Introduction to Section 1 (1f – Making the Transition to Minimum-Till and No-Till in Irrigated Agriculture)

Top ten critical factors for no-tillage adoption:

- (1) Improve your knowledge about the system, especially weed control
- (2) Analyze your soil (aim at a balanced nutrient and pH status)
- (3) Avoid soils with bad drainage
- (4) Level the soil surface
- (5) Eliminate soil compaction
- (6) Produce the highest amount of mulch possible
- (7) Buy a no-till seeding machine
- (8) Start on 10 percent of your farm
- (9) Use crop rotations and green manure cover crops
- (10) Be prepared to learn constantly and stay up to date with new developments

Key Words: Biodiversity, Minimal Soil Disturbance & Integrated Cropping System

(Ref. Critical Steps to No-Till Adoption, Rolf Derpsch)

Data-Set (West ABQ)	UNITS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	183 frost free days
avg. Precipitation	inches	0.47	0.43	0.59	0.51	0.59	0.67	1.26	1.73	1.06	0.98	0.63	0.47	Total = 9.4"
avg. High Temp.	^{0}F	48	55	62	71	80	90	92	89	82	71	57	48	Hardiness Zone 7b
avg. Low Temp.	^{0}F	24	28	34	40	50	59	65	63	56	44	32	24	5 ^{0}F - 10 ^{0}F
Heat Units	GDD	0	0	93	315	620	885	1,038	961	720	387	0	0	Total = 5,019 GDD
Total Monthly ET (1st yr)	inches	0	0	0	0.96	4.38	8.84	9.51	0	0	0	0	0	Total = 23.69" (corn)
Crop Rotation (Cash Crop) & Cover Crop	1st yr.	Cover Crop				Sweet Corn					Cover Crop			Negligible crop growth in December thru February
	2nd yr.	Cover Crop				Pinto Beans					Cover Crop			
	3rd yr.	Cover Crop				Green Chile					Cover Crop			
	4th yr.	Cover Crop				Squash					Cover Crop			
Irrigations for 1st year	in.	Irrigation applied thru drip system as needed to meet ET of both Cash Crop & Cover Crop.												≈ 35" needed/year

Growing Degree Days (GDD) = (max daily Temp. + min. daily Temp.)/2 minus base Temp. of 45 ^{0}F (if answer is negative, assign zero GDD). Average Method used.

Soil Health Integrated Cropping System (ICS) for irrigated agriculture includes conservation practices such as:

1) Irrigation System (drip, hi-flow, sprinkler, etc.)
2) Irrigation Land Leveling
3) Irrigation Water Management
4) Cover Crop Cocktails (grasses, legumes & brassicas)
5) Residue Management (Minimum- and No-Till)
6) Integrated Weed Management
7) Nutrient Management
8) Crop Rotation (warm & cool-season crops of both grass and broad-leaved plant families)
9) Prescribed Grazing (if it fits in the ICS)
10) Pollinators and Insectaries
11) Integrated Pest Management

Weed Control: In No-Till, herbicides replace tillage. The more diversity in the rotation, the easier it is to control weeds. Cover crops compete with weeds (some produce allelochemicals, while decomposing, that inhibit weed growth). Different planting and harvest dates among crops provide additional opportunities to prevent either plant establishment or seed production by weeds. Crop residue serves to suppress establishment of the weeds (NOTE: Straw & chaff must be uniformly spread over the Entire surface at harvest).

Also, use various different modes of action when applying herbicides to prevent development of herbicide resistant weeds.

Nutrient Management: Take irrigation water, soil and plant tissue samples/tests for developing nutrient budget. Estimating crop demand for nitrogen based on yield potential is the first step in determining application rate. Initially, tie-up of N in the soil organic matter will increase, until new equilibrium is established (i.e., higher OM).

Managing Diseases and Insects: Crop rotations are the most effective way of reducing many pest populations (e.g., rotating between broad-leaved crops & cereal crops can break the disease pathogen's cycle on the residue). Choose disease-resistant plant varieties, use certified seed & apply seed treatments if needed. Monitor environment, weather and crop growth stage. Because disease pathogens can develop resistance to pesticide, be sure to rotate with different modes of action, from different chemical classes.

Additional Planning Considerations: Implement an intensified (i.e., manage soil water for optimum use) and diversified production system that utilizes deep- and shallow-rooted plants.

Producers must use a dynamic cropping approach, where management decisions are adjusted annually based on changing climatic and economic conditions. Use a net return per rotational acre to measure profitability of various crop rotations. It is important to evaluate the rotation effect and to optimize the crop synergy of your ICS. On-farm research and demonstrations is essential to determine what will best work on your farm (detailed record keeping is a must).

Restoring Soil Health to achieve Economic and Environmental Ag Sustainability: Remember that biodiversity with minimal soil disturbance drives soil health. Therefore, growing diverse crops will develop a diversity of organisms in the soil. Also, bringing livestock into the operation will add additional diversity into the system (grazing returns most of the nutrients harvested in feed back into the soil). Surface residue left by no-till/minimum-till conserve moisture and protects soil from wind and water erosion. There are many benefits when implementing an ICS based on soil health, such as: saving time, labor, equipment and money (i.e., reduced fuel and inputs); improved wildlife habitat, restored watersheds, etc.

References used: Zero Tillage Production Manual, 1991; Zero Tillage, Advancing the Art, 1997; Beyond the Beginning, The Zero Till Evolution, 2011.

Agronomy Tech Note 76 (http://www.nm.nrcs.usda.gov/technical/handbooks/iwm/nmiwm.html)