,086
Cauliflower	5	1,125	0.6	0.1	\$1,013
Chard, Swiss	4	900	1.1	0.0	\$616
Corn, Sweet	18	4,050	0.5	0.4	\$2,547
Cucumbers	14	3,150	2.1	0.1	\$2,434
Eggplant	8	1,800	2.0	0.1	\$1,406
Garlic	4	900	0.2	0.3	\$4,490
Greens, Kale/Collards	10	2,250	0.8	0.1	\$2,718
Greens, Salad	14	3,150	0.4	0.4	\$5,568
Herbs, Summer Annual	5	1,125	0.7	0.1	\$794
Kohlrabi	10	2,250	0.9	0.1	\$1,401
Leeks	3	675	0.3	0.1	\$2,043
Lettuce, Head	12	2,700	1.3	0.1	\$1,103
Muskmelon (Cantaloupe)	16	3,600	2.4	0.2	\$3,111
Onions, Bulb	18	4,050	1.0	0.2	\$2,900
Peppers	18	4,050	2.0	0.2	\$3,276
Potatoes	18	4,050	0.8	0.3	\$5,489
Potatoes, Sweet	12	2,700	3.2	0.1	\$1,340
Roots, Radish/Turnip	10	2,250	0.7	0.2	\$1,507
Scallions	4	900	0.4	0.1	\$2,234
Squash, Summer	25	5,625	4.0	0.2	\$4,277
Squash, Winter	35	7,875	3.1	0.4	\$5,354
Tomatoes	35	7,875	6.5	0.2	\$5,232
Watermelon	20	4,500	6.5	0.1	\$867
You-Pick	10	2,250	2.5	0.1	\$1,139
<b>TOTAL</b>	<b>400</b>	<b>90,000</b>		<b>5.5</b>	<b>\$74,952</b>



**TABLE 8: Whole Farm Budget for 225 CSA Members**

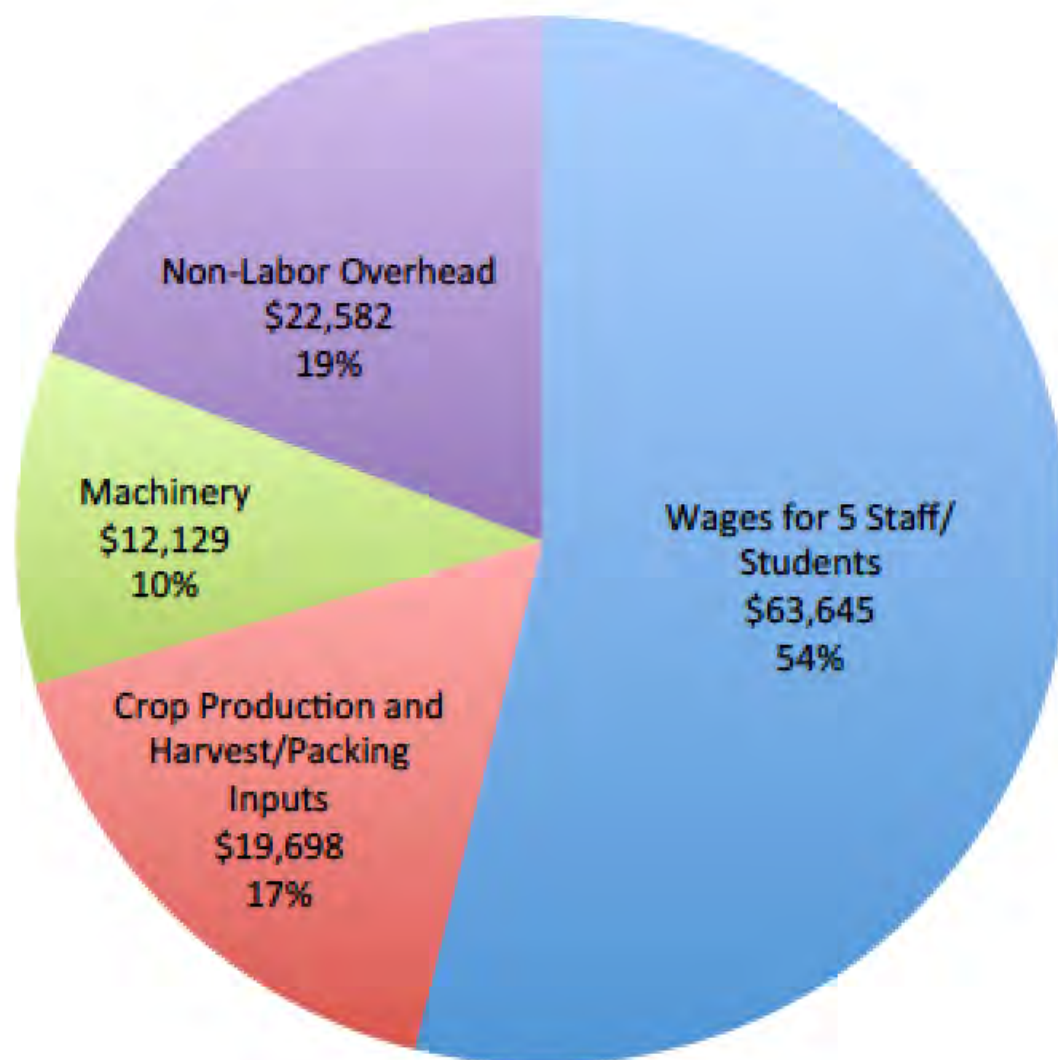
Cultivated Acres	5.5	
CSA Shares Sold	225	
<b>REVENUE</b>		
CSA Income @ \$649 / Share	\$146,025	
80 25-lb Tomato Boxes Sold at \$25 / Box	\$2,000	
<b>Total Revenue</b>	<b>\$148,025</b>	
<i>Total Revenue / Acre</i>	<i>\$26,768</i>	
<b>EXPENSES</b>	<b>Total Cost</b>	<b>% of Total</b>
Wages for 5 Staff/Students (4824 hrs. @ \$13.19 / hr.)		
Crop production	\$34,024	28.8%
Overhead (CSA delivery and other non-crop tasks)	\$29,620	25.1%
<i>Subtotal</i>	<i>\$63,645</i>	<i>53.9%</i>
Crop Production and Harvest/Packing Inputs		
Direct-seeded and transplant seed	\$4,385	3.7%
Transplant production costs	\$2,183	1.8%
Compost	\$1,935	1.6%
Fertilizer	\$2,965	2.5%
Plastic mulch	\$492	0.4%
Drip tape	\$1,443	1.2%
Cover crop seed	\$994	0.8%
Pesticides/Fungicides	\$1,222	1.0%
Irrigation supplies	\$543	0.5%
Other crop management inputs	\$2,268	1.9%
Wash water sanitizer	\$439	0.4%
Plastic bags, paper sacks, twist ties, tomato boxes	\$828	0.7%
<i>Subtotal</i>	<i>\$19,698</i>	<i>16.7%</i>
Machinery		
Variable	\$4,131	3.5%
Fixed	\$7,999	6.8%
<i>Subtotal</i>	<i>\$12,129</i>	<i>10.3%</i>
Non-Labor Overhead	\$22,582	19.1%
<b>Total Expenses</b>	<b>\$118,054</b>	<b>100.0%</b>
<i>Total Expenses / Acre</i>	<i>\$21,348</i>	
<b>NET RETURN TO MANAGEMENT</b>		
<b>Net Return To Management</b>	<b>\$29,971</b>	
<i>Net Return to Management / Acre</i>	<i>\$5,420</i>	

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**Fig. 19 Expense Categories for 225 CSA Members**








# Cover Crops





# Cover Crops

- 
- Short and long term weed control
  - Cool season: rye/vetch, oats/pea
  - Warm season: Sudex, buckwheat
  - Multi-species mix when possible
  - Allelopathic crops are critical, as is establishment
  - Cover crops drive the rotation







# Weed the Soil Not The Crop



## Weed The Soil Not The Crop

A Slide Presentation by Anne & Eric Nordell

A Holistic Plan For Weed Management  
Rotational Cover Cropping  
Alternative Tillage Techniques

**TO PURCHASE COPIES CONTACT**  
Anne & Eric Nordell  
3410 Rt. 184  
Trout Run, PA 17771  
\$15.00 per DVD + \$3.00 S&H

Edited by Gerace Video  
Satisfaction Guaranteed  
570-494-1126  
2880 Heshbon Road  
Williamsport PA 17701



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# Plasticulture Production – 8 beds per plot on 6' centers





# Farmall 140 with Custom Plastic Cultivation System





















































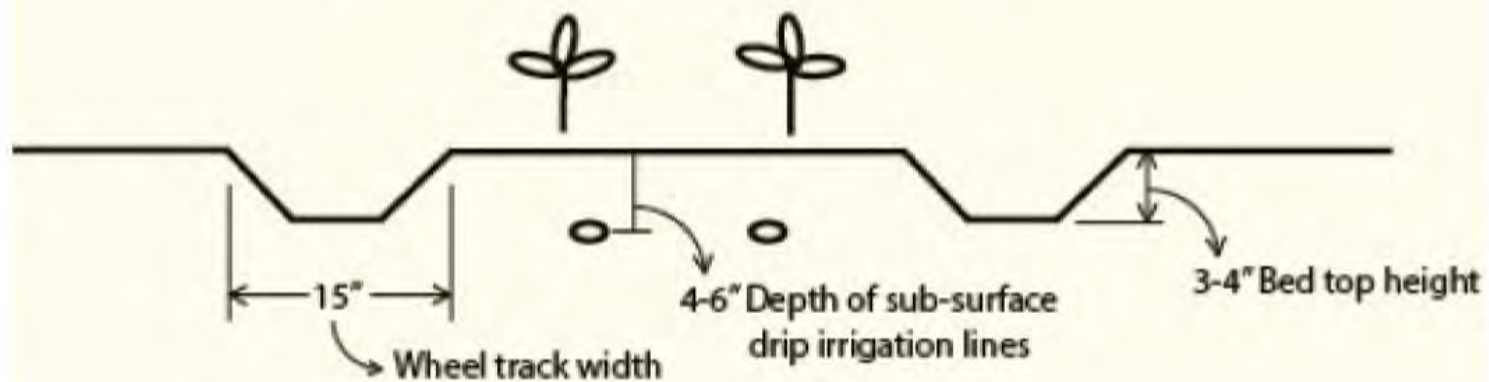
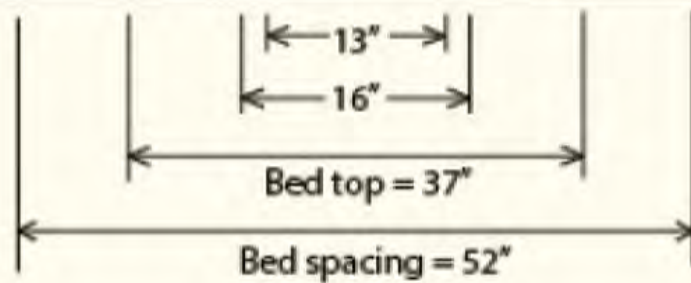
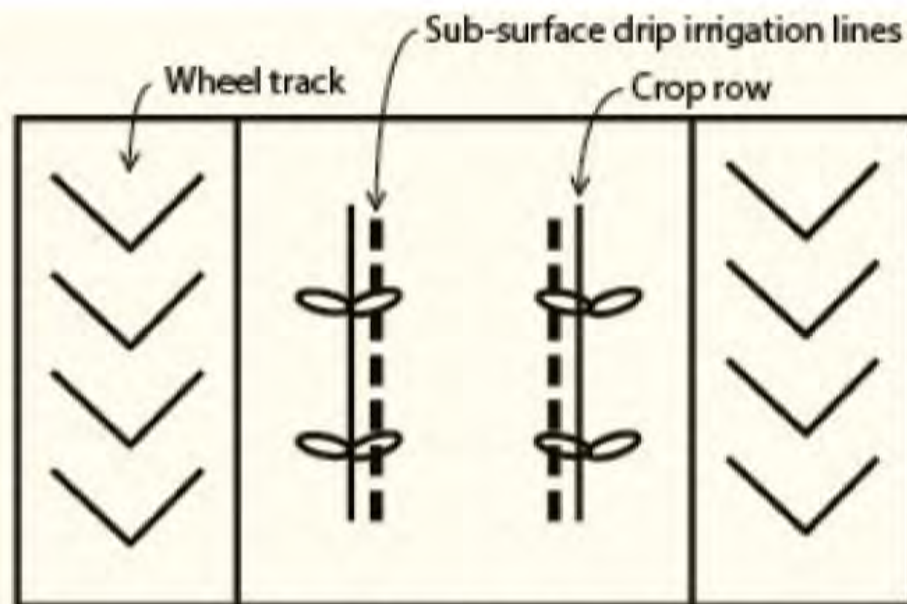


## Bare Ground Production

- 10 beds/ plot
- 52" wheel centers
- 37" bed tops
- 3-4" bed height
- Double rows on 16" center to center spacing













# Sub-surface Drip Tape Injection System





- 10 mil T-tape
- 8" emitter spacing
- 4-5" depth
- 2 lines per bed
- \$5,100











Pinnacle Organic, San Jose, CA.

## Rain-Flo

- 3 rows
- 0-10" injection depth
- \$3,200

## SUBSURFACE DRIP APPLICATOR



Heavy duty build for large acreage



Adjustable row centers 36 inches to 68 inches

## Features

- Heavy duty subsurface drip applicator with Category II and III 3- point hitch
- Depth adjustable from 4 inches to 17 inches
- Adjustable 36 inch to 68 inch row centers
- Shear bolt for rocky soil
- Convenient storage platform
- Drip attachment has an adjustable on demand disc brake
- Replaceable shank tooth, and shin guard
- Replaceable wear plate on side and bottom of shank
- 2" ID Stainless steel drop tube
- Optional adjustable rear closure disk





*Plasticulture Equipment - Multi-Row*

# DRIP TAPE APPLICATORS

**5-row**

**SDI**  
**SUB-DRIP IRRIGATION**





# False and Stale Seedbeds: The most effective non- chemical weed management tools for cropping and pasture establishment

Dr Charles N Merfield

The BHU Future Farming Centre

Permanent Agriculture and Horticulture Science and Extension

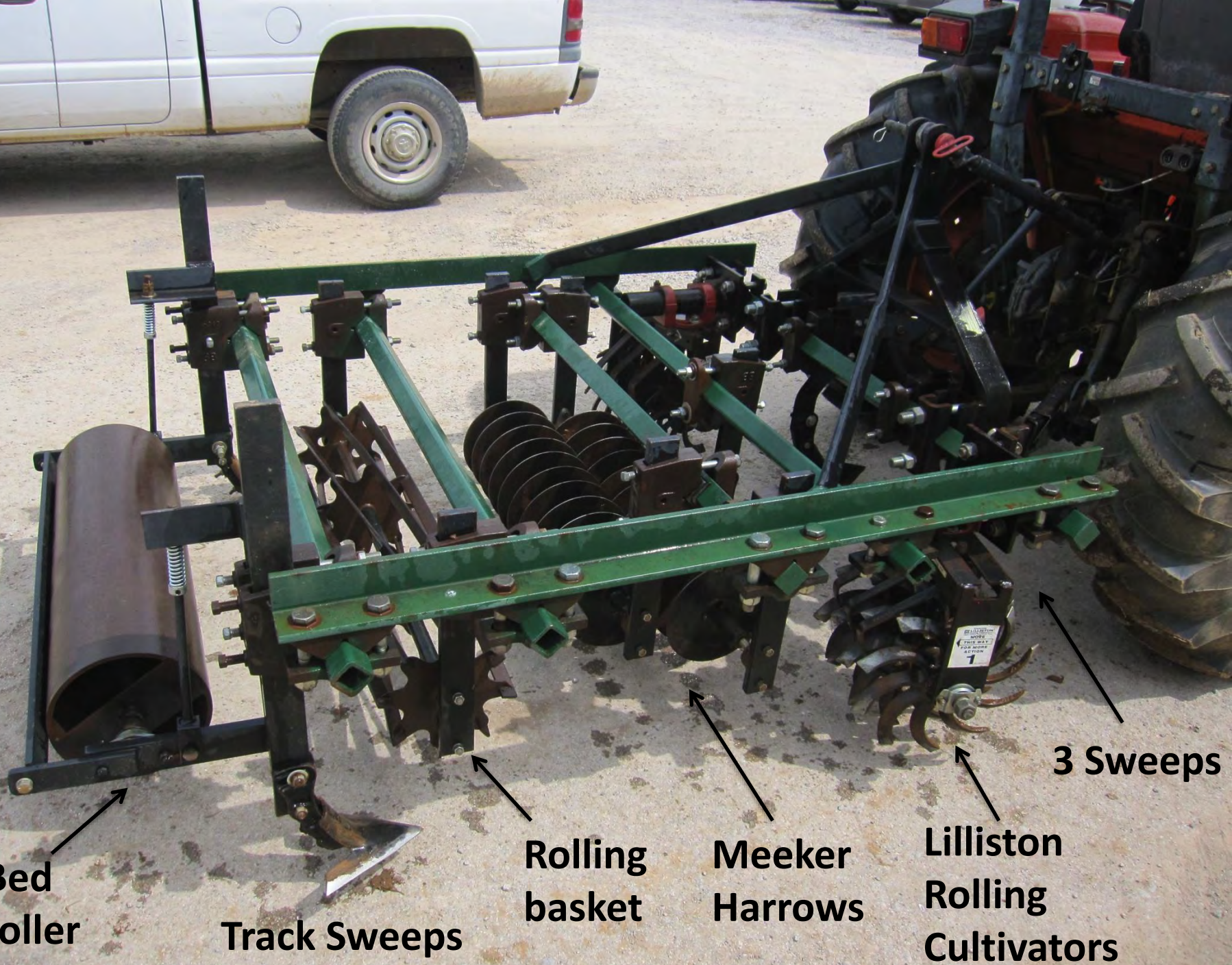
[www.bhu.org.nz/future-farming-centre](http://www.bhu.org.nz/future-farming-centre)



# Stale Seedbed Cultivator







Bed  
roller

Track Sweeps

Rolling  
basket

Meeker  
Harrow

Lilliston  
Rolling  
Cultivators

3 Sweeps



















# Stale Seedbed Cultivation Field Experiment - Summer 2017





# Stale Seedbed Cultivation Field Experiment - Summer 2017

- Four treatments: 1, 2, 3, or 4 cultivation events, each separated by 10 days
- Individual plot size: 52" x 40'; 4 replications arranged in a completely randomized design
- Weed data collected 10 days after final cultivation: dry weight biomass, species identification and abundance



















## Weed Dry Weight Biomass Per Treatment

<u>Treatment</u>	<u>Average Weight (gm)</u>
1 cultivation	127.5c*
2 cultivations	73.7c
3 cultivations	9.6b
4 cultivations	0.3a

\*Letters represent significant difference ( $P < 0.0001$ ) based on Tukey's Studentized Range (HSD) Test.





## **Impact of Stale Seedbed Cultivation:**

- 2 cultivations resulted in a 42% weed reduction
- 3 cultivations resulted in a 93% weed reduction
- 4 cultivations resulted in a 98% weed reduction





Food Bank Farm, Hadley, MA





Capay Organic, Capay Valley, CA.





The Steketee Seedbed combination implement





Catalog - Raised Bed Equipment

## BED RECONDITIONER

**Post-harvest or pre-plant  
raised bed maintenance**



**Unite raised beds with  
conservation tillage**





**Pyroweeder by  
Farmer's Friend  
•\$895**



# Mechanical Transplanter with fertilizer hopper









# Maternacc vacuum seeder with fertilizer hoppers





Between row cultivation with a  
Budding Basket weeder and custom  
power steering



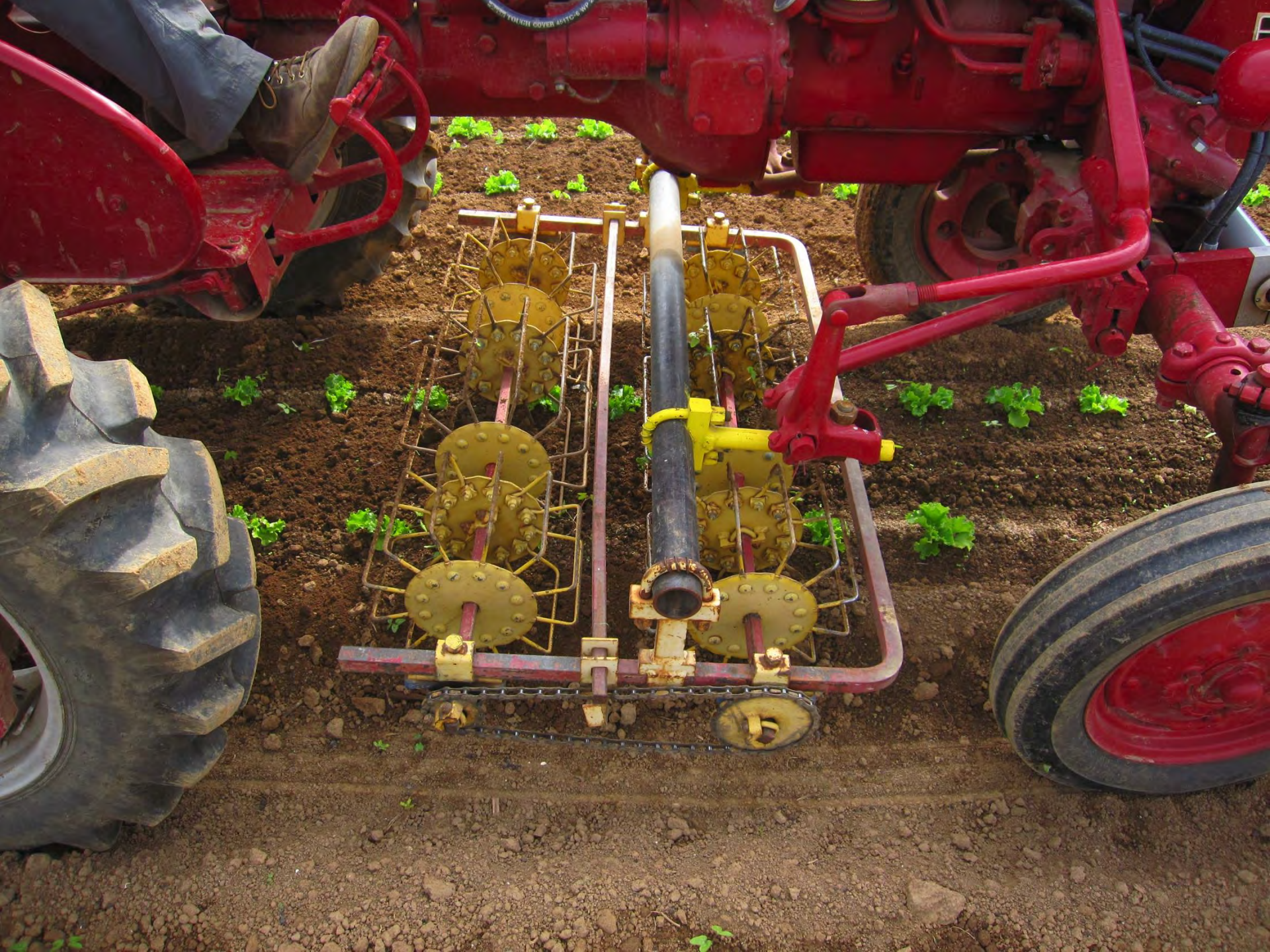




INTERNATIONAL

FARMALL  
140























# Kress Finger Weeder











\$7,600







# Critical Components of an Integrated System

- Allelopathic cover crops
- Mulches (living and dead)
- Subsurface drip irrigation
- Stale seedbed cultivation
- Restricted fertilizer placement
- Timely and effective between row cultivation
- Effective in-row cultivation