Gomes A, DeVincentis AJ, Sandoval Solis S, et al. 2023. Long-term reduced tillage and winter cover crops can improve soil quality without depleting moisture. Calif Agr 77(1):4–14. https://doi.org/10.3733/ca.2023a0001

Technical Appendix

The 2016-2017 cover crop mix “Multiplex I” (Lockewood Seed and Grain, Chowchilla, CA (https://farmerswarehouse.com/seed-export/) consisting of 45% bell beans, 35% Dundale peas, 10% common vetch and 10% barley was seeded at 100 lbs/ per acre by a John Deere 1560 no-till 15 ft-wide drill on October 20, 2016, and terminated by flail shredding on March 2, 2017 ahead of garbanzos and March 23, 2017 prior to sorghum. The mixture ”Multiplex II" consisting of 45% bell beans, 35% Dundale peas, and 20% common vetch was planted on October 24, 2017 at 140 lbs per /acre and terminated on March 9, 2018 prior to garbanzo seeding and on April 4, 2018 ahead of tomato transplanting. For the 2018 – 2019 winter season, on October 26, 2018 the 15 ft John Deere 1560 no-till drill hoppers were separated to seed four 15-inch lines of a mix of common vetch (23%), spring oats (Hayden) (60%), Nitro radish (9%), and African cabbage (8%) at 34 lbs per acre, one 15-inch line of the Multiplex I mix, and the remainder of the seed lines across the 15 ft drill composed of equal parts of Smart Radish, Trophy rape, and Phacelia at 34 lbs per acre. Termination was done on March 14, 2019 ahead of tomato transplanting and April 2, 2019 ahead of melon transplanting. The field has 60-inch wide beds, with one line for tomatoes and melon and two lines when growing garbanzos and sorghum.

In anticipation of the cash crop planting date, the cover crop treatment was cut at the soil line with a stalk chopper. In the reduced disturbance tillage plots, the cover crops were left on the soil surface to break down. In the ST system, the mowed cover crops were disked into the soil. The use of a subsoiling shank before cash crops to depth of 12 in to 18 in, additional disking to 8 in to break up soil clods created by the subsoiling shank, listing the beds, and finally, power incorporation of the surface 4 in of soil using a culti-mulcher with a power take off (PTO) tiller which pulverizes the surface 8 in of soil, creating fine powdery seedbed for both ST NO and ST CC plots.

Irrigation dates and quantities (inches):

2016

Post Sorghum		Post Garbanzo	
9/16/16	0.5''	10/21/16	1.0''
9/19/16	0.5''	10/25/16	1.0''
9/23/16	1.0''	11/03/16	1.0''
9/29/16	1.0''		

2017

Post Garbanzo		Post Sorghum	
10/06/17	0.5''	10/23/17	0.5''
10/09/17	0.5''	10/24/17	1.0''
10/13/17	1.0''	10/27/17	1.0''
10/19/17	1.5''	10/30/17	1.0''

2018

Post Garbanzo		Post Tomatoes	
10/31/18	1.0''	9/13/18	1.0''
11/01/18	0.5''	9/18/18	1.0''
11/02/18	0.5''	9/26/18	1.0''
11/05/18	1.0''	10/17/18	1.0''
11/13/18	1.0'		

CC Termination & Cash Crop Planting dates:

2016-17 Season

03/02/17 ST CC shredded & RD CC rolled; planted garbanzo 3/15/17
03/23/17 ST CC shredded & RD CC rolled; planted sorghum 5/22/17

2017-18 Season

02/02/18 ST CC shredded & 03/01/18 RD CC rolled; planted garbanzo 03/09/18
04/04/18 ST CC shredded & RD CC rolled; planted tomatoes 4/23/18

2018-19 Season

03/14/19 ST CC shredded & 03/18/19 RD CC rolled; planted tomatoes 04/17/19
04/02/19 ST CC shredded & RD CC rolled; planted melons 4/24/19

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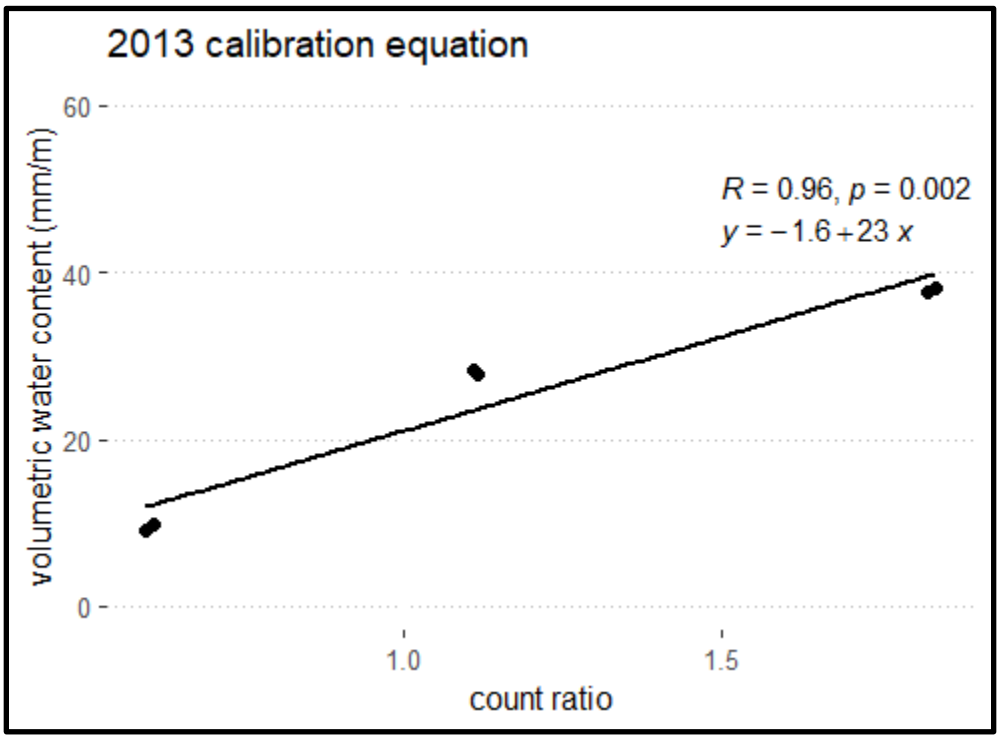
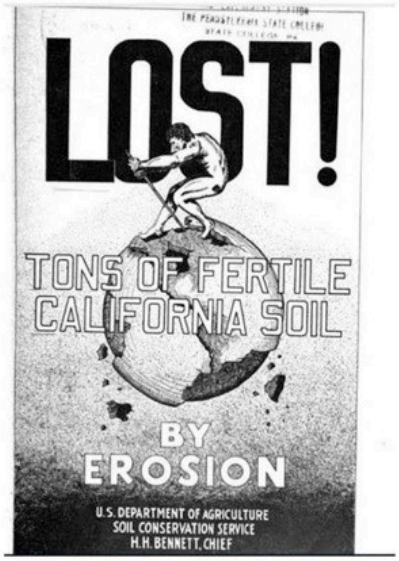


Figure A. Soil Neutron Probe Calibration Equation



KEEP THE RAIN DROP WHERE IT FALLS

There is no simpler way to state the solution of the problem of accelerated erosion, as it is found along the Pacific Coast, than: KEEP THE RAIN DROP WHERE IT FALLS. Water, under natural conditions, ranks with sunshine as a friend of man; but man, in his cultivation of the soil, has altered natural conditions, and in so doing has changed friendly rains into harbingers of ruin.

Rains usually carry with them a little soil as they run off the land, but this is a natural process. Natural erosion is so slow and so gradual in effect that its changes can be measured only by centuries of time. It pulverizes rock from the mountain tops to build fertile soil in the valleys below. In this way geological erosion has been a friend of man since the beginning of time.

Civilized man strips the protecting carpet of grasses and trees from the surface of the earth, leaving the rich, loose, food-filled soil a ready and easy prey for running water or sweeping wind. Nature intended the grasses and trees to cover the soil with a litter that formed millions of little dams to slow the water. Nature also intended the plant roots to hold the soil in place like clutching fingers. But man destroys these guardians of his most valuable natural resources.

The problem of soil conservation is a relatively simple one. The great waste can be stopped in large measure by restoring trees and grasses to highly erosible lands, and by cultivating, planting and irrigating on the contour. The continued prosperity of agriculture in our state and nation depends in large measure upon the understanding and cooperation of the men who till the soil.

KEEP THE RAIN DROP WHERE IT FALLS

U. S. Department of Agriculture

Soil Conservation Service

Harry E. Reddick, Regional Conservator
California and Nevada

Santa Paula, California
1938

Figure B. USDA, 1938 Reference, (Provided by Rich Collins)