Making the CT Paradigm Work in Processing Tomatoes

UCCE Northern SJV Processing Tomato Meeting

February 2, 2012


Welcome
to
CASI!
Conservation Agriculture Systems Initiative
RESOURCE
CONSERVATION DISTRICTS
Sustainable Conservation
NRCS
American Farmland Trust
SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL Company
University of California Agriculture and Natural Resources
Making a Difference for California
UC DAVIS
COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES
UC DAVIS
DEPARTMENT OF PLANT SCIENCES
UC CE

USDA Agricultural Research Service

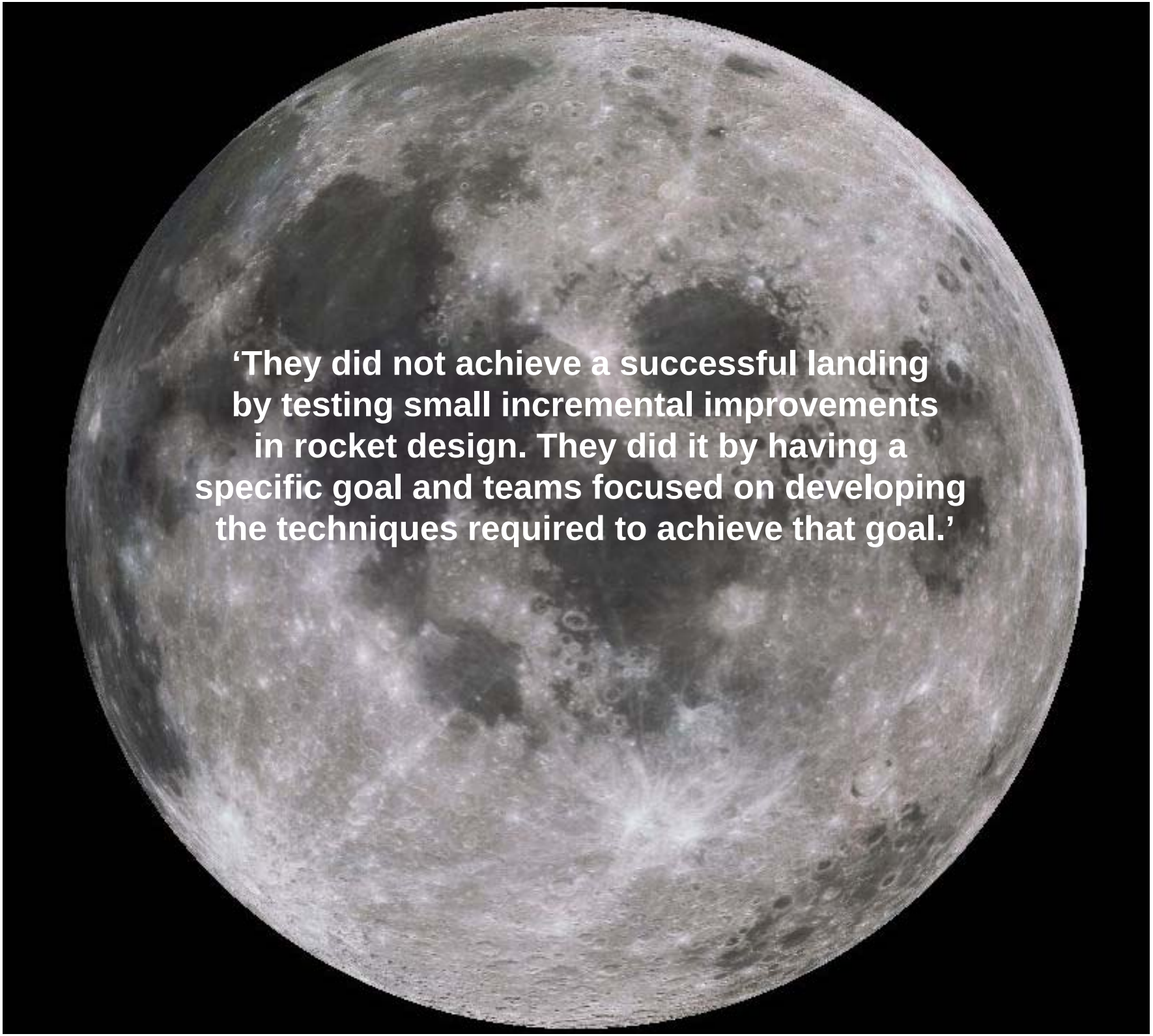
National Program 216

Agricultural Systems Competitiveness and Sustainability

CONSERVATION AGRICULTURE

…links production with sustainability.


‘The agronomic and ecological equivalent of the moon race of the 1960’s’
Dwayne Beck, 2012


‘They did not achieve a successful landing
by testing small incremental improvements
in rocket design. They did it by having a
specific goal and teams focused on developing
the techniques required to achieve that goal.’

Our Energy Goal

Total farm and processing net energy self sufficiency by 2012 for all types of energy

We aim to achieve this goal while taking into account:

1. Carbon neutral or negative
2. Nitrous-oxide neutral or negative
3. Use non-food sources for energy
4. Energy costs should be reasonable
5. Maintain past growth of about 30-35% annually, doubling every 2-3 years

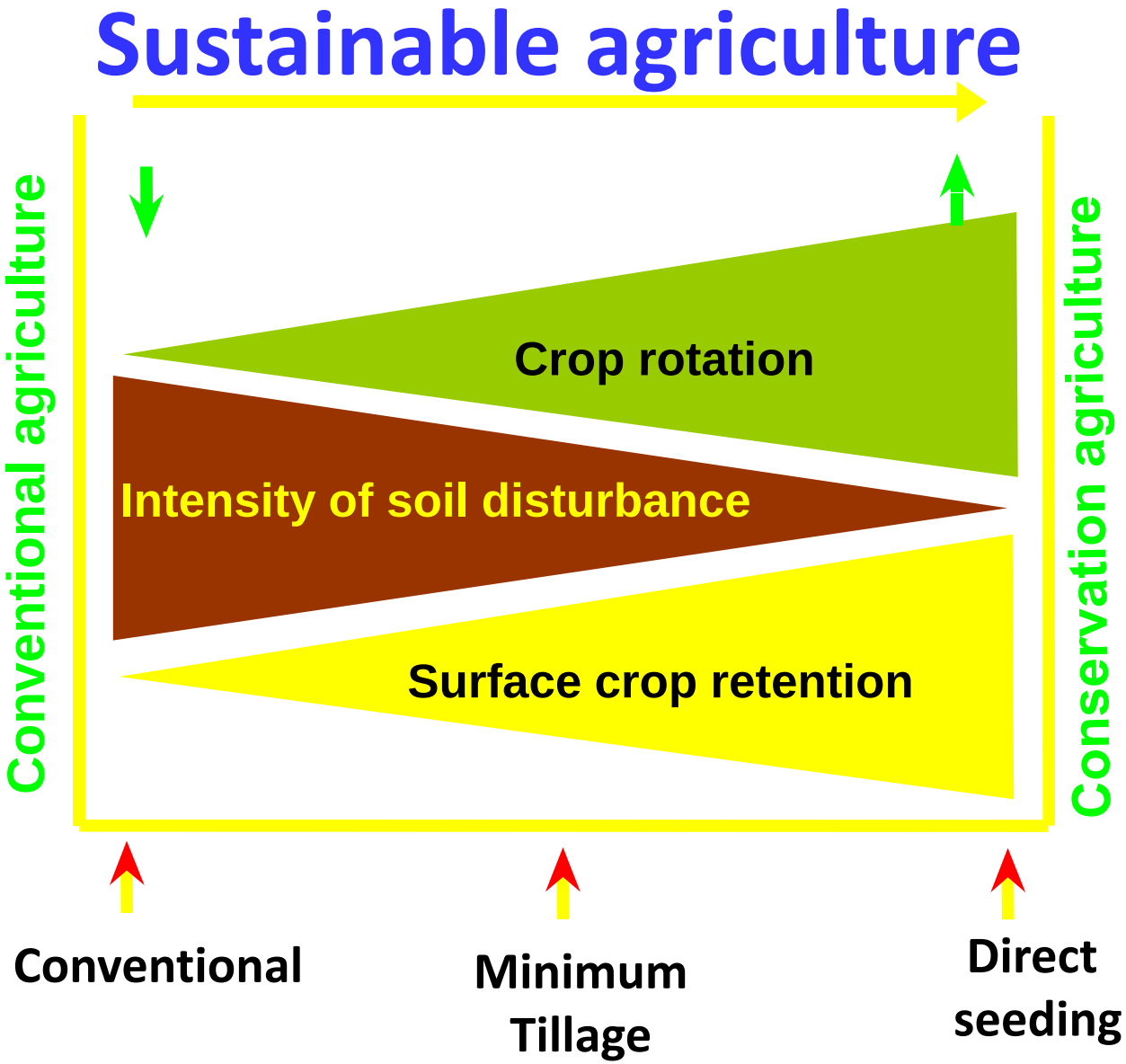
‘…Take all net geologic carbon use out of the system by the year 2026…. In other words, no net loss of organic matter…

A corollary goal is to stop all nutrient leakage from the land (recycle all that is not sold). This includes stopping the leakage of C.

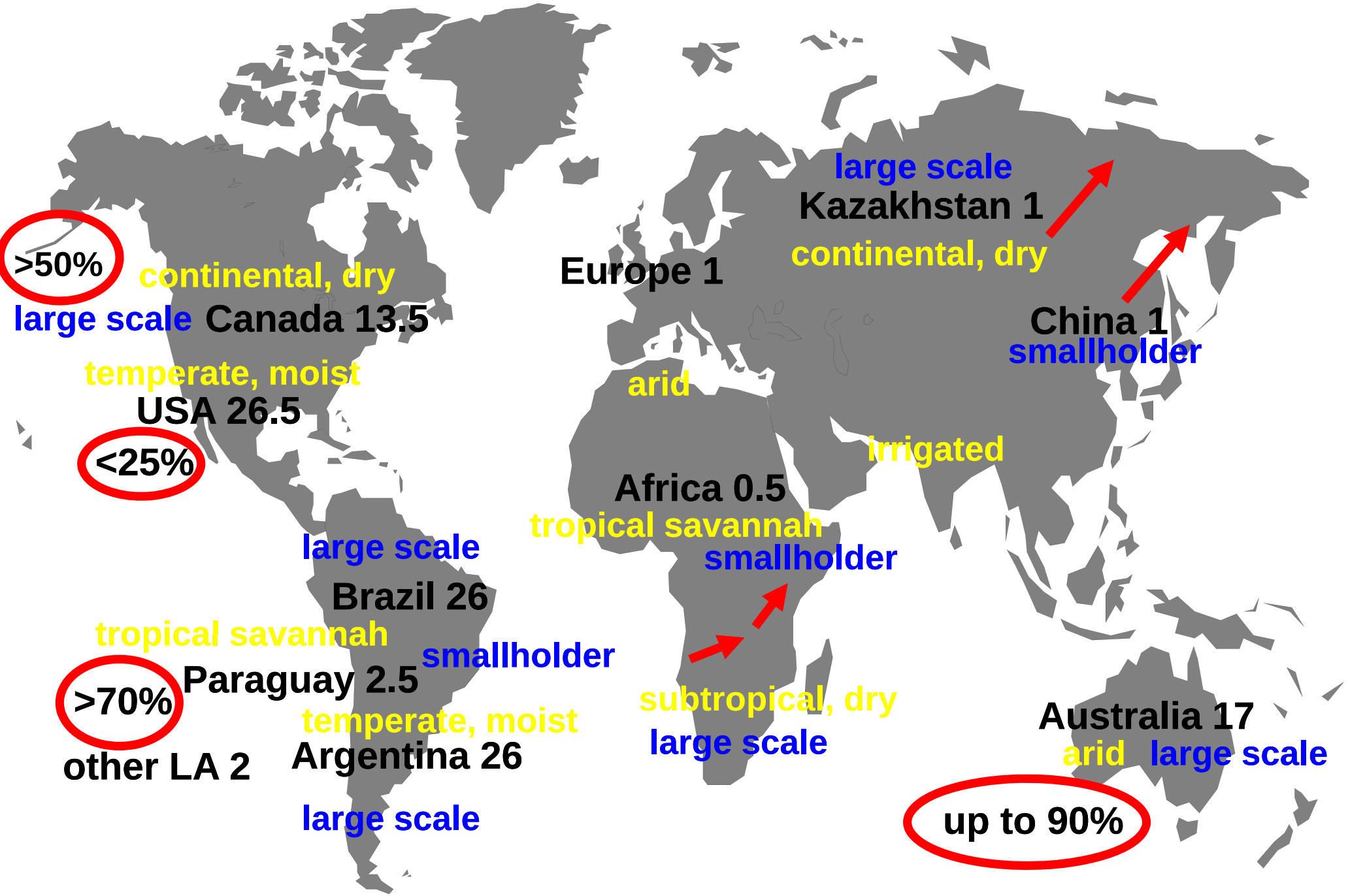
Once these goals are accepted, we can finally get over this need to compare tillage systems. It’s not about the tillage practice. It is about managing the ecosystem.

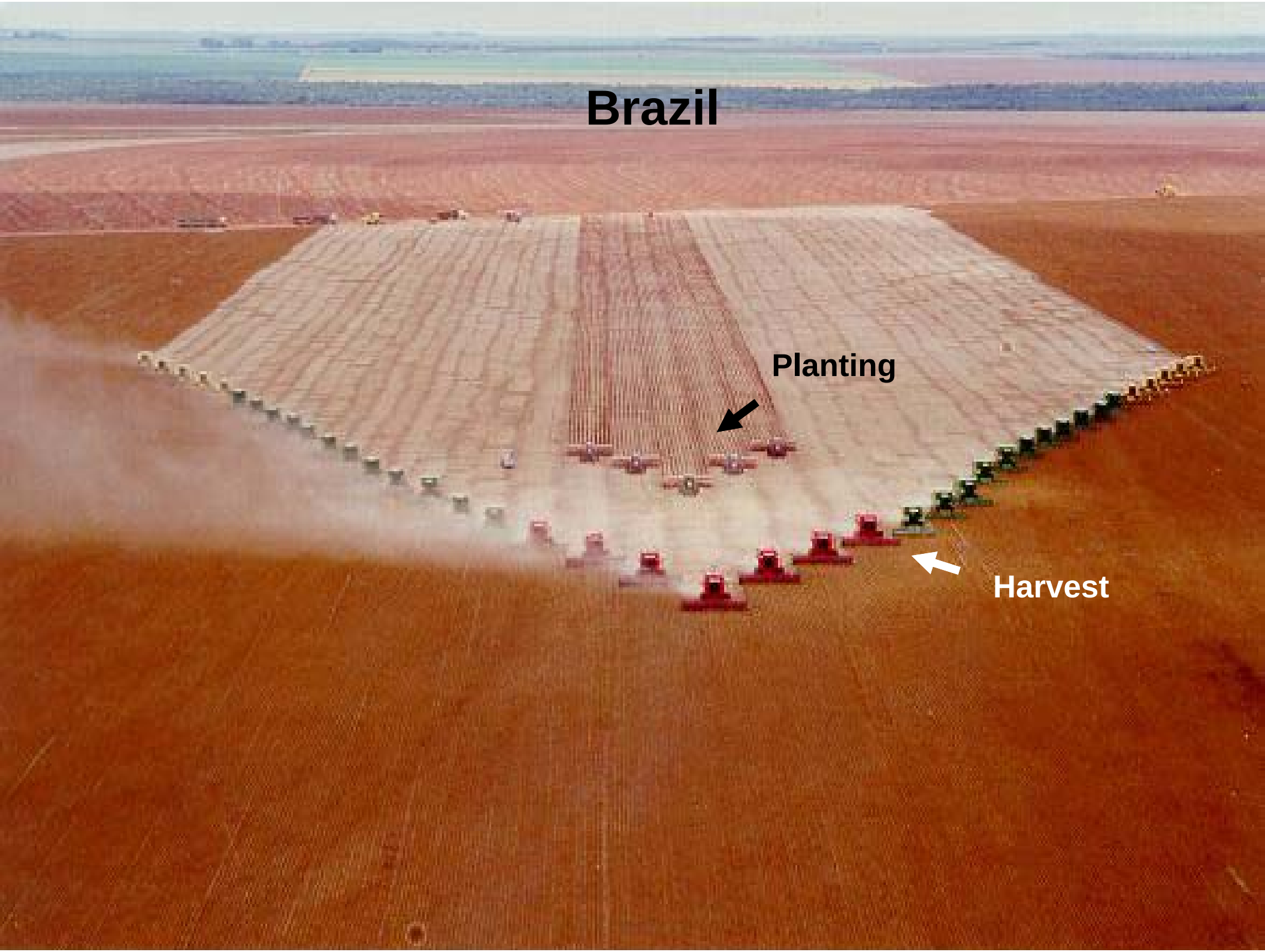
Tillage removes our ability to manage the system.’

Dwayne Beck
March 7, 2006

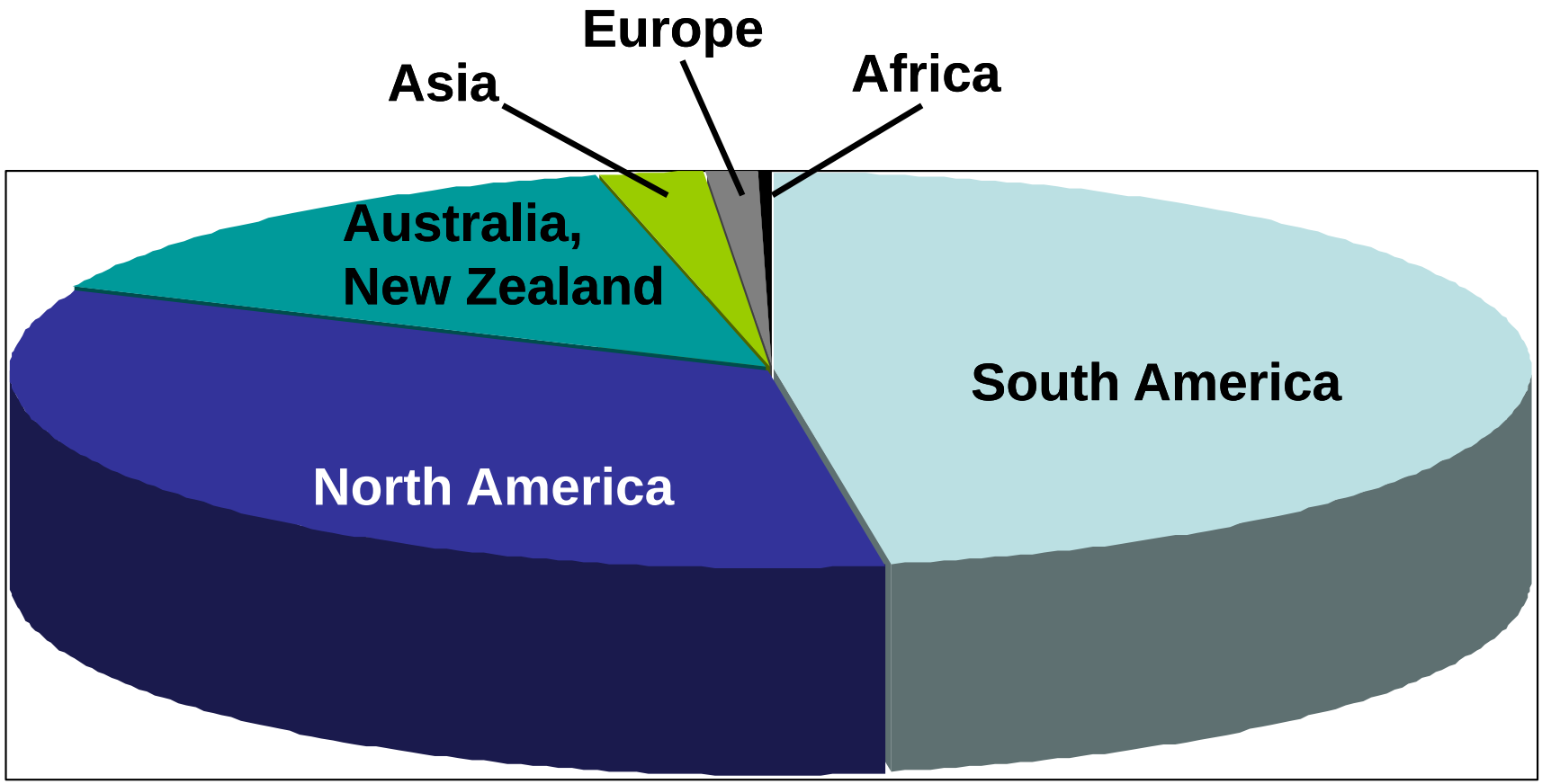

Sustainable agriculture
Conventional agriculture
Conservation agriculture
Crop rotation
Intensity of soil disturbance
Surface crop retention
Conventional
Minimum Tillage
Direct seeding

Conservation Agriculture worldwide 117 Million ha

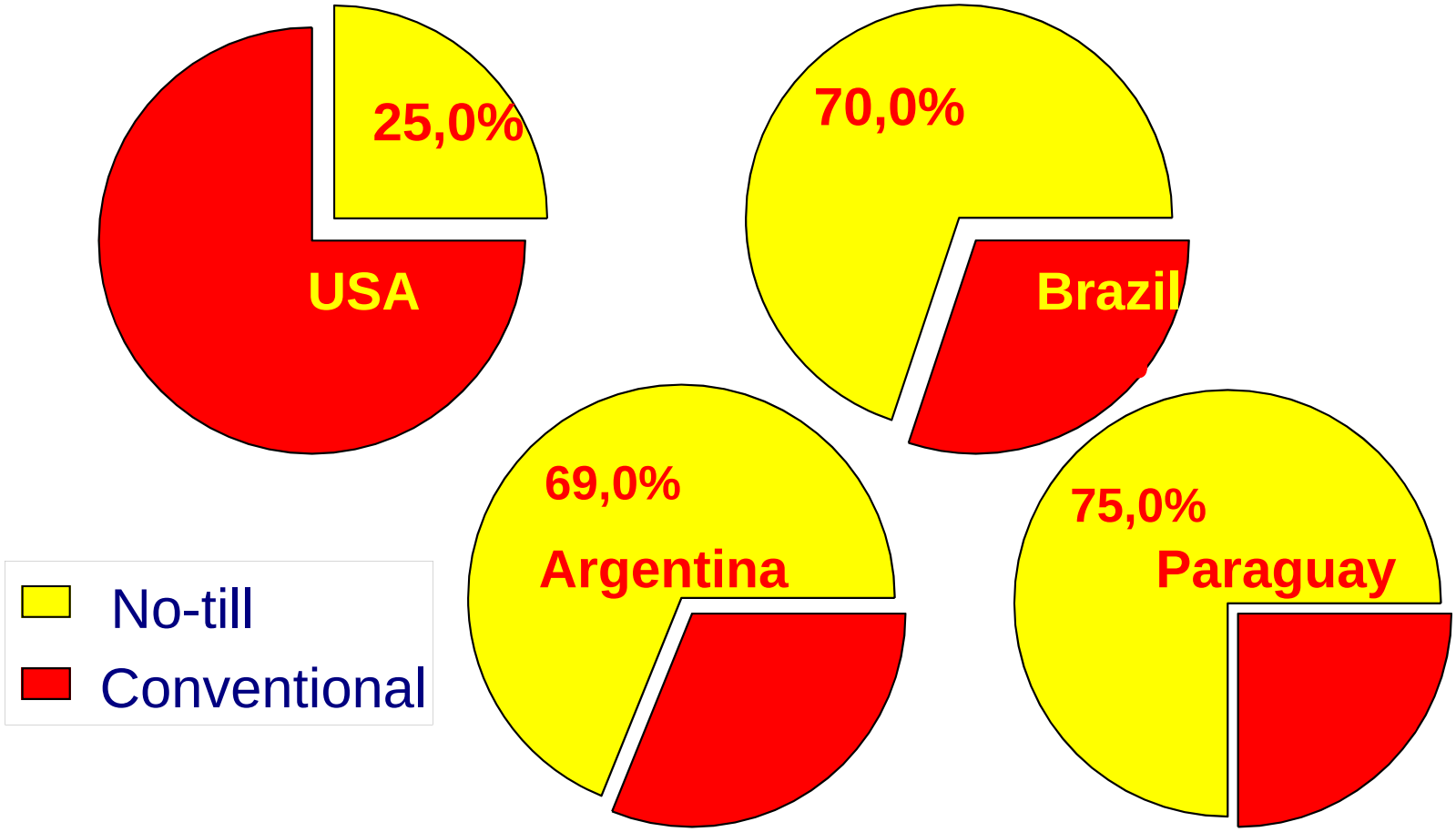



Brazil
Planting
Harvest

CA Adoption in percent by region worldwide



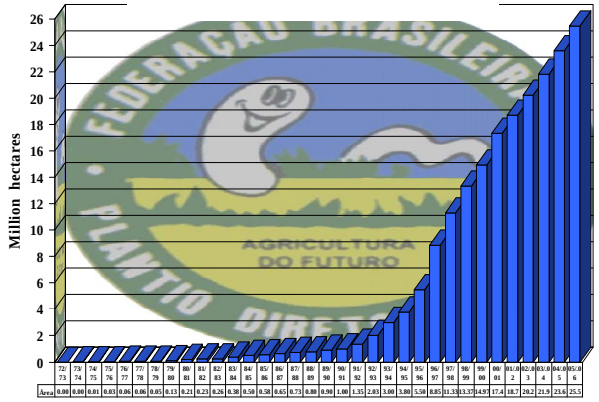
CA Adoption relative to total cropland



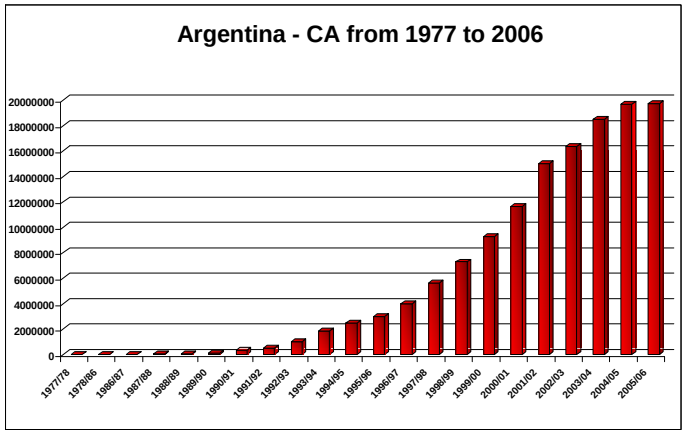
It is estimated that in less than a decade > 85% of the cultivated area will be under No-till.

(Derpsch & Friedrich, 2008)

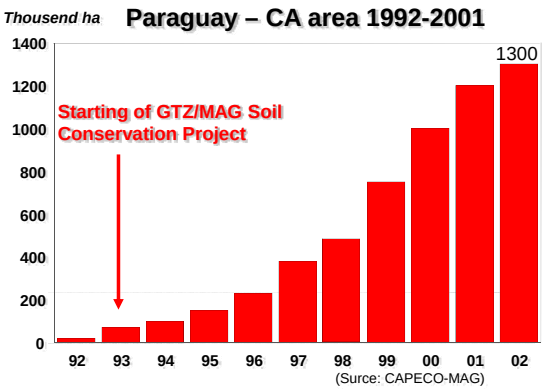
Brazil - Area under CA from 1972 to 2006

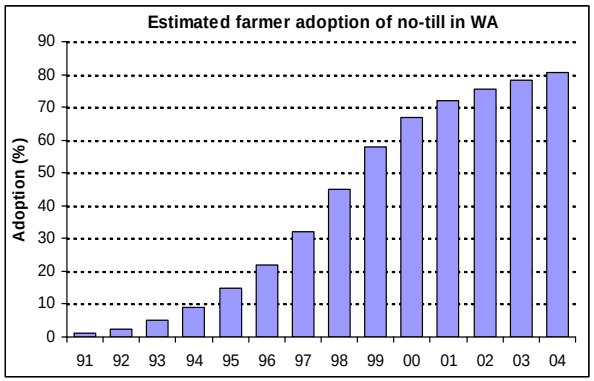


Fonte: EMATER-RS, EPAGRI-SC, EMATER-PR, CATI-SP, FUNDAÇÃO MS, APDC (Cerrado)



CA globally - history and adoption





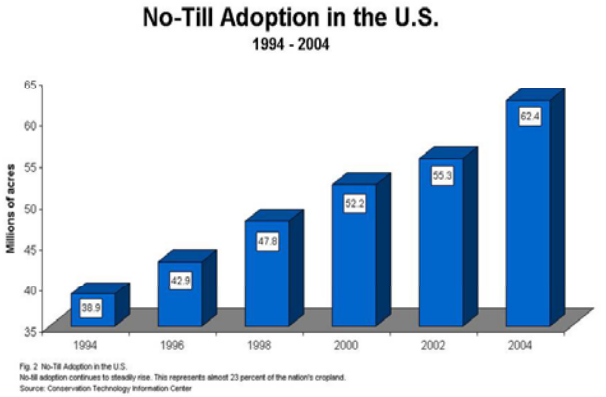
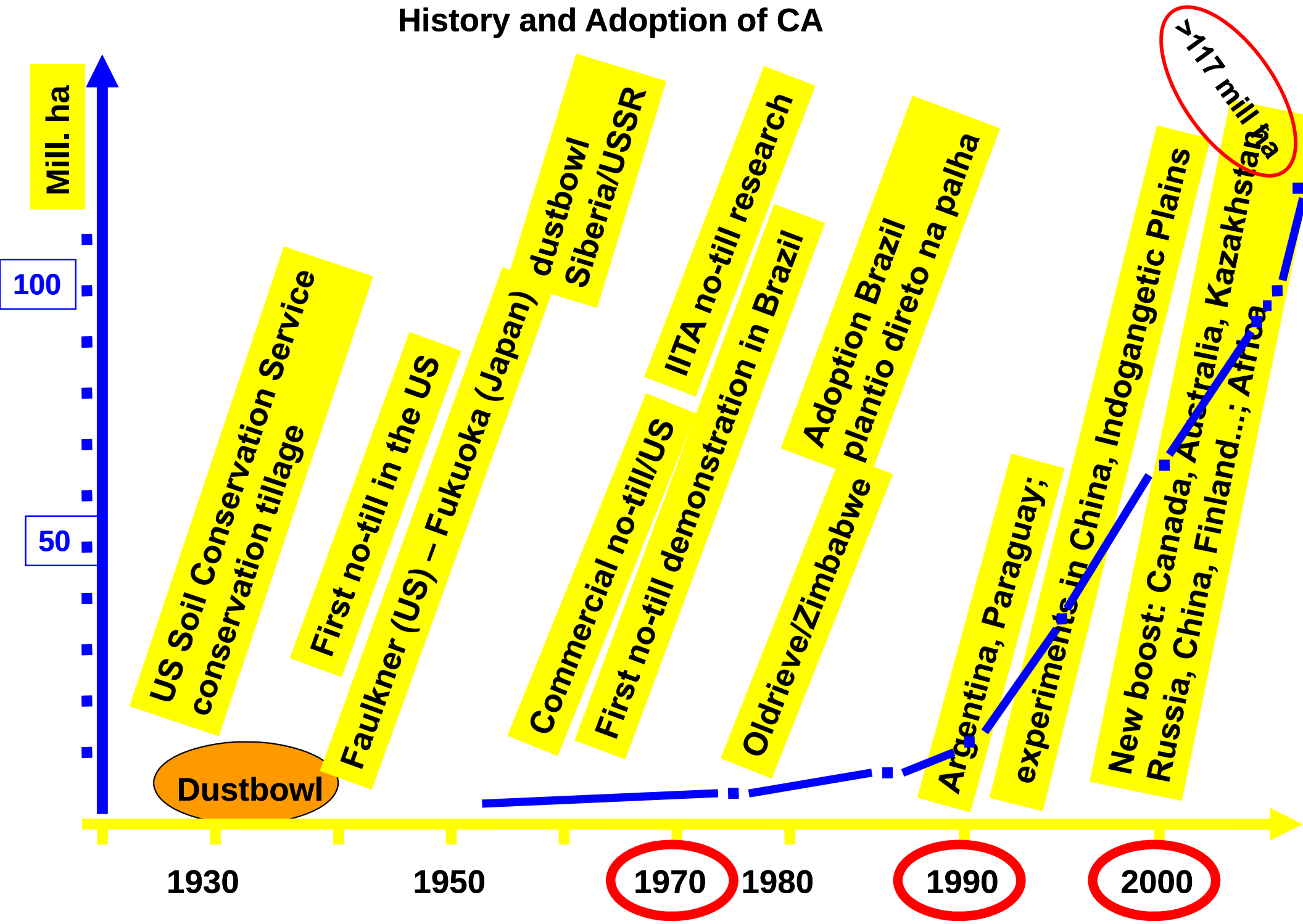


Fig. 2 No-Till Adoption in the U.S.
No-till adoption continues to steadily rise. This represents almost 23 percent of the nation's cropland.
Source: Conservation Technology Information Center

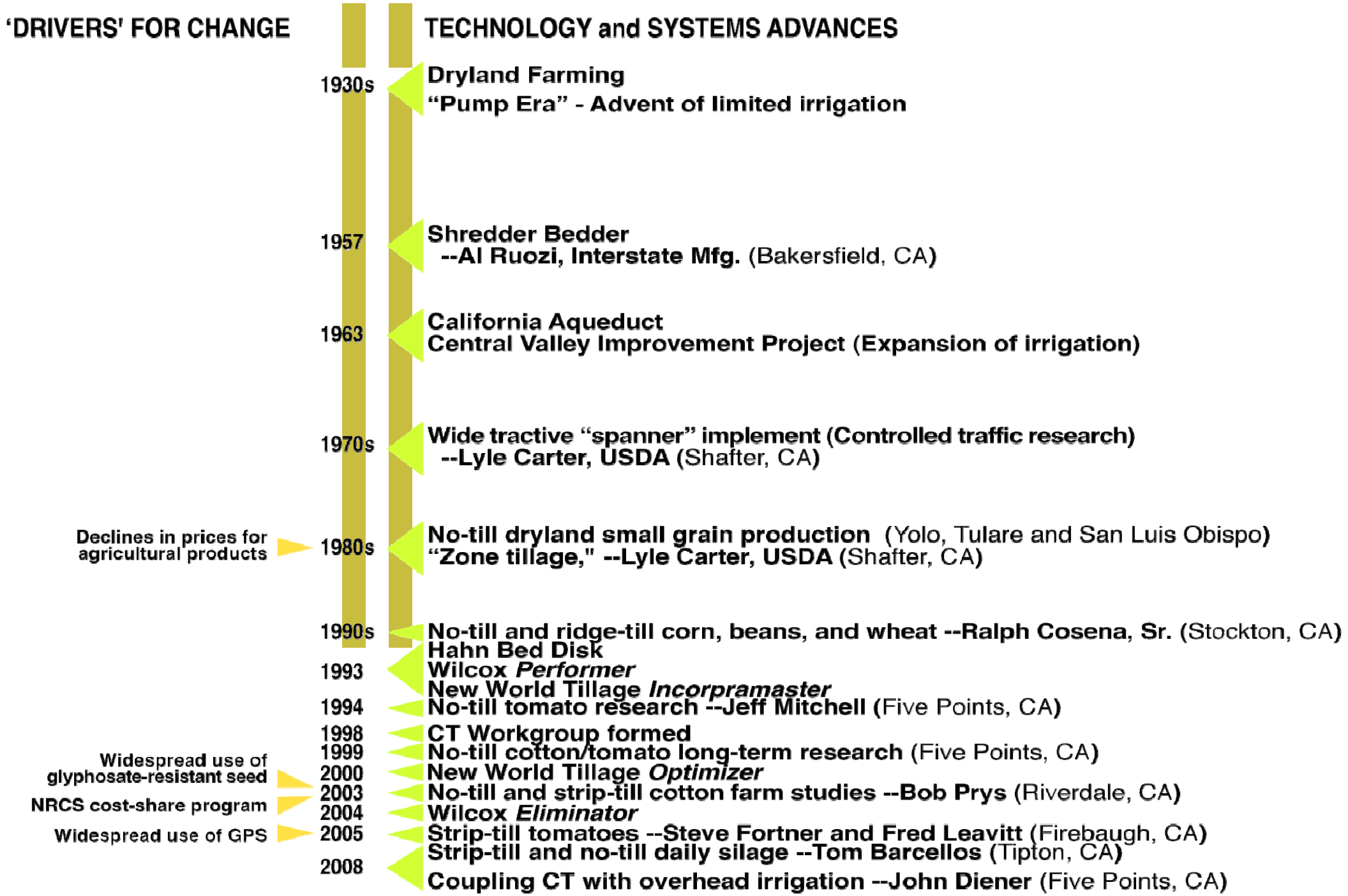

History and Adoption of CA
Mill. ha
100
50
US Soil Conservation Service
conservation tillage
First no-till in the US
Faulkner (US) – Fukuoka (Japan)
dustbowl
Siberia/USSR
Commercial no-till/US
IITA no-till research
First no-till demonstration in Brazil
Oldrieve/Zimbabwe
Adoption Brazil
plantio direto na palha
Argentina, Paraguay;
experiments in China, Indogangetic Plains
New boost: Canada, Australia, Kazakhstan,
Russia, China, Finland...; Africa
>117 mill ha
Dustbowl
1930
1950
1970
1980
1990
2000

Patos de Minas, Brazil
2007

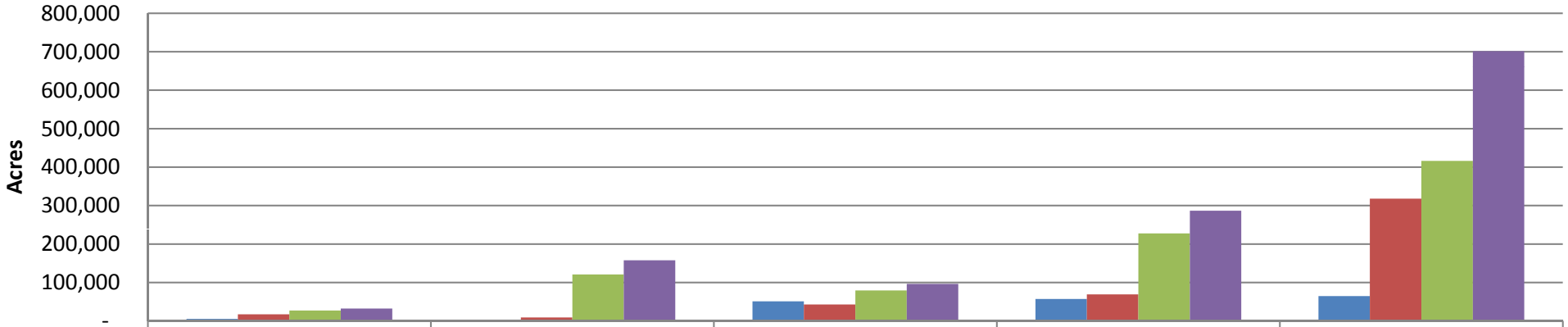
Silage wheat chopping ahead of tomato transplanting
Turkey
2009

Tomato transplanting following silage wheat chopping
Turkey
2009

Changes in Tillage Management in California's Central Valley



Increases in CT 2004 – 2010 in California



	No Till	RT/ST	Mulch Till	Subtotal	Minimum Tillage
2004	5,265	690	51,150	57,105	64,613
2006	17,181	9,020	42,964	69,165	318,006
2008	27,308	121,055	79,434	227,797	416,035
2010	32,387	157,824	96,267	286,478	701,760


Aref Abdul-Baki
USDA ARS
Beltsville, MD
Dwayne Beck
SDSU
Pierre, SD
Andy McGuire
Moses Lake, WA
Ron Morse
Virginia Tech
Blacksburg, VA
Dick and Sharon Thompson
Boone, IA
Karl Kupers
Rearden, WA
Steve Groff
Lancaster County
Pennsylvania
John Landers
Cerrado Region
Brazil
John Luna
Oregon State
University
Corvallis, OR
Mike Peterson
Greeley, CO
Don Reicosky
USDA ARS
Morris, MN

PAGE 1

New technology practiced on Tracy man's farm

Jonathan Partridge

The Tracy Press

Close to 30 people from all over Northern California gathered at Hal Robertson's Tracy farm on Friday morning to discuss ways to use less tilling for tomato fields.

The University of California sponsored "Reduced Tillage Field Day," which informed farmers about experiments UC researchers are doing to reduce the amount of tractor work done on fields — and reduce erosion in the process.

One of the largest UC experiments is being conducted on Robertson's farm, and spectators could look at the results on Robertson's tomato field firsthand on Friday.

"The (UC cooperative) extension office gets excited about this stuff, so it got me excited," Robertson said.

The Tracy farmer experimented on

See **TILLAGE**, page A14

September 4, 1999
The Tracy Press

PAGE TWO

TILLAGE: New methods

(Continued from page A1)

30 rows of tomatoes on a three-to-four acre section of his field. Some areas of the field were strip tilled — the amount of tractor work in the field was reduced by using specialized equipment. Other sections weren't tilled at all.

Robertson said the tomatoes seem to be growing rather well, and he plans to continue to use tillage conservation methods if it produces a good yield this year.

"There will be more (reduced tillage) in the future, especially as we face more and more regulations," Robertson said. "It's probably more environment-friendly, and we're always looking for ways to improve the environment."

Allan Romander of Western Farm Service agreed that reduced tillage farming is the next step for California farming. Western Farm Service is a Vernalis company, which distributes pesticides to farmers.

"It's definitely the wave of the future — there's no question about it," he said. "It's something we need to learn to use. We've been growing tomatoes (with heavy tillage) for 35 years. But you don't change a concept overnight."

California is actually behind other states in reduced-tillage technology said Jeffrey Mitchell, the horticulturalist for UC Davis who helped Robertson conduct the experiments in his field. He attributes the Midwest's greater experience with these growing methods to erosion requirements that those states impose on their farmers, which California doesn't.

Ralph Ceseña, who sells equipment using this technology in California and Mexico, said many Californians are actually opposed to using reduced-tillage methods, and he was surprised at the amount of people who attended Friday's meeting.

"I was shocked when I first came (to California)," Ceseña said. "I thought people would be more attuned to it, since they have so much information."

But Benny Fouché, farm adviser for the University of California Cooperative Extension in San Joaquin County, said many farmers in the county are interested in new technology.

"Our growers may seem like your run-of-the-mill conservative dirt farmers, but they're actually very innovative," he said. "They continue to impress me."

George Johannssen of Danville, a former horticulturalist for the California Tomato Research Institute, said the Robertson family is particularly innovative.

"We've got one of the finest growers here in the county with the Robertsons," he said. "And Hal is one of the finest leaders here in agriculture."


The ‘early’ history - 1994

Rototiller Strip-tiller
Hal Robertson
Tracy, CA
2001

First ever subsurface drip coupled with permanent beds and strip-till cover cropped fresh market tomato production

Firebaugh, CA

2003

Sano Farms, Firebaugh, CA
since 2004


Frank Coelho
Five Points, CA


Danny Ramos
The Morning Star Company
Los Banos, CA

First ever subsurface drip coupled with permanent beds and strip-till cover cropped fresh market tomato production

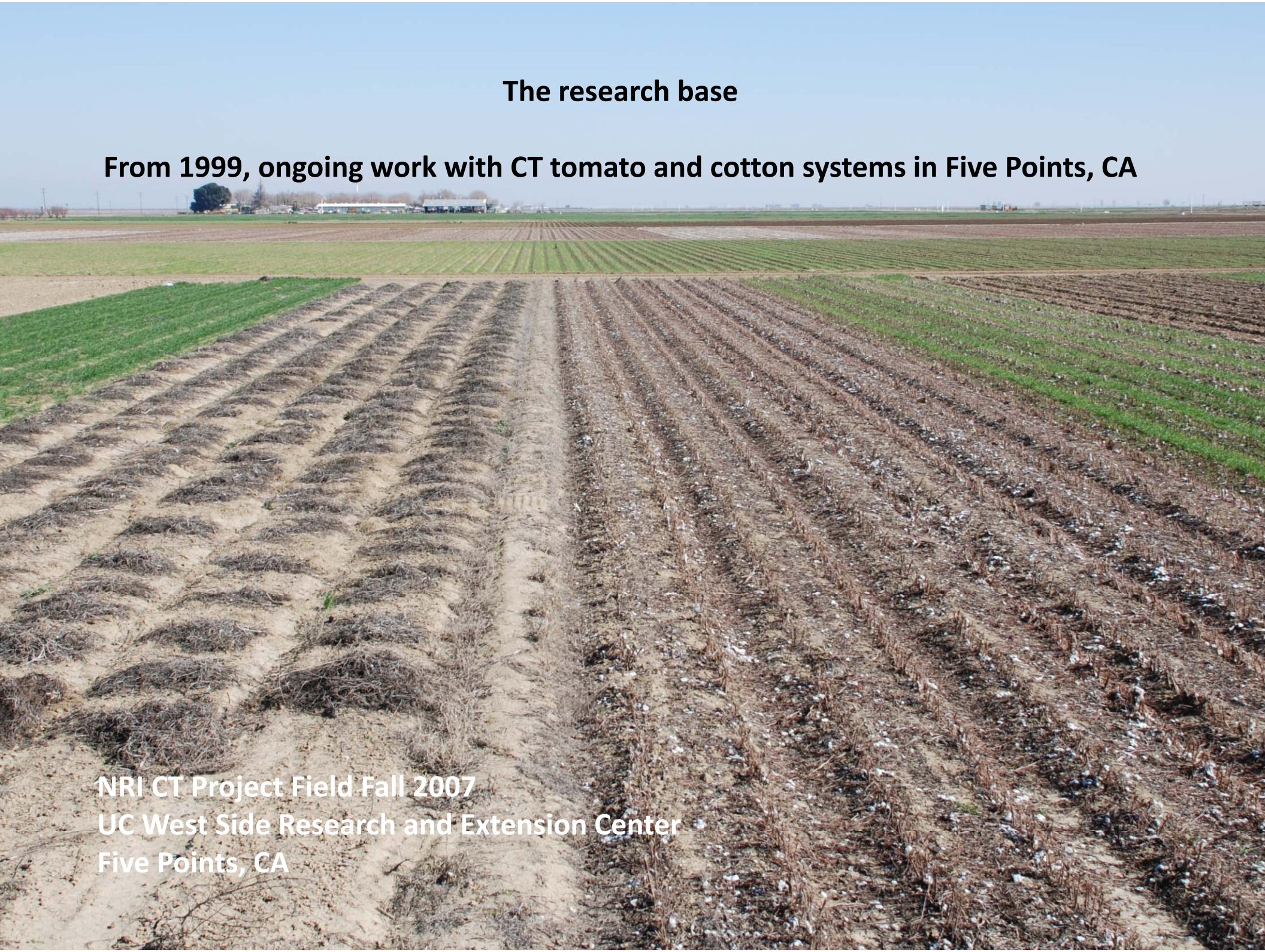
Firebaugh, CA

2003


Bowles Farming
Los Banos, CA 2011

The research base

From 1999, ongoing work with CT tomato and cotton systems in Five Points, CA




July 27, 2011

Conservation / Standard Tillage Comparison Study

(1999 – ongoing)

Standard Tillage

With cover crop

Without cover crop

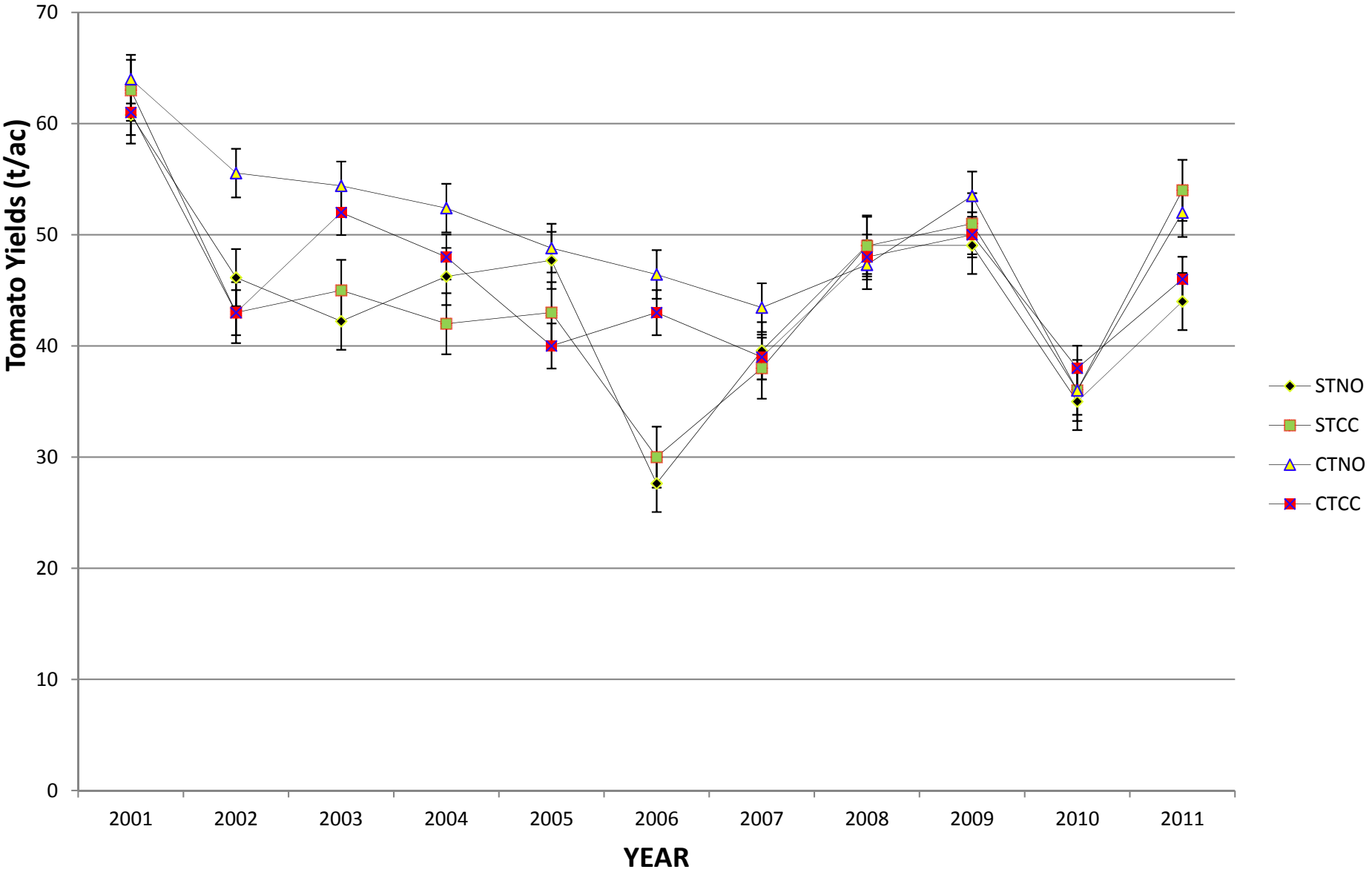
Conservation Tillage

With cover crop

Without cover crop

Rainfed winter cover crop being seeded into cotton and tomato residue Five Points, CA 2007

Winter, rainfed triticale, rye and pea cover crop no-till seeded into cotton and tomato residues
Five Points, CA 2008


Tomato Yields (t/ac)
70
60
50
40
30
20
10
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
YEAR
STNO
STCC
CTNO
CTCC

Tillage and cover crop system erosion estimates, soil condition index sub-factors, soil tillage intensity rating and estimates of diesel fuel use.

Cropping System*	Erosion Estimates RUSLE2 (Mg ha-1)	Soil Conditioning index	STIR Average Annual	Diesel fuel use	Fuel cost for entire simulation ($)
STNO	0.2	-0.71	261	32	128.6
STCC	0.07	-0.96	390	40	160.6
CTNO	0.04	0.43	30.6	9.3	36.8
CTCC	0.03	0.52	37.1	11	43.27

* STNO = Standard tillage no cover crop, STCC = Standard tillage with cover crop, CTNO = Conservation tillage no cover crop CTCC = Conservation tillage with cover crop.

Cultural costs for standard tillage (ST) versus conservation tillage (CT) for processing tomato, Westside Field Station, 2003 (operations expensed at 2007 input prices)

Cultural costs	ST	CT	Difference (ST-CT)
Fertilizer	79	79	0
Seed	176	176	0
Herbicide	76	70	6
Insecticide	0	0	0
Water	163	163	0
Labor (machine)	36	19	17
Labor (irrigation)	110	110	0
Labor (hand weed)	84	84	0
Fuel	58	21	37
Lube and repair	34	16	18
Interest	36	31	5
Total cultural	**853**	**770**	**83**

USDA NRCS

Soil Carbon weights (t/ha)

Depth (cm)	Standard Till No Cvr Crop	Standard Till Winter Cvr Crop	Conservation Tillage No Cvr Crop	Conservation Tillage Winter Cvr Crop
0-15	10.74 (0.26)	13.68 (0.43)	14.51 (0.61)	15.95 (3.43)
15-30	11.59 (0.43)	13.69 (0.73)	11.69 (0.45)	12.89 (0.54)
Total	22.33 C	27.37 B	26.20 B	28.84 A

Values in parentheses are standard error of the means (n=8; north and south field mean averages were not significantly different therefore treatments combined for analysis).
Letters represent significant differences among treatments using a one-way ANOVA analysis with Tukey HSD means comparison.

No-till cotton production following tomato

Five Points, CA • 2000 - 2010

Conservation Tillage Workgroup

ANR University of California UCCE

UCDAVIS Plant Sciences

UCDAVIS College of Agricultural & Environmental Sciences

NRCS

Sustainable Conservation

RESOURCE Conservation Districts

American Farmland Trust

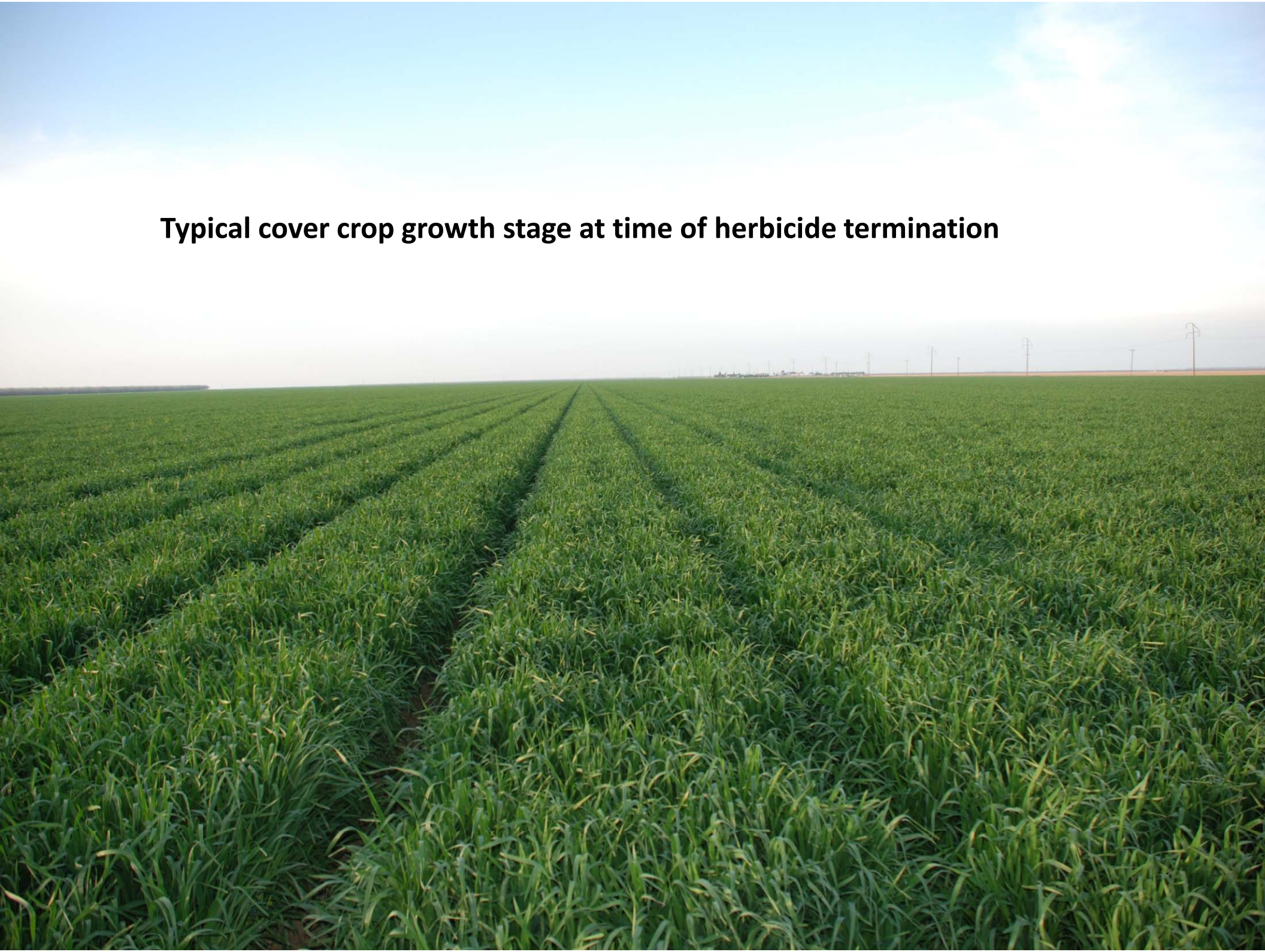
“Scaling up” conservation tillage techniques
at commercial processing tomato farm
Firebaugh, CA
2008

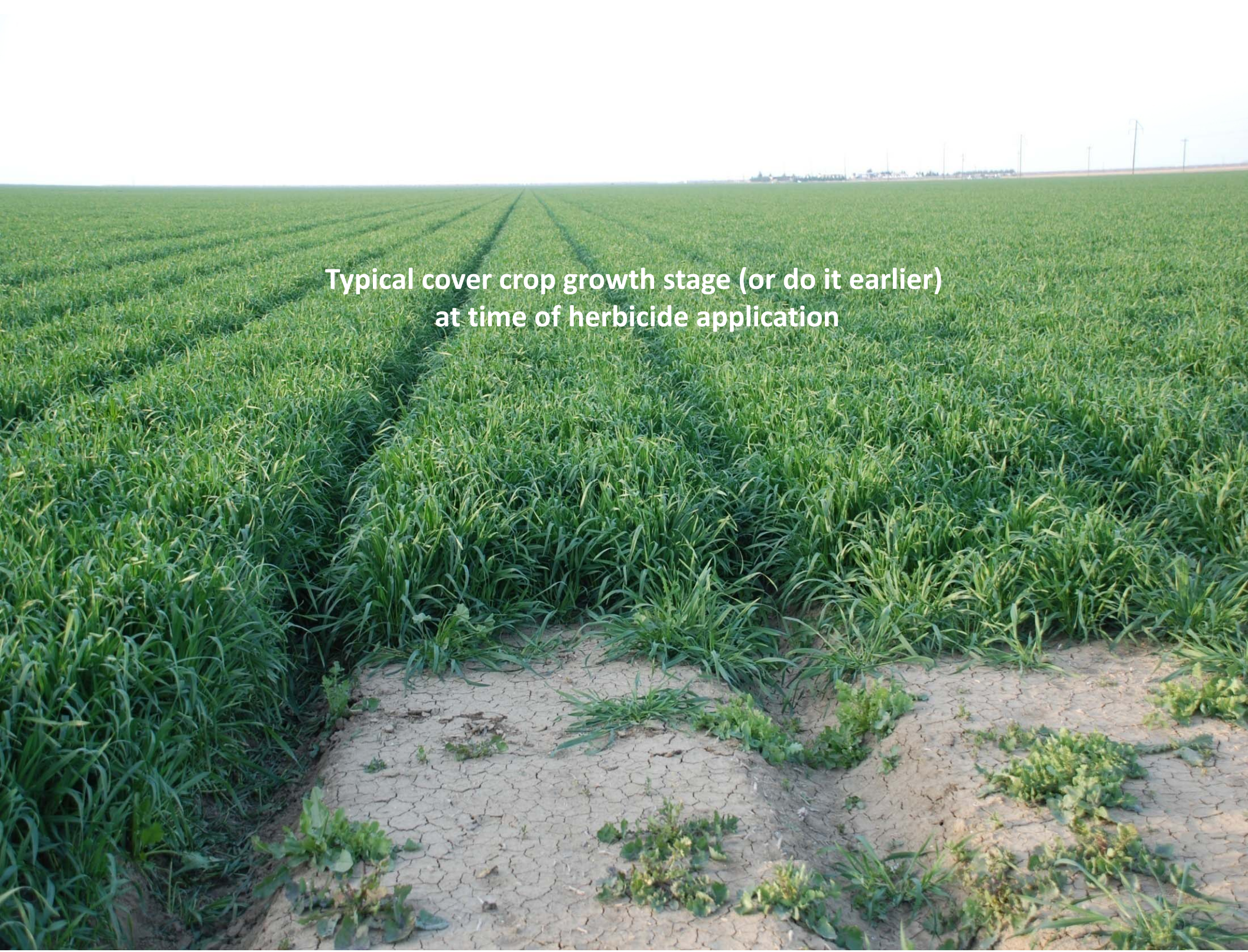
Fall tillage using Wilcox Performer
using GPS with permanent subsurface drip beds

20 ft. Great Plains cover crop seeder


Seeding the cover crops on the bed tops only

Typical cover crop growth stage at time of herbicide termination




Typical cover crop growth stage (or do it earlier)
at time of herbicide application

Burned down triticale cover crop prior to strip-tilling and transplanting
April 2009
Sano Farm
Firebaugh, CA

Typical burned down cover crop following strip-tilling

Strip-till planted processing tomatoes
Firebaugh, CA 2006

Comparative preplant tomato production costs for standard, minimum, Sano Farms CT and no-till systems

Operation	Standard	Minimum	Sano	No Till
Machine Labor Hours	1.89	0.95	0.55	0.05
Machine Labor Costs	25.93	12.95	7.59	0.71
Non-Machine Labor Hours	1.00	1.00	1.00	1.00
Non-Machine Labor Costs	10.96	10.96	10.96	10.96
Diesel Gallons	24.58	10.69	5.55	0.30
Diesel Costs	50.15	21.80	11.32	0.62
Lube	7.52	3.27	1.70	0.09
Repair	17.84	7.81	8.19	0.14
Interest	8.97	6.06	9.74	3.66
Total Operation Costs	121.37	62.85	49.50	16.18
Cash Overhead	2.75	1.09	1.72	0.07
Non Cash Overhead	29.36	11.65	17.42	0.00
Total Costs (Excluding Materials)	153.48	75.59	68.64	16.25

Add Materials	Standard	Minimum	Sano	No Till
Water	75.00	75.00	75.00	75.00
Roundup	8.07	8.07	48.42	8.07
Cover Crop	0.00	0.00	28.00	0.00
Total Materials	83.07	83.07	151.42	83.07
Total Costs (Including Materials)	236.55	158.66	220.06	99.32


CAUTION
PRECAUCION

2011 Tomato Cover Crop and Strip-till Demonstration Evaluation Sites

Yolo County locations (2)

San Joaquin County locations (2)

Merced County locations (2)

San Benito County locations (1)

Fresno County locations (3)

Conservation Tillage Workgroup


2012 Conservation Ag and Controlled Traffic Farming Conferences
To be held in: Tulare, Davis, Five Points, and Bakersfield, CA
Don Reicosky
USDA - ARS, MN
Tim Chamen
England
Jerry Hatfield
USDA, IA
Rolf Derpsch
Paraguay
John McPhee
Tasmania
CANADA
RUSSIA
CHINA
BRAZIL
AUSTRALIA
INDONESIA
MONGOLIA
MEXICO
NORTH ATLANTIC OCEAN
SOUTH ATLANTIC OCEAN
ANTARCTICA

Other sources of information:

The Conservation Tillage Workgroup:

http://ucanr.org/sites/ct/

Jeff Mitchell
(559) 303-9689

Thank you very much.

http://ucanr.org/sites/ct/