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USDA United States Department Of Agriculture
Agricultural Research Service 

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Washington Alfalfa Seed Commission




Cooperators

- Mr. Tim Wagoner, Chair, WA State Alfalfa Seed Commission/ Alfalfa Seed Producer
- 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

OBJECTIVE 1

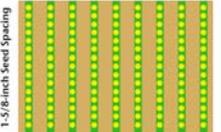
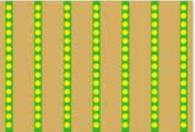
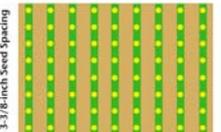
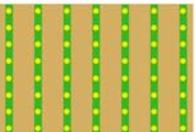


Establish research test plots utilizing precision seed placement.



Summer 2007

Seed Spacing/Row Spacing
(not to scale)

	22-inch Row Spacing	30-inch Row Spacing
1-5/8-inch Seed Spacing		
3-3/8-inch Seed Spacing		

OBJECTIVE 2



Evaluate the interactions between seed spacing, row spacing, tillage, burning, and removal (harvest) of stubble on white mold severity and abundance of insects and weeds in alfalfa grown for seed.

Results

For this establishment year, there were **no significant differences** in

- white mold infection,
- insect populations, or
- weed abundance

among the different row spacings and seed densities.

Weed Results in Detail

Row Spacing	Seeds in Row	Plants per Acre	Prickly Lettuce Incidence ¹	Salsify Incidence
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



Yield Results in Detail

Row Spacing	Seeds in Row	Plants per Acre	Seed Yield lbs/Acre ¹
22"	1-5/8"	117,000	571±36
22"	3-3/8"	80,000	565±54
30"	1-5/8"	71,000	899±44**
30"	3-3/8"	48,000	696±53

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



Mowing and Tilling Jan 2009

Results

Row Spacing	Seeds in Row	Plants per Acre	Seed Yield lbs/Acre ¹	Stubble Yield lbs/Acre ²
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

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

- Dormant season herbicides to be applied.
- 8' by 8' tarp will be placed in each plot prior to herbicide application.
- Weed counts will be taken.
- Canopy closure will be calculated.
- Weed competition assessments will made.



Spring and Summer 2009 Disease

White mold (*Sclerotinia* spp.) spore counts, disease incidence, and severity ratings will be calculated as the alfalfa breaks dormancy and grows through spring.



Spring and Summer 2009 Insects

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





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