
High Residue Farming under Irrigation

Workshop Digest

This publication summarizes the presentations of speakers at the **2007 High Residue Farming under Irrigation** workshop. For more information contact the WSU Extension office in Ephrata (509-754-2011 ext. 413, amcguire@wsu.edu).

Specific pesticides or uses of pesticides mentioned in this publication may not be labeled for use in Washington State.



Workshop agenda

Why Consider High Residue Farming in the Columbia Basin?, *Andy McGuire, WSU Extension, Grant-Adams Area*

Planters, Drills, and Attachments for High Residue Farming, *Andy McGuire*

What happens to the soil when you stop tilling it?, *Hal Collins, USDA-ARS, Prosser and Patterson*

Starter Fertilizer for High Residue Farming, *Rich Koenig, WSU, Pullman*

Strip-tillage for the Columbia Basin, *Andy McGuire*

Strip-tiller Discussion, *Jame Freeman, Sam Krautscheid, Alan Williamson*

High Residue Farming under Irrigation in California, *Tom Barcellos, Dairy Farmer, Tipton, California*

Why Consider High Residue Farming in the Columbia Basin?

Andy McGuire, WSU Extension, Grant/Adams Area

- 1) Increasing interest in high residue farming in the Western U.S.
 - a) No-till Seeding School, in Glen Elder, Kansas, late August 2007
 - i) First farmer that he met was an irrigated farmer from near Boise, ID
 - b) Gave a talk on High Residue Farming under Irrigation at the annual meeting of the Idaho Association of Soil Conservation Districts in Boise
 - i) “Adapting to Changing Times” was the conference theme
 - c) A farmer from California is on today's agenda
 - d) Conservation tillage working group in California is active
- 2) What is high residue farming?

Conventional Tillage		Non-conservation Tillage	High Residue Farming (Conservation tillage)				
Moldboard plow	Heavy offset disk	Reduced tillage, <30% soil covered by residues	Reduced tillage >30% soil covered by residues	Ridge tillage	Tined tillage (chisel plow)	Strip-tillage	No-till, direct seeding

- a) The name *high residue farming* draws attention to the fact that many of the benefits of these systems are a result of keeping the soil covered with a layer of residue.
- b) Everything talked about today is under sprinkler irrigation
- 3) Reasons why you should be interested
 - a) It saves you money
 - i) Dramatically reduces the number of passes over the field
 - (1) Saves time, fuel, labor and equipment
 - (2) \$2.50 per gallon diesel was used for this chart (2006 costs). Implement and tractor charges include depreciation, interest, insurance, housing, and repair charges:

	Costs per acre				
	Fuel use	Fuel & Labor	Implement overhead	Tractor overhead	Total
	Gal/ac	\$ per acre			
Deep ripping	1.7	6.00	1.60	5.90	13.50
Chisel plow	1.1	4.85	2.20	4.20	11.25
Disk	0.6	2.10	3.50	2.60	8.20
Field cultivate	0.7	2.59	1.80	2.40	6.79
Strip-till	0.6	3.01	3.96	2.52	9.49
No-till planting (compared to clean-till planting)					+2.13

(3) Money saved will depend on your system

(4) The results above would suggest that the typical-till and deep-till systems must either have higher yields, lower pesticide costs, or a combination of higher yields and lower costs in order to have the same profitability as the strip-till and no-till systems.

ii) Fuel savings

(1) Recently surpassed the past record diesel price, set in 1980

(2) The era of cheap petroleum is over and we may be close to peak global oil production (not the amount of oil left in the ground, but how much we are producing) to be followed by plateau and then decline

“By 2011 ... GLOBAL GROWTH WILL MARGINALLY EXCEED SUPPLY SIDE EXPANSIONS.”

-International Energy Agency, 2006

“THE TIME WHEN WE COULD COUNT ON CHEAP OIL... IS CLEARLY ENDING.”

-David O'Reilly, Chairman, Chevron, 2005

“THE ERA OF CHEAP AND ABUNDANT PETROLEUM MAY NOW BE OVER.”

-Samuel Bodman, U.S. Secretary of Energy, 2006

(3) Demand, mainly in China and India, is driving the price

iii) Labor

(1) If it is your time being saved, you can use it to farm more acres, do other things on the farm, or enjoy other activities

(2) If you are paying someone to do tillage work, it is direct savings

iv) Equipment

(1) Less demand means less needed, and less wear and tear on that equipment that is needed

(2) Allows better utilization of the equipment that is needed

v) When all of these small savings are added the result is significant total savings

b) It improves your soil

Growing season evaporation (inches of water) including irrigation and rainfall days (Klocke, 2004)				
Soil under corn canopy				
	Year	Bare	Straw	Water saving from cover
Dryland	1	5.2	5.2	0
	2	6.1	5.7	0.4
Limited irrigation	1	7.6	5.2	2.4
	2	8.5	5.7	2.8
Full irrigation	1	7.6	3.8	3.8
	2	8.5	4.7	3.8

(b) more saved under full irrigation than under dryland conditions

(2) Improved moisture catch and infiltration

	Water intake, inches/hour	
	Wheel traffic rows	Soft rows
Bare soil farming	0.2	0.4
High residue farming w/no-till	0.5	4+

Klein, 2005

Water savings, inches	
Elimination of tillage	0.3 — 0.7 per pass
Reduced evaporation	2 — 3.8
Increased storage	1 — 2
Total:	3.3 — 6.5

	Water and power	Value of saved water	
	\$ per ac	\$ per in	\$ per ac
Deep well water	80–150	3.60–6.25	11.90–40.60
Canal water	70–80	2.80–3.60	9.20–23.40

(3) Costs in above calculations are for the Fall of 2006

iv) Increased organic matter

(1) See Collins talk below

c) It works (produces competitive yields). Here are some examples:

i) Direct seeding

(1) beans into alfalfa or timothy



(2) dry corn

(3) peas

ii) Strip-till



(1) corn into mint, alfalfa, peas, beans, timothy, bluegrass

(2) Yields for 2007 National Corn Growers contest, 7.2 tons in the Basin this year, with a strip-till system

iii) Vertical tillage

(1) Example: Great Plains Turbo-Tiller

(a) Used for corn and alfalfa into timothy fields



4) Why consider high residue farming?

a) It saves you money

b) It improves your soil

c) It works

5) Farmers always have to adapt to changing times

You can do it on your own terms or wait until you are forced to change

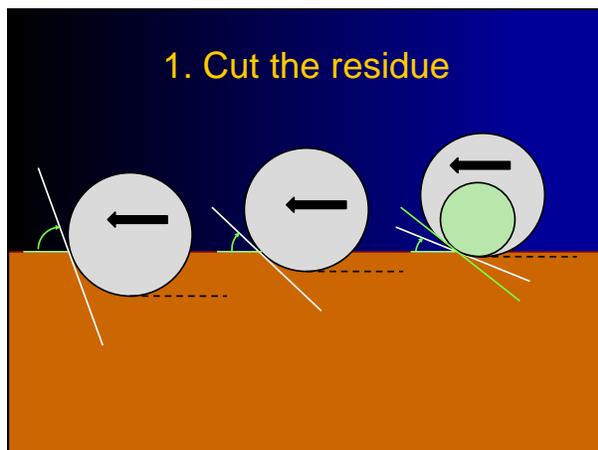
Planters, Drills, and Attachments for High Residue Farming

Andy McGuire, WSU Extension, Grant-Adams Area

- 1) Drills vs. Planters for direct seeding
 - a) Any modern planter can be modified to direct seed
 - b) Drills designed for tilled soils cannot be modified for no-till; a no-till drill must be purchased. The lack of no-till drills is a challenge in the Columbia Basin
1. Four steps to successful no-till planting (from Paul Jasa at previous workshop)
 - a. Cut the residue
 - b. Penetrate the soil to the proper seeding depth
 - c. Ensure good seed-to-soil contact
 - d. Close the seed slot
2. Think of these as separate operations. In tilled soils, the last two are often combined.

1) Step 1: Cut the residue

- a) Residue management must happen first, but it will not be covered here
 - i) Uniform distribution
 - ii) Increase decomposition
 - (1) Humid Midwest conditions are more favorable to decomposition than our drier conditions
- b) Cutting angle between the cutting tool (disk or coulter) is best between 30-45° F. (Think of a pair of scissors)



- 2)
 - i) The deeper you go, the larger the disk you can use. Shallower planting depths require smaller disks:

Cutting Angle of Opening Disks and Coulters at Various Depths								
Disk or Coulter Depth (in.)	Diameter of Opening Disk (in.)							
	12	14	15	16	18	20	22	24
0.25	16.6	15.4	14.8	14.4	13.5	12.8	12.2	11.7
0.50	23.6	21.8	21.0	20.4	19.2	18.2	17.3	16.6
0.75	29.0	26.8	25.8	25.0	23.6	22.3	21.3	20.4
1.00	33.6	31.0	29.9	29.0	27.3	25.8	24.6	23.6
1.50	41.4	38.2	36.9	35.7	33.6	31.8	30.3	29.0
2.00	48.2	44.4	42.8	41.4	38.9	36.9	35.1	33.6
2.50	54.3	50.0	48.2	46.6	43.8	41.4	39.4	37.7
3.00	60.0	55.2	53.1	51.3	48.2	45.6	43.3	41.4
4.00	70.5	64.6	62.2	60.0	56.3	53.1	50.5	48.2

3) You want to be in the green zone.

(1) For shallow planted crops, you may want a coulter in front to go deeper than planting depth while cutting the residue. This should be offset from the row because it will disturb the soil in front of the opener

ii) Disk drills for minimum disturbance

(1) Single disk drills, good at cutting residue

(2) Coulter caddy system in front of double disk openers. The coulters cut the residue in front of the openers.

(3) Disk drills require a lot of down pressure, especially a double disk drill with coulters

iii) Coulters

(1) A gang of coulters in front of the disk openers doubles the required down pressure. You can manage this by either:

(a) Adding weights to drill or

(b) Or taking off coulters and cutting residue with disk openers

iv) Row cleaners

(1) Do you need them?

(a) Perhaps not in a long-term no-till system where residue is managed well

(2) Where can they help?

(a) Where residue is not uniform, to move the piles

(b) Should not be running continually, only for deeper residue. Should only turn half the time. Should not be moving soil.

(3) Many types available

(a) Floating, spiked, single, double, for planters and now drills

(4) Placement in relation to coulters

(a) Before

(i) Useful in heavy residue conditions so that the coulter does not have to cut

everything

(b) After

(i) In lighter residue conditions, usually before double disk openers

v) Problems with cutting the residue

(1) Worn coulters, replace when worn 1-2" (see chart above)



(2) Non-uniform residue distribution. Hard to set the planter for variable conditions.

(3) Long stalks all on ground after grazing

(4) Hairpinning



- (a) Soft sandy soils do not provide a firm surface to cut against
 - (i) Size residue so it does not need cutting or use hoe openers
- (b) Planting into tough fresh residues in the fall
- (c) Piles of deep residue

4) Step 2: Penetrate the soil to the proper seeding depth

- a) Openers
 - i) Disk openers
 - (1) Lower disturbance than hoe openers
 - (2) Require more down pressure
 - (3) Replace when worn
 - ii) Hoe or shank openers
 - (1) Higher disturbance
 - (2) Higher HP requirement
 - (3) Lower down pressure requirement
- b) Depth-gauge wheels
 - i) Hold the openers at the proper depth
 - ii) Reduced inner diameter gage wheels
 - (1) Can cause problems in heavier, wetter soils
- c) Row down pressure

- i) Firmer, untilled soils require higher down-pressures
- ii) If planter is not getting deep enough, there may not be enough down pressure, or weight on the drill/planter
 - (1) Weight of planter should be greater than sum of the row down pressures
- iii) Drills require more weight because of the greater number of rows/openers
- iv) Each coulter or opener for banding fertilizer that is used requires more down pressure

5) Step 3: Ensure good seed-to-soil contact

- a) seed should be pressed into moist soil at the bottom of the seed furrow



- i) This promotes uniform emergence
- b) What does not work in firm untilled soils:
 - i) Small disks following the opener, with wide closing wheel
 - ii) Solid rubber and iron wheels can work, but not in wetter soils
- c) Seed firmers for planters
 - i) Keeton or Rebounder
 - (1) Add down pressure to Keetons with add on devices (Mojo wire)



- ii) Presses seed into bottom of seed furrow
- iii) Can break off if taken across deep circle tracks
- iv) Can be used to apply pop-up fertilizer with seed

d) Seed firmers for drills

i) Firming wheels

(1) Small wheels mud up in wetter soils

(2) Replacement of wider wheels with narrower wheels has some benefits in dryer soils

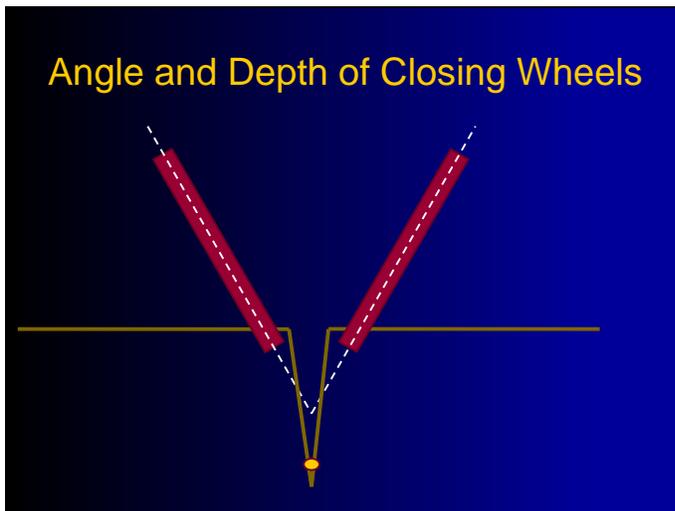
6) Step 4: Close the seed slot

a) Standard rubber closing wheels work OK in softer soils, compact in wet soils

b) Spiked closing wheels do better in wet and firm soils



i) Break up the soil and cover the seed with loose dryer soil



ii) Many types available. Some combinations of solid and toothed wheels used

iii) Do not have to be set aggressive, unlike solid wheels. These do not give seed-to-soil contact and therefore require little or no down pressure.

c) Planter should be level or slightly tail down for these to work

d) Problems

i) Smearing of the sidewall by openers is not alleviated by smooth closing wheels

ii) Solid closing wheels to not close seed slot



iii) Plants emerge through the slot cut by the toothed closing wheels rather than that cut by opener

7) Ideal planting results

- a) Seeds are pressed into moist furrow bottom
 - i) Seed draws moisture from soil and air for germination
- b) At desired, consistent depth
- c) Furrow sidewall is shattered to cover seeds uniformly with loose soil
 - i) Loose soil slows the loss of water, water pores are broken
 - ii) Increased air permeability
 - iii) Higher temperatures

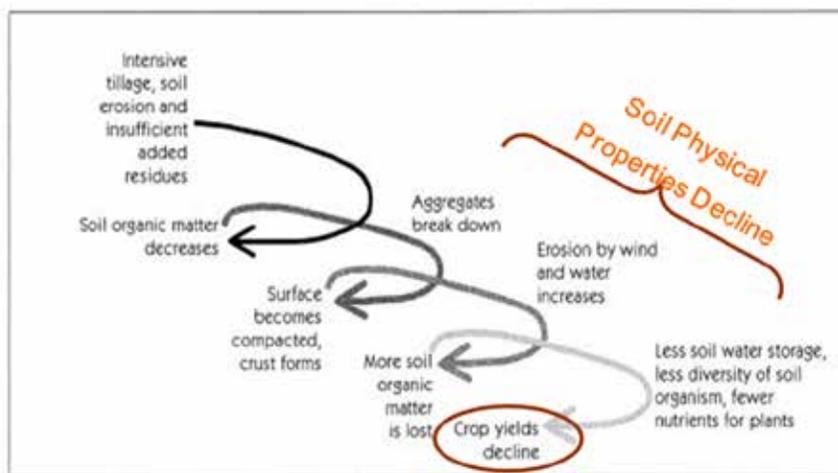
8) Four Steps to Successful Planting

- a) Cut the residue
- b) Penetrate the soil to the proper seeding depth
- c) Ensure good seed-to-soil contact
- d) Close the seed slot

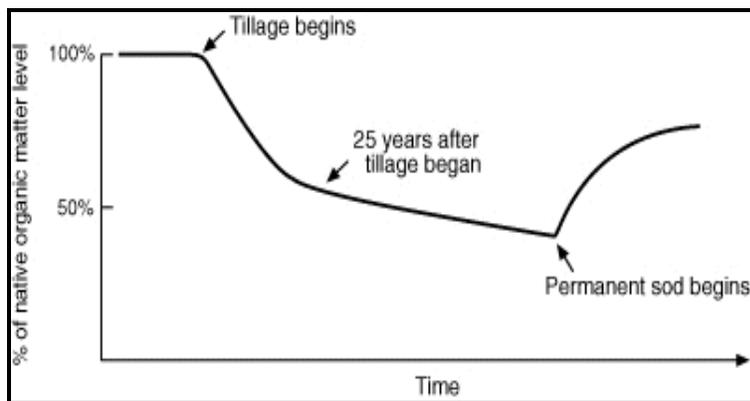
What happens to the soil when you stop tilling it?

Hal Collins, Soil Microbiologist, USDA-ARS, Prosser, WA

- 1) Productivity of our irrigated systems are among the highest in the world
 - a) This has been done under conventional tillage, so why change?
 - i) Soil erosion by water and especially wind in this region
 - ii) Cycle of soil degradation with intensive tillage
 - (1) Intensive tillage leads to soil erosion and decreased soil organic matter (SOM)
 - (2) Decreased SOM leads to breakdown of soil aggregates
 - (3) Crusting and compaction become a problem
 - (4) Intensive tillage need to relieve compaction, back to #1



- iii) Tillage in our desert soils has different effects than on other soil types
 - (1) These soils developed under arid environment, sands – silt loams, under native vegetation with low productivity (1,100 lb C/ac annually)
 - (a) Low OM, low aggregation, low stability, low water storage, high to moderate infiltration. Tillage can degrade these soils further
 - (2) Cultivated crops with irrigation can produce 3,000 – 12,000 lb C/ac annually
 - (3) Without tillage the OM has increased in these soils under pasture or perennial crops
 - (4) Increased frequency of tillage and low residue crops in rotation increases soil erosion, decreases organic matter and associated soil physical properties
 - (a) Low residue crops: onions, potatoes, carrots, sugarbeets
 - (b) Losses due to erosion are offset by increased inputs
 - (i) Water, fertilizer, pesticides, labor, energy



- iv) Plowman's Folly by Edward Faulkner, 1943
- v) Starts with managing residues
- vi) No-till potato research by WSU in 1977
 - (1) Potatoes flat planted, but caused problems with harvest
 - (2) More successful in later harvested potatoes where residues decomposed more before harvest and did not interfere with harvest operation
 - (3) This was adapted by Collins for a reduced tillage potato system
 - (a) Did not flat plant because of harvest considerations in moving a large amount of soil to get tubers
 - (b) Old adage "trashy field, low yield" is not true
- b) Effects of reducing tillage on soil
 - i) Biological, chemical and physical properties change
 - ii) Physical, the "dilution effect" of adding organic matter
 - iii) Increase in soil OM, which increases biological activity which increases aggregation which improved air/water infiltration and water storage, "tilth" and reduces soil erosion
 - iv) Increased SOM
 - (1) Decrease in soil temp, sunlight reflected by residues
 - (a) An advantage in the hot summer months, especially for cool season crops like potatoes, but can be a disadvantage in the spring with slower emergence of crops from cooler soils
 - (2) Decreased bulk density
 - (3) Increase in number and stability of aggregates
 - (4) Increased porosity
 - (5) Decreased resistance to soil penetration
 - (6) Increased water infiltration
 - (7) Increased water holding capacity
 - (8) Increased microbial populations
 - v) These changes take place primarily in top 3-4" of soil
 - vi) How long does it take? Depends on soils types, but takes a minimum of several years to see

most changes. They happen slowly.

vii) Compaction

"Increased frequency of tillage increases soil compaction"

- (1) Restricts root growth.
 - (a) limits water availability
 - (b) limits nutrient availability
- (2) Limits aeration.
 - (a) poor root health
 - (b) increased root pathogens
- (3) Limits tuber growth.

viii) Several researchers have found that it takes a minimum of 2% OM before significant aggregation occurs

- (1) No aggregates in Quincy sands
- (2) Strong relation between OM and aggregate stability

ix) Creates a habitat shift in microflora, microfauna, macrofauna, insects and animals. Most, but not all, of the shifts are beneficial.

- (1) Population levels increase in top 3", but some decreases in 3-6", not much difference overall in top foot
- (2) Changes N cycling, increases immobilization of N, P, and S. Some changes are short-term, others are longer

x) Influence of crop residues/reduced tillage on plant disease

- (1) Most studies have found no change or decreases for many diseases, but there are some diseases that increase. Rotation can control many of these diseases.

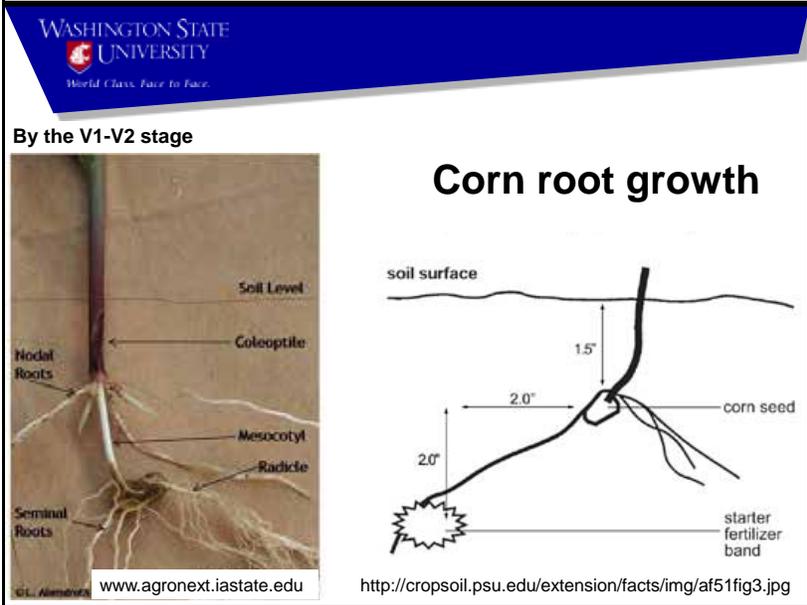
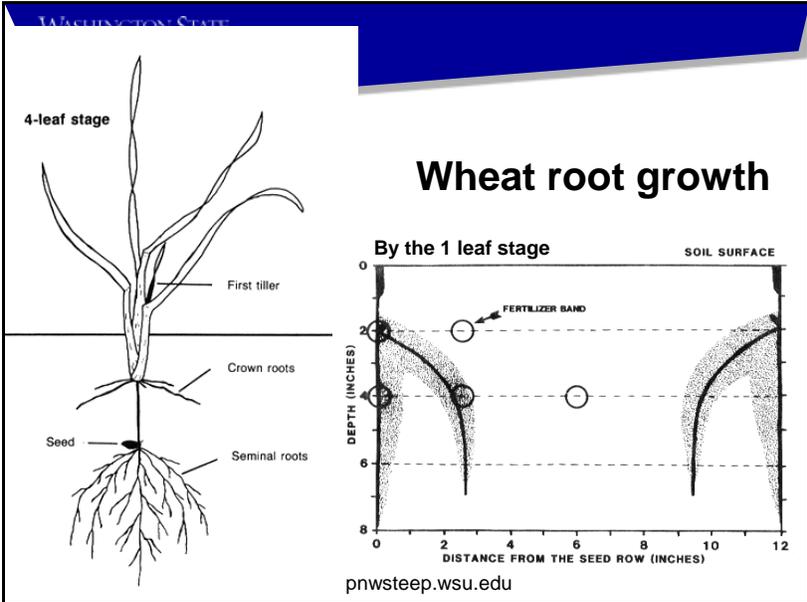
xi) In Collin's study, yields in conventional tillage vs. reduced tillage have shown no significant difference in potato yields, sweet corn yields were ~1 ton less in reduced tillage treatments over five years, perhaps due to weed pressure or cooler soil temperature which delayed emergence. Was not due to diseases.

- 2) Collins has this advice from someone else: *"Never be afraid of something new. Remember that a lone amateur built the ark. A large group of professionals built the Titanic"*

Starter Fertilizer for High Residue Farming

Rich Koenig, WSU Soil Scientist, Pullman

- 1) Challenges of high residue farming
 - a) Lower soil temperature
 - i) 2-5°F lower at 2" depth during planting season
 - (1) Limits early season root growth and nutrient uptake
 - (2) Fundamentally a soil limitation
 - (3) Limits early season shoot growth
 - (4) There is the potential for lower final yields
 - b) Higher soil moisture near the surface
 - c) Lower soil oxygen levels
 - d) Compaction (possible)
 - e) All this creates a greater potential for root disease
- 2) Starter fertilizers can help overcome these challenges
 - a) Types of starter fertilizers
 - i) Low rates of fertilizer placed with or near the seed
 - ii) Early access to nutrients for young roots growing in cool, wet soils
 - b) Placement options
 - i) Banded with the seed (pop up)
 - ii) Banded 2 inches immediately below the seed
 - iii) 2 × 2 placement (2 inches below and 2 inches beside the row)
 - (1) Ideal for corn in tilled systems
 - iv) In furrow over seed row (mainly nitrogen)
 - c) Root architecture as the basis for starter placement



- i) Legumes
 - (1) Primary root grows down, no branching early
 - (2) Placement will be with or below the seed
- d) Benefits of starter fertilizers
 - i) Higher yields in all tillage systems, but more important in high residue systems

Minnesota corn study

	Starter		Residue Cover
	no	yes	
Tillage	-----bushels/acre-----		-----%-----
Chisel plow	161	171	26
Strip till	158	166	64
No till	149	162	87

Starter = 9-23-30

Response to starter in all tillage systems

<http://www.extension.umn.edu/distribution/cropsystems/components/7694c05.html>

- ii) In high residue systems, the benefits of starter are greater for later planting dates. Later planted winter wheat responds better to P starter than earlier seeded winter wheat.
- iii) Response to N-P-K mixture varies with soil nutrient levels
 - (1) Can get responses to nutrient even when soil levels are high because of poor root growth and uptake due to low soil temperatures.
 - (2) N+P starters have a synergistic effect over those of just N or just P.
- iv) Broadcast applications in no-till systems are generally not beneficial because roots cannot access the nutrients [This is true in dryland systems where the soil surface is dry, but not necessarily under irrigation where soil surface remains wet enough for root growth and nutrient uptake at shallow depths]
- v) With green peas in the Walla Walla area
 - (1) N-P-(Zn or S) starters gave best results, 2" below seed row
- vi) Canola responds to banded P in most cases
- e) Summary of starter research
 - i) Many examples of positive yield response (majority) – only a few given here
 - ii) Few examples of no yield response
 - iii) Starter will not solve all problems of early growth
 - iv) Yield response potential increases with
 - (1) Cold, wet, marginal spring conditions
 - (2) Low soil test nutrient levels, particularly P and K
 - (3) Other problems (disease, other stresses)
 - (4) Late seeding?
 - v) Placement options
 - (1) Banded with the seed (pop up), common with wheat and no-till corn
 - (2) Banded 2 inches immediately below the seed, wheat, legumes
 - (3) 2 × 2 placement (2 inches below and 2 inches beside the row), corn
 - (4) In furrow over seed row (mainly nitrogen)
 - (5) Starter formulations are a function of soil-test levels
 - (a) Nitrogen always included in a starter
 - (b) Phosphorus is usually in starter
 - (c) Potassium rarely because many soils have high K levels – may be necessary in the Basin

- (d) Sulfur and micronutrients are rarely included in starters but responses are possible when soil test levels are low
- (6) Rates of starter fertilizers
 - (a) Starter nutrient rates for seed placement
 - (i) Corn (due to wide row spacing)
 1. 5 lb N+K₂O/ac in sandy soils
 2. 10 lb N+K₂O/ac in loam or finer texture soils
 - (ii) Beans and peas (somewhat salt sensitive)
 1. 10 to 15 lb N+K₂O/ac maximum on <12-inch row spacing
 - (iii) Wheat
 1. Up to 20 lb N+K₂O/ac; higher in moist soil
 - (iv) No urea or ammonium thiosulfate; lower rate of UAN or diammonium phosphate (DAP) in seed band (ammonia toxicity issue). Also watch for salt effects on germination when applying with seed
 - (b) Rates for 2 × 2 and 2 below placements
 - (i) Common: around 20-20-20
 - (ii) Corn (because of wide rows)
 1. Maximum 70 lb N+K₂O/ac in sandy soils
 2. Maximum 100 lb N+K₂O/ac in loam or finer soils
 - (iii) Beans and peas
 1. Maximum 100 lb N+K₂O/ac
 - (iv) Wheat
 1. Maximum 100 lb N+K₂O/ac; higher in moist soil
- (7) Summary: Starter fertilizer for high residue farming
 - (i) Possible to overcome many (not all) of the early growth problems associated with reduced and no-till
 1. Higher yields certainly possible
 2. Earlier maturity also possible
 - (ii) Ideal formulation depends on soil test nutrient levels – use soil testing as a guide. N+P very common, with K added as needed.
 - (iii) Precision placement is the key for early interception by roots
- (8) Questions
 - (a) For early season cold conditions
 - (i) Ortho-phosphate are better than poly-phosphates for plant uptake
 - (b) Dual depth band benefits?
 - (i) Shallow band immediately available, but lower rate
 - (ii) Deeper band with higher rates – should work

Strip-tillage for the Columbia Basin

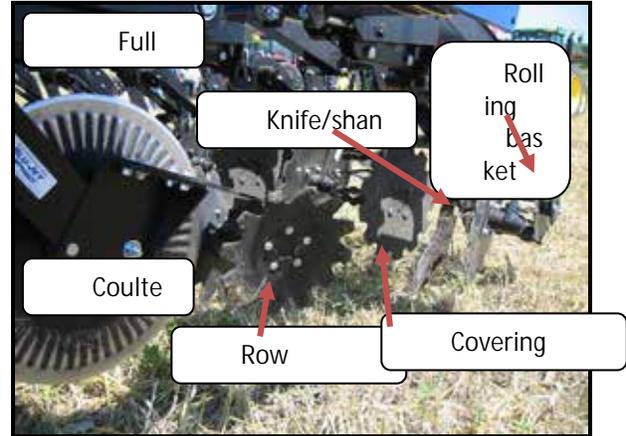
Andy McGuire, WSU Extension

- 1) Introduction
 - a) Attended a Strip-till Expo at the end of July in Waterloo IA
 - i) 10 strip-till machines demonstrated
 - ii) Speakers on strip-till related topics
 - iii) Today I will share what I learned and how it might apply to the irrigated farming systems here.
- 2) Point #1: Strip-tillage is pre-plant, limited-width, in-row tillage



- a) Goals of strip-till in the Midwest
 - i) Higher soil temperatures in the spring
 - ii) Better drainage on heavier, poorly drained soils
 - iii) Fall fertilizer application
 - iv) To achieve these goals in the Northern part of the corn belt, they do fall strip-tillage

b) Basic strip-till machine lineup



i) Coulter

- (1) Large, 18-24"
- (2) Are generally smooth edged
- (3) Sometimes have depth control wheels along side
- (4) Some are spring loaded

ii) Row cleaners, usually toothed

- (1) Placement either in front of coulters or more commonly behind them

iii) Knife or shank

- (1) Many shapes and sizes
- (2) Various tips
- (3) Adjustable to various depths
- (4) Auto-reset or shear bolts for rocky soils

iv) Covering disks/berm builders

- (1) Can be adjusted for various strip widths, heights, and field conditions

v) Rolling baskets or other type of “soil conditioner”

- (1) Used to prepare seedbed for planting
- (2) Often left off in fall strip-till



vi) Companies making strip-tillage machines (there may be others)

- (1) Bigham Brothers, <http://www.bighambrothers.com/>
- (2) Blu-Jet (Progressive Ag Systems), <http://blu-jet.com/>
- (3) Brillion Farm Equipment, <http://www.brillionfarmeq.com/>

- (4) Case IH/DMI, <http://www.caseih.com/>, www.dmifarm.com
- (5) Dawn, <http://www.dawnequipment.com/>
- (6) Hiniker, http://www.hiniker.com/ag_products/
- (7) John Deere, www.johndeere.com/tillage
- (8) Orthman, <http://www.orthman.com/>, <http://precisiontillage.com/>
- (9) Redball, <http://www.redballproducts.com/>
- (10) Remlinger, <http://www.remlingermfg.com/>
- (11) Schlagel, <http://www.schlagel.net/>
- (12) Twin Diamond Industries, <http://www.twindiamondind.com/>
- (13) Unverferth, www.unverferth.com
- (14) Wil-Rich, <http://www.wilrich.com/>
- (15) Yetter, <http://www.yetterco.com/>

c) Options

i) Timing, fall or spring

(1) Fall, to allow soil heating, drainage and fertilizer applications in heavy, poorly drained soils in Northern corn belt. Do these same conditions apply to the Columbia Basin?

(2) Spring

(a) One-pass or two-pass

(i) One pass, with planter attached behind strip-tiller

1. Requires significant horsepower depending on the strip tillage depth and number of rows
2. Does not allow warming of soils before planting
3. If residue is loose and not attached to the soil, the wind can blow it into seed rows

(ii) Two pass

1. Allows strip-tilling and planting to be done by separate operators
2. GPS guidance makes it easier, but is not required
3. Depending on the timing, may allow some soil warming

ii) Depth and width of tillage – depends on your goals

(1) Why are you tilling? If it is to treat compaction, the depth of tillage must be below the depth of the compacted layer. If it is just to loosen soil in the seedbed, the depth can be shallow.

(2) The wider the strip, the less water is saved by residue cover. Make strips only wide enough to achieve your goals. **Wider strips also make it more difficult for later operations to stay between the rows as wheels tend to drift into soft strips.**

iii) Height of tilled mound

(1) Fall vs. spring

(a) Fall strip-till aims for a tall mound, 3-4" high, which will then settle by planting time

(b) Spring strip-till wants a firm seedbed, with less of a mound

iv) Residue management

(1) Depends on the previous crop – corn residues will take more work than dry beans or peas

v) Fertilizer application

(1) N, P, K, depth is adjusted for the crop; wings can place nutrients to side and below the seed row, either liquid, dry, or both.

(2) Spring more effective for P and K applications.

vi) Other

(1) Down pressure – requirements will depend on the soil and residue conditions

(2) Frame strength – continuous corn creates conditions that require a heavier frame as do rocky soils and wider units.

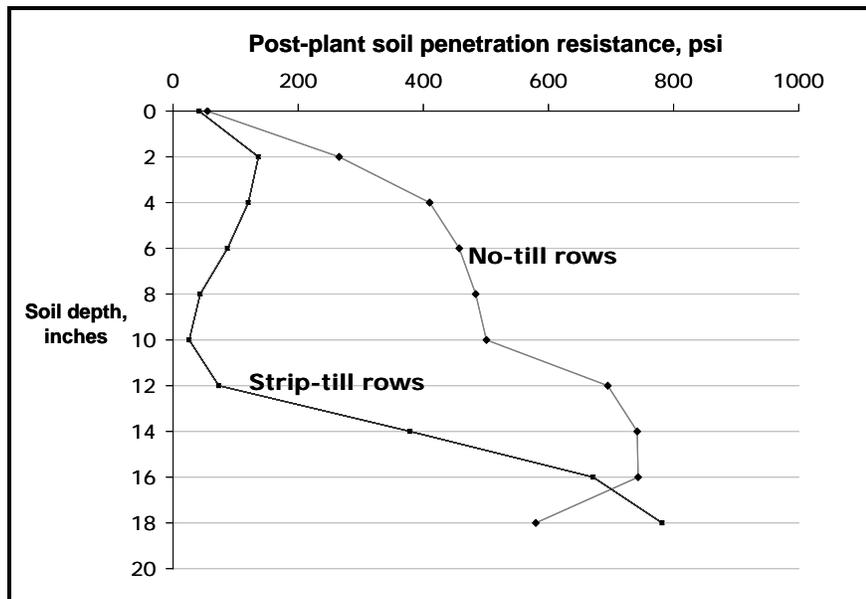
d) The advantage of strip-till is most apparent in cold, wet springs, not in dry, warm springs. It can also help if compaction or poor residue distribution are problems.

3) Point #2: Strip-tillage offers many benefits for Columbia Basin farmers

a) Like no-till/direct seeding, the residues left on the soil surface after strip-tilling can help control wind erosion and improve soil quality

b) Strip tillage helps farmers deal with conditions out of their control

i) Alleviation of compaction, due to harvest equipment (especially with processing vegetables) or grazing



- ii) Manage non-uniform distribution or high amounts of residues, either because you did not have control of the land during the previous crop or because you do not have the equipment needed to spread the residue adequately.



- iii) Short-term leases, where you do not have control of the land before the spring of planting

c) Reduced costs for labor, fuel, possibly water requirements

i) See tables in other McGuire presentation. Compare the amount of time, labor and fuel between obtaining this: Or this:



ii) Example: farmer in George area saved \$20,000 on 8 circles in first year of strip-tilling

d) Allows more double cropping options

i) Examples: Late sweet corn after green peas, dry beans after 1st cutting of timothy or alfalfa

e) Planting with little or no planter modification compared to direct seeding, if the strip till does a good job at removing residue from the seed row

i) A stabilizing coulter can help the planter remain on the rows in a two-pass system

f) Warmer soils

i) Midwest vs. Columbia Basin, how often will warmer soils make a difference in yield here in the Columbia Basin?

ii) Crop residues act as a buffer of temperature so that bare soils are warmer during the daytime, but cooler at night than residue-covered soils.

iii) This may be most important in heavy, poorly drained soils where Pythium and other diseases can damage slow-growing crops

g) Continuous corn

i) Strip-till is one way to deal with the large amounts of residue in continuous corn rotations

h) Fertilizer options

i) Strip-till allows application of N, P and K in bands near the seed

4) Point #3: Strip tillage has challenges too

a) Guidance from above: GPS guidance, although not necessary, is very helpful with strip-tillage.

b) Requires purchase cost of new equipment and horsepower to pull it, especially in a one-pass system



i) Reduce costs by spreading them over more acres by either farming more ground with the time saved or by doing custom strip-tilling

c) Spring strip-till

i) Soils have no time to warm up

ii) Incorporated residue does not break down

iii) Wet soils limit alleviation of compaction

- iv) Consider direct seeding in warm, dry years
- d) Fall strip-till
 - i) Limited by time and equipment demands during harvest
 - ii) Limits flexibility in choosing crops for next year
- 5) Conclusion
 - a) Direct seeding is a good practice, but does not fit many of our constraints here in the Columbia Basin. Strip-till is a good compromise between direct seeding/no-till and clean-till.

Strip-tiller Discussion

Jame Freeman, Othello/Basin City

Sam Krautscheid, George

Alan Williamson, George

- 1) Jame Freeman
 - a) Has been strip-tilling for two years (started with 2006 crop)
 - i) All corn-on-corn, that is why they went to strip-tilling
 - ii) Rent a lot of ground from hunters who only want corn grown on their land
 - (1) Rocky soils almost made tillage prohibitive
 - iii) Orthman 1tRIPr, in a one pass spring system



- (1) Removed the rolling baskets in back
 - (2) John Deere Maximerge planter right behind strip-tiller
 - iv) Has been a successful for them. Allows them to raise continuous corn without primary tillage
- 2) Sam Krautscheid
 - a) Started strip-tilling four years ago (2004 crop season)
 - b) Has a two-pass system spring system
 - c) Saw the potential for custom strip-tilling for farmers who want to do their own planting
 - d) Owns a Case-IH strip-till machine
 - i) Runs a mole knife instead of a shank



- ii) Has allowed them to triple their corn acreage and halve the labor.
- iii) Does custom planting with 12-row planter matched to his strip-till machine



- iv) Have some fields best left to hay production (due to rocks), but this system allows them to grow corn on those fields
- v) Strip-till machine has auto-reset on shanks for rocky soil
- vi) Applies fertilizer with strip-till machine

3) Allan Williamson

- a) Has been strip-tilling since 2004
- b) Recently bought a Schlager machine because it has trip-shanks where their old machine did not. Saves a lot of time replacing bolts.



- c) No trash wheels up front because he could not get them to work well
 - i) Curved shank sheds residue well
- d) One-pass spring system
- e) Soil conditioners run on parallel link. All weight is on this link so seedbed is packed well. Can sometimes be a problem in soft soils.
- f) Lots of machines out there, need to do some experiments
- g) Compared strip-till and no-till beans - found no difference in yields
 - i) In field that was ripped in the fall and planted to a wheat cover crop
- h) The strip-till really works well in double cropped peas
 - i) Allows them to start planting right after peas are harvested
- 4) Q & A
 - a) Are they using the strip-till machines to break up hardpan?
 - i) Williamson – yes, to break up compaction from cattle grazing. Running about 12-14” deep
 - ii) Freeman, 6.5” deep

- iii) Krautscheid, in clean fields can run to 12", more commonly 8-9" deep
- b) How much fertilizer are they putting down with strip-tiller?
 - i) Krautscheid
 - (1) 20-25 gallons of solution 32 per acre
 - (2) 10-34 run through planter for a starter band
 - ii) Williamson
 - (1) Previously he used a 2x2 placement through Sunco openers with planter
 - (2) Now he applies through the shank on strip-tiller, good results at 2-6" deep
 - iii) Freeman
 - (1) Starter applied behind shank
 - (2) 2x2 placement, 20# of N, P when needed
- c) How do you handle the residue in continuous corn?
 - i) Freeman
 - (1) A challenge
 - (a) Always grazed
 - (b) Row cleaners on planter *and* strip-tiller
 - (c) Spraying is a challenge to keep it on the row. The wheels want to go into soft strip-tilled rows
 - ii) Krautscheid
 - (1) Staying between the rows with sprayers seems easier with the Case-IH strip-tiller, perhaps because it has a narrower point, only 1.5" wide.
 - (a) Can go 7-7.5 mph
 - (2) Burns about 0.3 gallons/acre for strip-till machine only in wheat fields, 0.6 gallon/ac in an alfalfa field, and 0.3-0.4 gallons/ac for planter.
 - iii) Williamson
 - (1) ~4 mph for Williamson and Freeman one-pass system
 - (2) Some strip-till systems need higher speeds to work, these will not work with one-pass systems
- d) Weed control?
 - i) Burndown application before strip-tilling has worked well for Williamson. More problems than with conventional tillage.
 - ii) Krautscheid – tank mixes, pre-plant glyphosate, post-plant preemergent, with RR corn he uses early glyphosate with residual.
 - (1) With wheat residue, had a second flush of grasses after first spraying which sometimes requires a second application.
- e) Why not do Fall strip-till?
 - i) Williamson – they are set up for one pass system
 - ii) Krautscheid – custom graziers do tillage in the fall, harvest in fall makes it hard to fit in their schedule
 - iii) Freeman – also grazes all fields which would not fit with fall strip-till. Would like to for higher soil temperatures.
- f) Is there demand for custom work?
 - i) Yes, due to increase in corn acres and growers who do not have planters
 - ii) Also with farmers who want to try strip-till before buying at machine
- g) Narrow rows? 22"
 - i) Williamson – problem with getting residue through machine
 - (1) Maybe with staggered openers
 - ii) Krautscheid – would work behind silage, not grain corn; too much residue

- h) No-tilling into perennial crops?
 - i) Works better than no-till planting into annual crops
 - ii) Less residue than annual crops
 - iii) Works well with dry beans, Tom Grebb at Central Bean
- i) Strip-tilled beans?
 - i) Williamson – strip-tilled beans yielded the same as no-tilled beans in 2007
 - ii) No-till is less of a problem with later planted crops like dry beans (a larger portion of the soybeans in the Midwest are direct seeded than corn for this reason)
 - iii) Freeman – strip tilled beans into alfalfa after first cutting, 30” rows, great yields, did a good job
 - iv) Krautscheid, direct seeded beans into timothy sod with good results
(1) Problem with flexible planters planting shallow at ends of the planter
- j) Are guidance systems necessary?
 - i) Krautscheid - Needed if markers are not used, helps with productivity
 - ii) Williamson – price has come down, uses SF2 with one pass, RTK needed for two-pass system
 - iii) Freeman: there is a lot going on in a one-pass system and the guidance system helps the operator focus his attention on important items other than steering
- k) Corn-on-corn planting?
 - i) Freeman – Splits old rows, same direction, but has RTK guidance to allow him to do this
 - ii) Williamson – SF2 GPS is not accurate enough to split the rows, but it works best to plant there if possible.
- l) Dammer diking?
 - i) Freeman – does not do it any more on most fields, only very steep hills
 - ii) Krautscheid – does not dammer dike strip-tilled fields, having the residue on the soil really saves on early water use
 - iii) Williamson – does not dammer dike, not generally needed.
- m) Circle track problems?
 - i) Freeman – strip-tills across the circle tracks. They usually disk the tracks to fill them in a bit.
 - ii) Krautscheid – plants straight across pivot fields
- n) Second pass in two-pass system?
 - i) Krautscheid, second pass can be done without GPS but it still helps make it easier
- o) Strip-tilling in same direction as previous harvest
 - i) Krautscheid – runs best if all widths, header on combine, strip-tiller and planter are same widths. Very difficult to plant opposite of harvest direction in continuous corn.

High Residue Farming under Irrigation in California

Tom Barcellos, Dairy Farmer, Tipton, California

- 1) Site details
 - a) Has flat fields that are flood (border) irrigated
 - b) Clay loam soils
- 2) His history with high residue farming
 - a) Started in 2001 with no-till planting
 - b) It worked so well that in 2002 he planted 5000 acres for himself and neighbors

- c) Now there are 40,000 acres of no-till/strip-till in his area
 - d) 30% strip-till, 70% no-till on his farm
 - e) He is selling the last of his cultivators because he does not use them any more
 - f) In their system, no-till saves them \$70 per acre over their conventional tillage system
 - g) Less stress because they don't need the quality labor to do all the tillage
- 3) Cropping cycle; wheat – corn – sorghum-sudan (all for silage for dairy), one-year triple crop on 20% of acreage, 50% in alfalfa, the remainder varies.

"The best strip-till machine is the one that you own because that is the one you will make work. There is no one perfect tool for everybody."

a) Wheat

- i) Uses a John Deere 1590 20' no-till drill to plant into 5th year alfalfa, in December, after rain has softened soil. The alfalfa is sprayed out just before planting.



b) Corn

- i) Plants corn with an Orthman 1tRIPr strip-tiller on the same day that the wheat silage is harvested
- ii) The Orthman has a hookup for attaching the planter to strip-till bar
- iii) Orthman is run without the baskets on the back
- iv) Closing wheels on his John Deere planter have been converted to the Schlagel closing wheels
- v) All 30" rows on corn



c) Sorghum-sudangrass hybrid

- i) After corn is chopped and removed, the sorghum-sudan is planted the same day, offset on either side of old corn row with RTK guidance. They have RTK guidance on planters and tractors, SF1 (less accurate) on silage choppers
- d) Ground is disked and re-leveled before planting back to alfalfa



- e) Stripper header
 - i) When he does harvest the grain, he runs a Shelbourne (<http://www.shelbourne.com/harvesting/stripper-header>) stripper header on his wheat and then bales the straw for the horse market
 - ii) Stripper header on black-eyed beans worked great.
- f) Q & A
 - i) Water usage has decreased slightly, 5% less
 - ii) Compaction is a non-issue because of added organic matter and improved soils
 - iii) Strip-till takes care of any rutting from harvest trucks or where soil is too hard for planter penetration
 - iv) Strip tiller is run shallow, about planting depth, but at 6 mph in dry soils to fracture them
 - v) He no-till drilled 25# oats into 4-yr alfalfa stand, took off 4.5 tons of oats, and then harvested alfalfa the rest of the year. The oats seemed to reinvigorate alfalfa. They were going to take the stand out but it looked so good they left it in.
 - vi) Insect and weed pressures have been less since reducing tillage
 - vii) Push Andy to get with Jeff Mitchell and set up a tour with WA and CA producers

For more information go online: grant-adams.wsu.edu

- Previous workshop digests
- Fact sheets
- Links to relevant information

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