

Alternatives to Burning Crop Residues in Alfalfa Grown for Seed



Economic/Pest Management Impacts and Interactions Between Selected Burning Alternatives and Precision Crop Spacing

Report June 2009



World Class. Face to Face.

Dr. Douglas B. Walsh, IPM Coordinator, Entomologist

Ms. Sally O'Neal, Research and Extension Communication Specialist



Dr. Rick Boydston, Plant Physiologist, Weed Scientist

Dr. Lyndon Porter, Geneticist, Plant Pathologist



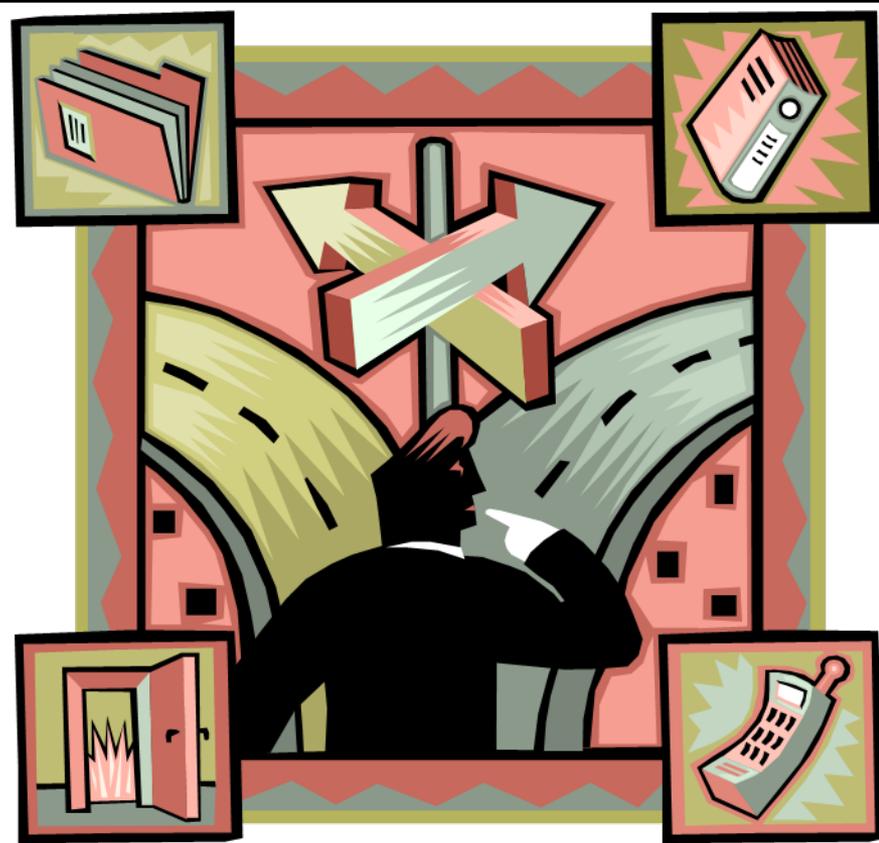
Washington Alfalfa Seed Commission



Cooperators

- **Mr. Mark Wagoner, Commissioner, WA State Alfalfa Seed Commission/ Alfalfa Seed Producer**
- **Mr. Rod Christensen, Administrator, Washington State Alfalfa Seed Commission**
- **Mr. Timothy Waters, WSU Extension Educator**
- **Mr. José Arias, Director of Seed Production, Forage Genetics International**

Alternatives to field burning?



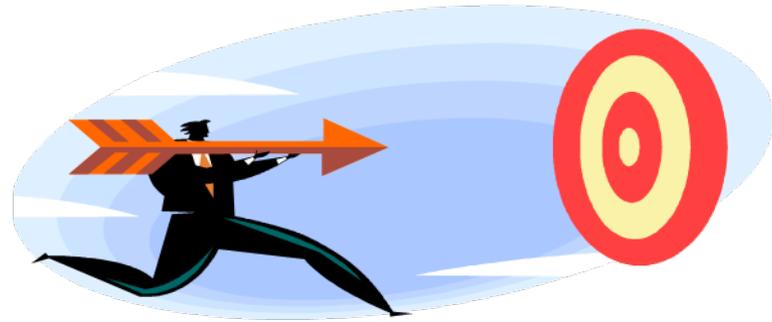
- **removal of hay or stubble**
- **increased insecticide and herbicide use**



- **1. Establish research test plots utilizing precision seed placement.**



• **July 2008**



- **2. Evaluate the interactions between seed spacing, row spacing, tillage, burning, and removal (harvest) of stubble on white mold severity in alfalfa grown for seed.**
- **Spring 2009**

Results 2008 (establishment year)

<u>Row Spacing</u>	<u>Seeds in Row</u>	<u>Plants per Acre</u>	<u>Prickly Lettuce Incidence¹</u>	<u>Salsify Incidence</u>
22"	1-5/8"	117,000	1.6±0.50	1.70±0.70
22"	3-3/8"	80,000	1.8±0.40	1.80±0.58
30"	1-5/8"	71,000	1.7±0.48	1.90±0.68
30"	3-3/8"	48,000	1.7±0.48	1.90±0.57

1/ Weed incidence ± standard deviation rated on a 1-3 scale where 1=<0.5 plant/m²; and 3=1 plant per m²

For this establishment year, there were no significant differences in weed abundance among the different row spacings and seed densities

Results

<u>Row Spacing</u>	<u>Seeds in Row</u>	<u>Plants per Acre</u>	<u>Seed Yield lbs/Acre¹</u>	<u>Stubble Yield lbs/Acre²</u>
22"	1-5/8"	117,000	571±36	1467±66.7*
22"	3-3/8"	80,000	565±54	1081±71.4
30"	1-5/8"	71,000	899±44**	1215±106.0
30"	3-3/8"	48,000	696±53	1162±68.6

1/ Seed yield in pounds per acre ± standard error in August 2008

2/ Stubble yield in pounds per acre ± standard error in January 2009

**/ Seed yields were significantly ($p < 0.01$) greater in the 30" row space and 1-5/8" seed-in-row plots than any of the other treatment combinations in pairwise t-tests.

*/ Stubble yields were significantly ($p < 0.05$) greater in the 22" row space and 1-5/8" seed-in-row plots than any of the other treatment combinations in pairwise t-tests

Economic returns per acre
@ \$1.75 per pound of seed

- 22" by 1-5/8" 571 # \$ 999.25
- 22" by 3-3/8" 565 # \$ 988.75
- 30" by 1-5/8" 899 # \$1,573.25
- 30" by 3-3/8" 696 # \$1,218.00

Mowing and Tilling Jan 2009





Field burning spring 2009



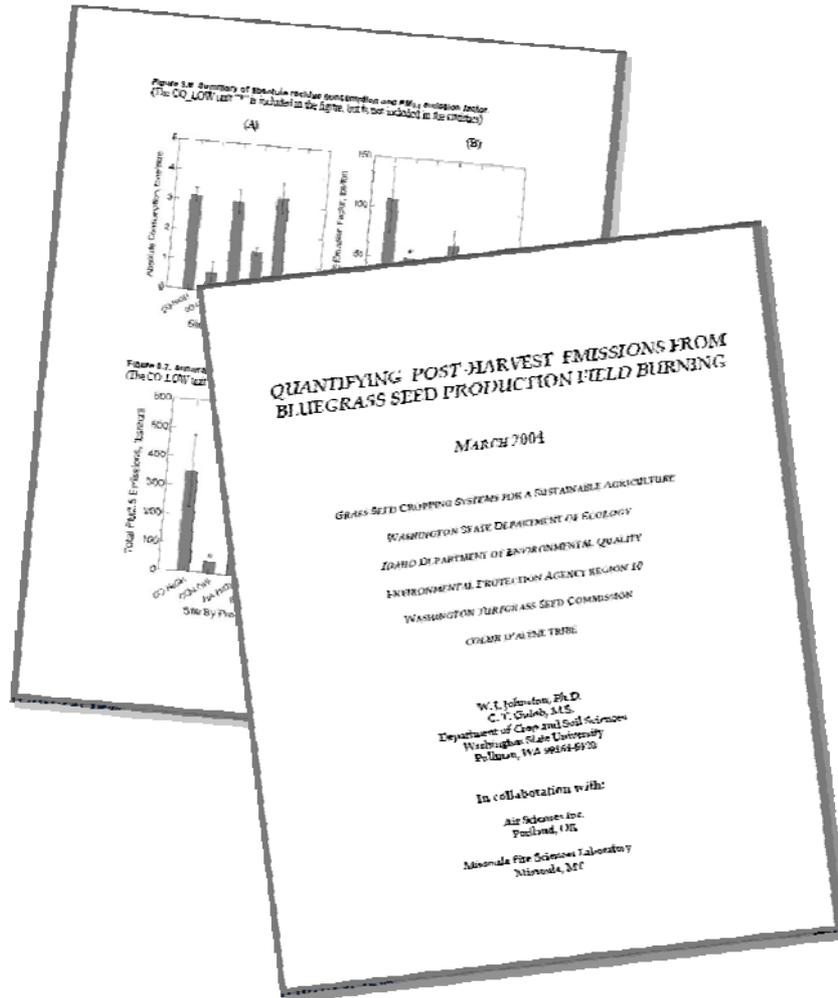
Research plots after burning spring 2009

Looking at Emissions

Johnston, W.J. & C. T. Golob.
2004

Quantifying post-harvest emissions from bluegrass seed production field burning

http://www.ecy.wa.gov/programs/air/aginfo/research_pdf_files/FinalKBGEmissionStudyReport_4504.pdf



Extrapolating from Johnston & Golob, when a burn was conducted on stubble left in a “low load” grass seed field 0.9 tons of combusted residue resulted in:

- 2,881 lbs of CO₂
- 291 lbs of CO
 - 18 lbs CH₄
 - 58 lbs PM_{2.5}
 - 73 lbs of PM₁₀

Combustion efficiency was calculated at 87%



Potential Emissions

Spacing	22x1-5/8	22x3-3/8	30x1-5/8	30x3-3/8
Residue/Acre	0.73 tons	0.54 tons	0.61 tons	0.58 tons
CO ₂ lbs	2337	1729	1953	1857
CO lbs	309	228	258	245
CH ₄ lbs	29	22	24	23
PM _{2.5} lbs	42	31	35	45
PM ₁₀ lbs	53	39	44	42

Spring and Summer 2009 Weeds

- We applied dormant season herbicides.
- An 8' by 8' tarp was placed in each replicate plot prior to herbicide application.
- Weed counts were taken within these plots.
- Canopy closure was calculated and weed competition assessments were taken.

Spring 2009 Disease

- White mold (*Sclerotinia* spp.) spore counts, disease incidence, and severity ratings were calculated when the alfalfa broke dormancy.

Spring 2009 Insects

- Population assessments of pest and beneficial arthropods were taken by sampling the research plots with sweep nets, yellow sticky cards, and pitfall traps.



New Proposal Objectives (1-4)

1. Maintain established research test plots planted at 2 row spacings (22' or 30") and 2 in row seed spacings (1-58" and 3-38").
2. Evaluate the interactions between seed spacing, row spacing, tillage, burning, and removal (harvest) of stubble on white mold severity in alfalfa grown for seed.
3. Determine the impact of seed spacing, row spacing, and alternatives to burning alfalfa seed fields annually on the efficacy of a standard herbicide treatment of simazine, paraquat, and pendimethalin on control of prickly lettuce and other weeds in alfalfa grown for seed in established test plots.
4. Determine the impact of field burnings on the viability of Western salsify, mayweed, and prickly lettuce seed placed at two depths: soil surface and 5 mm deep.

New Proposal Objectives (5-8)

5. Determine impacts of seed spacing, row spacing, tillage, burning, and removal (harvest) of stubble on pest and beneficial insect populations; examine all treatment interactions with insecticide applications.
6. Analyze harvested crop residue for characteristics relevant to biofuel production.
7. Calculate cumulative economic costs and environmental benefits from modifying plant densities and applying annual mowing, tilling, and burning treatments compared to untreated plots.
8. Disseminate key research findings to growers via meetings, publications, and the Internet.

Fiscal Year 2010 for 9 months, September 2009-June 2010

PERSONNEL		
Wilson Peng ¹	Ag Research Technician II @ 10% FTE	\$ 3,259
	Benefits @ 40%	1,304
Chon Rivera ²	Ag Research Technician II @ 10% FTE	3,259
	Benefits @ 43%	1,401
Hourly Labor	\$12/hr for 20 hr/wk for 24 wks	5,760
	Benefits @ 9.7%	559
GOODS & SERVICES		
Mark Wagoner	Compensation for use of 1.7 acres for 80 plots	2,000
TRAVEL		
R/T Prosser to Touchet	100 mi/trip x 50 RT annually @ \$0.585/mi	2,925
OVERHEAD		
WSU Indirect Costs	26% of direct costs, above	5,117
TOTAL		\$25,584

Fiscal Year 2011 for 12 months,**PERSONNEL**

Wilson Peng ¹	Ag Research Technician II @ 10% FTE	\$ 4,519
	Benefits @ 40%	1,808
Sally O'Neal ³	Communications Specialist @ 5% FTE	3,035
	Benefits @ 33%	1,002
Chon Rivera ²	Ag Research Technician II @ 10% FTE	4,519
	Benefits @ 43%	1,943
Hourly Labor	\$12.48/hr for 20 hr/wk for 24 wks	5,990
	Benefits @ 9.7%	581

GOODS & SERVICES

Mark Wagoner	Compensation for use of 1.7 acres for 80 plots	2,000
Publication Costs		1,200

TRAVEL

R/T Prosser to Touchet	100 mi/trip x 67 R/T annually @ \$0.485/mi	2,925
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OVERHEAD

WSU Indirect Costs	26% of direct costs, above	7,381
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TOTAL		\$36,903
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Total for 2 year project is \$62,486