Research Update for Apple Weed management

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Outline

- NESARE Project Results
- Critical Weed Control Requirements in High Density Apple Orchards
- Fall Weed Control

What has changed in 15 years ?

- New herbicides
- 900-2000 trees/a
- Inter-tree competition?
- Less shade from tree canopy
- Critical weedfree timing?
- Critical weedfree zone?
- W/wo irrigation?
- Impact on yields/ payback cost of establishment \$



NESARE Partnership Project ('11-12)

- 2 seasons of study in new orchards
- Lamont Fruit Farms and Mason Farms
- Super spindle vs. Tall spindle
- Irrigated vs. no irrigation

- Identify strengths and weaknesses in herbicide treatments.
- Evaluate impact of weed control programs on tree growth.
- Evaluate herbicide treatments for trunk damage.
- 4. Evaluate changes in soil health.

Evaluation of treatments

- DAT days after residual treatment when postemergence needed
- # P sprays number of post-emergence treatments needed
- % WC = % weed cover, goal is <20% avg for the season.
- TCA (trunk cross-sectional area cm²) which is used to predict potential crop load
- Identified weeds that grew through treatments
- Looked for trunk damage, glyphosate?
- Soil health parameters

2nd leaf Summary – Lamont 2012

Materials: Irrigated	**DAT	# Post-Apps	Avg. % WC
Untreated check	-	-	97 a
Prowl 4 qt. + paraquat (P), Rely	33	4	18 de
Surflan 4 qt. + P, Rely	33	4	15 def
Prowl 4 qt. + Chateau 12 oz. + P, Rely	37	3	21 cd
Surflan 3 qt. + Chateau 12 oz. + P, Rely	37	3	17 def
Prowl 4 qt. + GoalTender 3 pt + P, Rely	61	3	8 f
Surflan 3 qt. + Goal Tender 3 pt. + P, Rely	61	4	11 ef
Prowl 4 qt. + glyphosate (G)*	71	2	14 def
Prowl 4 qt. + Chateau 12 oz. + G	37	3	14 def
Surflan 3 qt. + Matrix 4 oz. + P	49	4	20 de
Surflan 3 qt. + Matrix 4 oz. + Goaltender 3 pt. + P	77	4	14 def
Sinbar 8 oz. + P, Rely	33	4	17 def
paraquat, Rely - Post	33	4	37 bc

3 rd Leaf Summary – Mason 2012 No irrigation	DAT	# Post- Apps	Avg. % WC
Untreated check			86 a
Prowl 4 qt. + paraquat (P), Rely	44	2	19 d
Surflan 4 qt. + P, Rely	44	3	18 d
Prowl 4 qt. + Chateau 12 oz. + P, Rely	62	2	10 fg
Surflan 3 qt. + Chateau 12 oz. + P, Rely	46	2	7 ghi
Prowl 4 qt. + GoalTender 3 pt + P, Rely	69	3	11 fg
Surflan 3 qt. + Goal Tender 3 pt. + P, Rely	69	2	10 fgh
Prowl 4 qt. + glyphosate (G)*	64	2	27 bc
Prowl 4 qt. + Chateau 12 oz. + G	62	2	17 de
Matrix 4 oz. + P, Rely	44	1	16 de
Surflan 3 qt. + Matrix 4 oz. + P	44	2	17 de
Surflan 3 qt. + Matrix 4 oz. + Goaltender 3 pt. + P	105	1	5 hi
Alion 5 oz. + P, Rely	44	1	4 i
Sinbar 8 oz. + P, Rely	44	3	13 ef
diuron 4L + simazine 4L + P	64	2	30 b
paraquat, Rely - Post	44	2	31 b

Alion – no winter annuals





Treatment costs

Treatment	\$/treated acre		
Untreated	lost production?		
Surflan (4 qts/a) + 3P	\$ 64		
Prowl H2O (4 qts/a) +3P	\$ 60		
Surflan (3 qts/a) + Chateau (8 oz/a) + 2P	\$ 91		
Prowl H2O (4 qts/a) + Chateau (8 oz/a) + 2P	\$ 97		
Surflan (3 qts/a) + CoalTender (3 pt/a) + 2P	\$106		
Prowin20 (a cts/a) - Goalt inder (1 p/a) + 2P	\$112		
Matrix (4 oz/a) + 1P	\$ 64		
Surflan (3 qts/a) + Matrix (4 oz/a) + 1P	\$ 94		
Surflan (3 qts/a) + Matrix (4 oz/a) + GoalTender (3 pt/a) + 1P	\$154		
Sinbar (8 oz/a) + 2P	\$ 36		
Diuron 4L (1.6 pt/a) + simazine 4L (1 qt/a) + 2P	\$ 26		
Prowl H2O (4 qts/a) + 2 glyphosate	\$ 55		
Prowl H2O (4 qts/a) + Chateau (8 oz/a) + 2 glyphosate	\$100		
Alion + 1P	\$60		

Accumulated NPV (excluding land)

	Max Yield	Break Even	15 yr NPV	20 yr NPV
Lamont unt	1210	15	2,366	9,829
Lamont best	1210	13	6,820	14,283
Mason unt	1000	29	(9,740)	(4,940)
Mason best	1000	22	(4,550)	250
Mason unt	1200	19	(3,171)	4,657
Mason best	1200	15	3,012	10,840

Conclusions

- If perennial weeds not controlled before planting, they will return. Preplant preparation!
- No herbicide program in these plots gave season long control.
- Significant reduction in tree growth in new planting if left weedy which reduced profitability.
 Detected less difference in tree growth in 1-yr established trees.
- The potential crop value was increased by \$2300 per acre in the super spindle planting, and \$1200 per acre in tall spindle plantings compared to the weedy untreated plots – for 2 years.

Conclusions (cont.)

- Prowl or Surflan alone will provide about 30-40 days of weed control: the higher rate, the longer control.
- Adding Chateau (12 oz./acre) or Goaltender to Prowl or Surflan will extend effective control and broaden spectrum of control
- Matrix at 4 oz./acre provided long term control
 60-90 days in 1-yr trees
- Alion will provide 75 days control in trees 3 years or older.
- Sinbar residual was variable 40-87 days
- Diuron + simazine (low rates) cheapest but watch for resistant weeds

Conclusions (cont. and final!)

- Irrigation reduces the duration of residual herbicide.
- What is "safe use" of glyphosate? No trunk damage noted from glyphosate but did see bark flaking on trees that had Gramoxone application in mid-Jun when temps hit 87F.
- The only impact on "soil health": Increased water infiltration rates in weedier plots than weed-free.

"Critical Weed Control Requirements in High Density Apple Orchards"

Objective:

to study the effect of weed competition at different timings on tree growth and potential yield in <u>new high density</u> apples.

What is the critical weed free window for high density orchards?

Methods: Treatment Timings – Weed free periods

The red boxes signify the months of weedfree periods for each treatment. The pink signified earlier treatments in 2014 in the 2nd leaf planting.

8 treatments per site were randomized in 4 - 6 reps, 6 trees per plots

TRT	Apr	May	Jun	Jul	Aug	Sep
1						
2						
3						
4						
5						
6						
7						
8						

Methods

- Prowl at 4 pts/acre + Gramoxone SL 2.0 at 2.5 pts./acre + Induce at .25% applied at the scheduled treatment timings
- The % weed cover was evaluated by estimating the % of ground covered with weeds between trees in 3 locations in each plot.
- Trunk circumference measured at 30 cm above the graft union before and after the growing season.
- The trunk cross sectional area (TCSA) was calculated (cm2). Leader growth was measured (cm) for each tree.
- The average shoot length was multiplied by the number of shoots, added to the leader growth, to calculate the total shoot growth for each season.
- Soil and leaf analysis samples were collected in early August.
- Estimated potential yield by predicting 6 apples could be produced per cm2 of TCSA X trees/acre.

Kast Farms – Gala on M9/337 planted 3' x 12' on April 26 and Sept., 2013



2014 RR site, Gala on M9/336 at 3' x 12' spacing



Kast Farms % Weed Cover

2013	Seasonal %		2014	Season	Seasonal %	
Treatment	Weed	Cover	Treatment	Weed C	over	
May thru Sept	1	D	Apr thru Sep	2	Ε	
May thru Aug	1	D	Apr thu Aug	3	Ε	
May thru Jul	1	D	Apr thru Jul	11	CD	
Jun thru Sep	1	D	May thru Aug	5	DE	
Jun thru Aug	2	D	May thru Jul	15	С	
Jul thru Aug	21	С	Jun thru Aug	11	CD	
Aug thru Sep	42	В	Jul thru Aug	29	В	
Untreated	54	Α	Untreated	74	Α	

Average percent weed cover for each treatment through the season.



2014 Kast Percent Seasonal Weed Cover and Effects on Tree Growth in 2nd leaf.

			TCSA	% Increase			AVG	TOT.
Treatment	Seaso	onal	after	TCSA,	LEADER	#	SHOOT	GROWTH
	% Weed	Cove	r year 2	Yr1 + Yr2	(cm)	SHOOTS	(cm)	(m)
Apr thru Sep	2	Е	9.4 A	353A	68 B	27A	51BC	14.5B
Apr thu Aug	3	Е	9.1 AB	313A	69 B	26AB	48CD	13.7B
Apr thru Jul	11	CD	9.3 A	345A	74AB	29A	50BCD	15.7A
May thru Aug	5	DE	8.9 AB	338A	81A	27A	55 B	15.0A
May thru Jul	15	С	9.6 A	344A	76AB	29A	52 BC	15.8A
Jun thru Aug	11	CD	9.5 A	347A	80A	28A	61A	18.2A
Jul thru Aug	29	В	8.0 B	269 B	81A	22 BC	54BC	12.9B
Untreated	74	А	6.3 C	196C	72AB	18C	45 D	8.7C

Reality Research Plots

2014 Treatment May thru Sep May thru Aug May thru Jul Jun thru Sep Jun thru Aug Jul thru Aug Aug thru Sep untreated

Seasonal % Weed cover 1.2 C 0.6 C 0.7 C 7.6 C 4.9 C 45.5 B 41.3 B 61.9 A



Average percent weed cover for each treatment through the season.



Table 3. 2014 Palmer Percent Seasonal Weed Cover and Effects on Tree Growth in 1st leaf.

TRT	Seaso Weed	nal % cove	TCSA 1	% Increa TCS	ase A	LEAD (cm	ER)	# SHOC)TS	AVG SHOOT (cm)	TOT. Growth (m)
May thru Sep	1.2	С	1.5 A	64	Α	41.2	AB	5.4	AB	28.8A	2.03A
May thru Aug	0.6	С	1.6 A	72	Α	40.9	AB	6.5	Α	26.2AB	2.11A
May thru Jul	0.7	С	1.5 A	60	AB	41.7	AB	5.2	AB	22.6AB	1.72AB
Jun thru Sep	7.6	С	1.5 A	62	Α	45.2	Α	5.8	AB	30.1A	2.2A
Jun thru Aug	4.9	с	1.5 A	59	AB	38.5	AB	4.7	BC	26.3AB	1.63ABC
Jul thru Aug	45.5	В	1.4 A	39	BC	40	AB	3.2	С	17.3B	0.96CD
Aug thru Sep	41.3	В	1.5 A	27	С	34.6	В	2.9	С	16.6B	0.83D
untreated	61.9	Α	1.6 A	25	С	33.7	В	4.2	BC	16.3B	1.06 BCD

Kast - 2nd and 3rd leaf potential fruit production based on 6 apples per cm² TCSA (Gala) for different weed control treatments.

	Potent	ial #		Apple	Potential #		Apple	
TRT	apples	'14	Va	alue '14	apples	'15	Value '15	
Apr thru Sep	23.7	B*	\$	2,607	56.5	А	\$ 6,215	
Apr thru Aug	24.8	AB	\$	2,728	54.5	AB	\$ 5,995	
Apr thru Jul	24.6	AB	\$	2,706	55.6	А	\$ 6,116	
May thru Aug	24.2	В	\$	2,662	53.7	AB	\$ 5,907	
May thru Jul	26.7	Α	\$	2,937	57.4	Α	\$ 6,314	
Jun thru Aug	24.7	AB	\$	2,717	57.0	А	\$ 6,270	
Jul thru Aug	20.8	С	\$	2,288	47.7	В	\$ 5,247	
Untreated	18.2	D	\$	2,002	37.6	С	\$ 4,136	

Leaf analysis results.

Farm	TRT	Ν	К	Р	Ca	Mg
	May thru Sep	2.4	1.64	0.284	0.53	0.238
Kast 1st loaf	Jun thru Aug	2.27	2.02	0.212	0.69	0.254
Kast Ist lear	Untreated check	1.87	1.53	0.207	1.17	0.392
	Planting thru					
	Sept	2.46	1.33	0.181	1.04	0.381
RR 1st leaf	Jul thru Aug	2.17	1.36	0.201	1.4	0.293
	Untreated					
	Check	1.8	1.45	0.153	1.18	0.263
	April thru Sep	2.8	1.91	0.211	1.06	0.227
	May thru Jul	2.39	1.35	0.193	1.21	0.367
Kast 2nd leaf	Jul thru Sep	2.28	1.19	0.231	1.25	0.366
	Untreated check	2.03	1.34	0.243	1.34	0.359

The least percent weed cover for the season had higher N levels and less full color Brookfield Gala compared to the untreated check.



	%	
	Poor color <	%
TRT	50%	Full color
April-Aug	60	39
Untreated	45	66

Conclusions for new plantings:

- If weeds are allowed to establish into July or later, there is significant reduction in tree growth TCSA, and number of shoots to support crop, and potential yields
- If weed control is initiated in May and Jun after planting, the preliminary analysis of this data does not show any difference in tree growth or potential fruit production.
- The only nutrient impacted by treatments was N in leaves. The untreated checks (1.87, 1.8, 2.03) were significantly lower leaf N compared to the least weedy plots (2.4, 2.46, 2.8).
- It is expected that in an unirrigated orchard in a dry season, more differences would be detected.

Economic impact!

There is a potential for \$1600-2900 per acre lost in Gala yield by the 3rd leaf if weeds are not controlled in May through Jul.

Fall Weed Control

Percent weed cover after fall applications in 2012.										
Trootmont	25-Oct-	29-Mar	14-May-	13-Jun-						
ireatment	'12	'13	'13	'13						
Untreated, May 27	34.6	77	90	0						
Goal 2 XL (3 pt) + P *	0.1	0	0	27						
Goal 2 XL (6 pt) + P *	0	0	0	14						
Chateau (12 oz) + P	0.5	1	1	5						
Glyphosate *, May 27	9.4	0	2	1						
Alion (5 oz) + Rely *	0.6	0	0	0						
Matrix (4 oz) + P	3.7	0	0	15						
Gramoxone (P), May 27	0.6	6	9	2						
2,4-D (2.4 qt) + G *, May 27	5.3	1	3	5						
2,4-D *, May 27	22.1	41	75	2						

All treatments included Induce (NIS) at .25%

May 27 – applied glyphosate where listed due to reaching 30% weed cover by May 24.

Pros of fall weed control:

- Removes a time sensitive task from the early spring which competes with many other tasks –fungicide for scab/mildew, fire blight sprays, thinning sprays, tree planting, trellis building, fertilizer applications, and more.
- If weeds are not treated in the early spring, they are generally too tall and have passed their susceptible treatable stage.
- Reliable rains in the fall help to incorporate the residual herbicides into the weed seed germination zone.
- Remove the winter annuals and will help control some persistent perennials.

Winter annuals typical in orchards are hoary bittercress, annual blue grass, purple deadnettle, and chickweed. How much competition from winter annuals in the fall and early spring?

Cons:

- A trashy, weedy surface prevents an even distribution of residual herbicides and failure to stop weed seed germination.
- Winter annuals are good cover crops so not the best option where soil erosion would be an issue.
- One more job after a long season!
- Low hanging fruiting branches will be sprayed with herbicide.
- Use of <u>glyphosate in the fall is very risky</u> in terms of potential uptake in the trees and transport to the root systems. Do not spray across the herbicide strip in one pass under a tree row when using glyphosate especially in the fall!
- Perennial weeds are most susceptible to glyphosate before a frost so may not be effective in a November treatment against them unless they are still green and actively growing.
- Wait to use glyphosate for perennial weeds in the spring.

Perennial Weed Control NY-2/Bud 9, planted in 2013, 3X15 at Reality Research

Row 1	Row 2	Row 3	Row 4
Canada thistle	Canada thistle	Canada thistle	Canada thistle
Horsenettle	Horsenettle	Horsenettle	Horsenettle
Bindweed	Bindweed	Bindweed	Bindweed
Toadflax	Toadflax	Toadflax	Toadflax
Quackgrass	Quackgrass	Quackgrass	Quackgrass
Milkweed	Milkweed	Milkweed	Milkweed

20 trees per weed plot per row,

5 treatments on 4 trees per treatment randomized in weed plot.

To be continued in spring.

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Handout in the back but will also be posted on our website soon.