INTERMOUNTAIN RESEARCH & EXTENSION CENTER
2013
ANNUAL FIELD DAY

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Research and Extension Center System

Welcome to our Annual Field Day. This event is a collaborative effort involving all of the Center Staff, visiting researchers and many growers and grower groups in the region. The general purpose of the tour is to allow participants a chance to see research being conducted on our Center and interact with Center researchers. We sincerely appreciate the opportunity to share our research programs with members of the community, many of whom have helped sponsor the research and this event.

During the tour, please ask questions freely. If you would like additional information on any project, please seek out a side conversation with the researcher during breaks or over lunch. Additional information on all our research projects is available at the office.

Please enjoy the tour, the lunch and the conversation.

Thanks for coming!

Sincerely,

The IREC Staff

Table of Contents

Intermountain Research & Extension Center

Current Staff

Rob Wilson	Center Director / Farm Advisor
Shanna Done	Business & Financial Manager
Laurie Askew	Cooperative Extension Coordinator
Kevin Nicholson	Staff Research Associate II
Darrin Culp	Staff Research Associate II
Greg McCulley	Senior Farm Machinery Mechanic
Tom Tappan	Farm Machinery Mechanic
Seferino Salazar	Senior Agricultural Technician
Josefina Vallejo	Seasonal Farm Worker
Leopoldo Pedroza	Seasonal Farm Worker
Robert Carver	Seasonal Farm Worker
Matthew Barber	Seasonal Farm Worker/Student Intern

Intermountain Research & Extension Center

Current Research

Project:	**132 Potato Variety Selection Evaluation & Development**
Project Investigators:	**Rob Wilson, Center Director, UC Intermountain Research & Extension Center** **David Holm, Professor of Horticulture, Colorado State University** **Julian Creighton Miller, Professor of Horticulture, Texas A & M University** **Brian Charlton, Cropping Systems Specialist, Oregon State University, Klamath Basin Research and Experiment Center**
Objectives:	**Evaluate new russet, specialty, and chip cultivars developed by public and private breeding programs for adaptation and suitability to Tulelake's unique soil, climate and marketing conditions.**

Project:	**133 Management of Potato Early Die in the Tulelake Basin**
Project Investigators:	**Rob Wilson, Center Director, UC Intermountain Research & Extension Center** **R. Michael Davis, Cooperative Ext. Specialist, Department of Plant Pathology, UC Davis**
Objectives:	**1. Compare the efficacy and cost-effectiveness of different fumigant application rates in fields with a high incidence of early-dying on Tulelake soils.** **2. Evaluate the efficacy of fungicides and biological control of black scurf and black dot.** **3. Determine the effectiveness of stem residue management at harvest on the incidence of early-dying in subsequent potato crops.** **4. Determine if irrigation scheduling can influence the incidence of early-dying disease.**

Project:	**134 Nightshade Control In Potatoes**
Project Investigators:	**Rob Wilson, Center Director, UC Intermountain Research & Extension Center** **Brian Charlton, Cropping Systems Specialist, Oregon State University, Klamath Basin Research and Experiment Center**
Objectives:	**1. Compare weed control efficacy and crop safety of pendeimethalin, dimethenamid-p, metribuzin, eptam and rimsulfuron tank mixes applied pre-emergence at different timings.** **2. Determine if post-emergence application timing of metribuzin plus rimsulfuron or rimsulfuron alone influences control of hairy nightshade; determine if adjuvant choice influences rimsulfuron efficacy.** **3. Determine if special local needs permit is justified for sulfentrazone use in potatoes for nightshade control.** **4. If hairy nightshade populations escape rimsulfuron applied at maximum rate, determine if hairy nightshade and mustard populations are developing herbicide resistance.**

Project:	**146 Cultural Management of New Potato Varieties**
Project Investigators:	**Rob Wilson, Center Director, UC Intermountain Research & Extension Center** **David Holm, Professor of Horticulture, Colorado State University** **Julian Creighton Miller, Professor of Horticulture, Texas A & M University** **Brian Charlton, Cropping Systems Specialist, Oregon State University, Klamath Basin Research and Experiment Center**
Objectives:	**Develop cultivar specific cultural management practices appropriate for the successful introduction of new cultivars into commercial production.**

Project:	**238 Wheat Genetic Resources & Mapping Experiments**
Project Investigators:	**Calvin O. Qualset, Professor Emeritus, Department of Plant Sciences, UC Davis** **Shiaoman Choa, USDA/ARS Research Geneticist, Fargo ND** **Bryce Falk, Department of Plant Pathology, UC Davis**
Objectives:	**1. To grow and make observations on agronomic and disease resistance on advanced breeding and genetic lines,** **2. To make the genetic resources available to any researchers who have interest for their breeding or research,** **3. To genetically characterize two populations of recombinant inbred lines for morpho-physiologic and agronomic traits,** **4. To host the annual meeting of wheat workers in the Western Region, if the group is interested, for discussions of various current research topics and to view the field plantings of widely diverse wheat genetic materials.**

Project:	**239 Improving Spring Barley for Northern Intermountain Areas**
Project Investigators:	**Lynn Gallagher, Researcher, Department of Plant Sciences, UC Davis** **Dr. Pat Hayes, Barley Breeder, Dept. of Crop & Soil Science, OSU Corvallis, Oregon**
Objectives:	**The project objective is to increase grain yield and disease resistance in spring barley adapted to the Klamath Basin.**

Project:	**253 Seeding Rate & Planting Date Effects on Spring Wheat**
Project Investigators:	**Steve Orloff, County Director/Farm Advisor, Siskiyou County, Yreka**
Objectives:	**1. Determine the effect of seeding rate on the yield of four commonly grown hard red and soft white spring wheat.** **2. Assess the impact of planting date on productive tiller production, kernel**

	number, bushel weight and yield 3. Quantify the interaction between seeding rate and planting date.
Project:	**255 Effect of Nitrogen Fertilization Practices on Spring Wheat Protein Content**
Project Investigators:	**Steve Orloff, County Director/Farm Advisor, Siskiyou County, Yreka** **Steve Wright, Farm Advisor –Tulare/Kings Counties** **Rob Wilson, Center Director, UC Intermountain Research & Extension Center**
Objectives:	**1. Compare the protein content of the most popular hard red spring wheat varieties.** **2. Assess the effectiveness of late-season N applications to increase protein in different spring wheat varieties.** **3. Evaluate controlled- and slow-release N fertilizers for improving both grain yield and protein.** **4. Evaluate N application practices and soft white wheat varieties to obtain high yield with low protein content (approximately 10 percent).**

Project:	**260 Development of Wheat Varieties for California**
Project Investigators:	**Dr. Jorge Dubcovsky, Assistant Professor, Department of Plant Sciences, UC Davis** **Oswaldo Chicaiza, Research Assistant, Department of Plant Sciences, UC Davis** **John Heaton, Department of Plant Sciences, UC Davis** **Lee Jackson, Extension Agronomist, Department of Plant Sciences, UC Davis**
Objectives:	**To produce new varieties & improved germplasm and distribute them to growers, breeders and other researchers. A multi-objective project will be conducted which:** **1. Introduces new germplasm for evaluation and breeding.** **2. Develops breeding populations through hybridization, selection and evaluation.** **3. Develops information on the inheritance of characters important to quality and yield in California production environments and finds molecular markers to assist the introgression of these characters into adapted breeding lines, and finally** **4. Produces Breeders Seed for multiplication as new varieties and germplasm for distribution to breeders and researchers. Specific goals are to introduce and**

	maintain disease resistance, maintain or increase grain yield potential and improve end-use characteristics.

Project:	**340 Alfalfa Experimental Germplasm and Cultivar Adaptation and Evaluation**
Project Investigators:	**Dan Putnam, Extension Agronomist, Dept. of Plant Science, UC Davis** **Steve Orloff, County Director/Farm Advisor, Siskiyou County, Yreka** **Craig Giannini, UC SRA, UC Davis**
Objective:	**1. Evaluate certified cultivar differences in alfalfa forage yield, quality, and persistence, and to communicate these results to clientele.** **2. Develop and provide forage yield and performance data on alfalfa experimental germplasm to public and private alfalfa scientists.**

Project:	**343 Characterizing N Fertilizer Requirements of Crops Following Alfalfa**
Project Investigators:	**Dan Putnam, Extension Agronomist, Department of Plant Sciences, UC Davis** **Steve Orloff, County Director/Farm Advisor, Siskiyou County, Yreka**
Objective:	**To determine the impacts of rotation with alfalfa on the N fertilization needs of wheat, to develop an "N Credit" recommendation for management of N fertilizers in non-legumes rotated with alfalfa. Since wheat is a highly responsive crop to N fertilizers, estimates will be made on wheat that can be extrapolated to other crops.**

Project:	**345 Cutting Schedule Effects on Reduced Lignin & Conventional Alfalfa**
Project Investigators:	**Steve Orloff, County Director/Farm Advisor, Siskiyou County, Yreka** **Dan Putnam, Extension Agronomist, Department of Plant Sciences, UC Davis**
Objective:	**1. Determine the effect of a 3-cut versus 4-cut harvest schedule on rate of forage quality change of genetically engineered low lignin alfalfa compared to the null that does not carry the trait and compared with a commercial**

	standard. 2. Determine the appropriate cutting management schedule for low-lignin alfalfa compared with conventional non-genetically engineered alfalfa.
Project:	**349 Fall Harvest Management Strategies for Alfalfa**
Project Investigators:	**Steve Orloff, County Director/Farm Advisor, Siskiyou County, Yreka** **Dan Putnam, Extension Agronomist, Department of Plant Sciences, UC Davis**
Objective:	**Fall harvest management is a critical aspect of alfalfa production in the intermountain area. If the alfalfa plants enter the winter with insufficient root reserves, reduced alfalfa vigor or even winter kill may result. In recent years growers have started harvesting later and later into the fall. The effect of this strategy on alfalfa yield and stand life in the Intermountain environment is not well understood and deserves further research.**

Project:	**367 Avoiding Weed Shifts and Weed Resistance in Roundup-Ready Alfalfa Systems**
Project Investigator:	**Steve Orloff, County Director/Farm Advisor, Siskiyou County, Yreka**
Objectives:	**The objectives of this project are to evaluate alternative herbicides other than glyphosate in a RR system to determine:** **1. The efficacy of alternative herbicides.** **2. The effect of different conventional herbicides on alfalfa yield.** **3. Assess the economics of different weed management systems.**

Project:	**397 Alfalfa Germplasm Evaluation - Fall Dormancy**
Project Investigators:	**Larry Teuber, Professor, Department of Plant Sciences, UC Davis** **Carla E. Rivera, SRA, Department of Plant Sciences UC Davis** **Steve Orloff, County Director/Farm Advisor, Siskiyou County, Yreka**

Objectives:	**1. To determine fall dormancy reaction of cultivars and experimental cultivars that have potential for marketing in California** **2. To determine stability of fall dormancy reactions of check cultivars across years and locations.** **3. To assess the interregional stability of cultivars and a recently adopted set of standard check cultivars.** **4. To evaluate winter injury and follow the relationship between winter injury and fall dormancy.**
Project:	**451 Application of Diallyl Disulfide (DADS) and Fungicides for the Control of White Rot on Garlic and Onions**
Project Investigators:	**R. Michael Davis, Cooperative Extension Specialist, Dept. of Plant Pathology, UC Davis** **Allison Ferry, Graduate Student, Plant Pathology Dept, UC Davis** **Rob Wilson, Center Director, UC Intermountain Research & Extension Center**
Objectives:	**1. Demonstrate the effectiveness of DADS in lowering soil levels of white rot sclerotia.** **2. Demonstrate fungicidal control of white rot in onions and garlic in plots with reduced soil sclerotia levels.**

Project:	**456 Onion Weed Control**
Project Investigators:	**Rob Wilson, Center Director, UC Intermountain Research & Extension Center** **Steve Orloff, County Director/Farm Advisor, Siskiyou County, Yreka**
Objectives:	**1. Evaluate crop and weed response to varied rates and timings of pre- and post-emergence water-run herbicides.** **2. Use the data collected to form UC recommendations and possible herbicide label changes for weed control in onions.**

Project:	**458 Evaluation of Insecticide Seed Treatments for Seed Corn Maggot Control**
Project	**Rob Wilson, Center Director, UC Intermountain Research & Extension Center**

Investigators:	**Larry Godfrey, Cooperative Ext. Specialist, Entomology CAES, UC Davis**
Objective:	**Evaluate the efficacy and crop safety of insecticides applied as a seed treatment and in-furrow at planting for maggot control in onions.**

Project:	**459 Management Practices for Improved Thrips Control in Klamath Basin Onions**
Project Investigators:	**Steve Orloff, County Director/Farm Advisor, Siskiyou County, Yreka** **Rob Wilson, Center Director, UC Intermountain Research & Extension Center** **Larry Godfrey, Cooperative Ext. Specialist, Entomology CAES, UC Davis**
Objectives:	**1. Compare the effectiveness of a range of insecticides for thrips control including standard conventional treatments, organic or low risk insecticides, and experimental insecticides.** **2. Evaluate the two most popular insecticides for thrips control applied via chemigation and a foliar-applied spray application to determine the relative efficacy of the different application methods.** **3. Develop methods to improve the efficacy of chemigation applications.** **4. Evaluate different strategies for thrips management over the season to compare single insecticides, tank mixes, alternating chemistries and application timing.**

Project:	**474 Fungicide Tank-Mix Combinations for Suppression of White Rot in Onions**
Project	**Rob Wilson, Center Director, UC Intermountain Research & Extension Center**

Investigators:	
Objectives:	**1. Evaluate the influence of tank-mixing fungicides for white rot suppression** **2. Determine the crop safety of tank-mixing fungicides** **3. Determine if applying Luna and Vertisan postemergence at the 2-3 leaf stage in combination with in-furrow treatments improves white rot suppression compared to in-furrow treatment alone.**

Project:	**561 Development of Cultural Management Recommendations for the Production of Peppermint in the Klamath Basin**
Project Investigators:	**Rob Wilson, Center Director, UC Intermountain Research and Extension Center**
Objective:	**Determine irrigation, fertilization, and harvest management strategies that maximize peppermint oil yield and oil quality under Klamath Basin soil and climatic conditions.**

Project:	**566 Integrated Pest Management of Insect and Mite Pests of Mint**
Project Investigators:	**Larry Godfrey, Cooperative Ext. Specialist, Entomology CAES, UC Davis** **Kris Tollerup, Post-Doctoral Researcher, Entomology CAES, UC Davis**
Objectives:	**1. To investigate the relationship between spider mite numbers and mint yield and quality.** **2. To determine and compare the cost-effectiveness of registered miticides against spider mites in mint. To study the use of releases of predatory mites for spider mite management in mint in California.** **3. Investigate the use of reduced risk insecticides for management of mint root borer larvae.**

Project:	**569 Weed Control in Peppermint**

Project Investigators:	**Rob Wilson, Center Director, UC Intermountain Research & Extension Center**
Objective:	**1. Investigate winter dormant herbicides for control of groundsel in peppermint.** **2. Investigate winter dormant herbicides efficacy for providing pre-emergent control of summer annual weeds.** **3. Investigate spring post-emergent herbicides for control of emerged summer annual weeds.**

Project:	**703 Medusahead Management Project**
Project Investigators:	**Joseph DiTomaso, UC Davis, Rangeland & Wild Land Weed Specialist** **Rob Wilson, Center Director, UC Intermountain Research & Extension Center**
Objective:	**1. Demonstrate the effectiveness of herbicides for large scale control of downy brome and Medusahead.** **2. Determine the utility of using herbicides and reseeding in sage grouse habitat restoration of desirable native species.** **3. Consider alternative methods of control with and without re-seeding efforts, and to determine the best seeding method when active restoration practices are necessary.**

Project:	**779 Determining Efficacy & Cost of Pocket Gopher Control Practices in Alfalfa**
Project Investigators:	**Steve Orloff, Cooperative Extension Director, Siskiyou County** **Roger Baldwin, Vertebrate Pest IPM Advisor, Kearny Agricultural Center**
Objective:	**1. Compare the effectiveness of four different gopher control measures including trapping, baiting with strychnine using an artificial burrow builder, fumigation with aluminum phosphide, and carbon monoxide injection using the PERC unit.** **2. Quantify the time, labor requirement and material cost associated with each control practice.** **3. Estimate the overall cost effectiveness for each control measure.**

Project:	**988 Oilseed as Alternative Crops for California**
Project Investigators:	**Stephen Kaffka, Extension Agronomist, Dept. of Plant Sciences, UC Davis** **Nicholas Alexander George, Visiting Assistant Project Scientist, UC Davis**
Objective:	**1. Identify the best oilseed species and varieties for California in diverse locations and cropping systems;** **2. Conduct agronomic experiments to determine regionally-specific best management practices;** **3. Use trial data and eco-physiological measurements to validate the crop model APSIM and use the model to estimate the productivity, water and nitrogen use of the oilseeds under different rainfall and irrigation regimes, locations throughout the state, and alternative future climate scenarios;** **4. Use variety performance and agronomic data to parameterize a previously-developed whole farm economic model to evaluate the potential for increased oilseed production in California. The model will help identify price and yield goals for new oilseed crops in diverse regions in the state;** **5. Use yield and agronomic data to create California oilseed production guides;** **6. Carry out extension and outreach activities at the county and regional level to support adoption of new crops, and;** **7. Create publications for California Agriculture.**

Weed Control Research in Potatoes

Rob Wilson, IREC Farm Advisor

Several growers indicated having trouble achieving acceptable control of hairy nightshade, cutleaf nightshade, and mustards over the last two years. Given the large number of weed control failures in 2011-12, Tulelake producers requested a research study comparing the efficacy of different applications timings of pendimethalin, dimethenamid-p, metribuzin, and rimsulfuron applied on potatoes. Growers also requested research evaluating tank-mix combinations of preemergence herbicides to determine if tank-mixes improve weed control.

A weed control trial was established in 2013 at IREC. The trial was located in a field with a history of high populations of hairy nightshade, purslane, and lambsquarter. Treatments were applied with a CO2 backpack sprayer at 30 GPA. Treatment evaluations include visual weed control ratings, weed density, and potato yield.

2013 weed density and potato stand results are presented in the Table on page 16. No herbicide treatment caused visual injury or a reduction in potato stand compared to the untreated control. Herbicide treatments highlighted in green in the table (trts 2, 3, 4, 5, 7, 8, 9, 13, 15, and 16) provided greater than 92% control of hairy nightshade, lambsquarter, purslane, and redroot pigweed by potato row closure. Most top-performing herbicide treatments combined a preemergence herbicide(s) treatment with Matrix plus methylated seed oil (MSO) applied postemergence. Another effective weed control strategy was to apply Matrix + MSO early and then again late postemergence. One postemergence application of Matrix + MSO early or late postemergence failed to provide greater than 90% control of all weed species. All preemergence herbicide failed to provide greater than 90% control of all weed species at potato emergence, thus a postemergence application of Matrix is likely needed in combination with any preemergence herbicide program. Yield data will be collected this fall.

Herbicides Influence on Potato Stand and Weed Density at Various Potato Growth Stages at IREC in 2013.

					Hairy Nightshade Density			Lambsquarter Density			Purslane Density			Pigweed Density	
Trt #	Herbicide Product	Application Timing	Product Rate/A	Potato Stand	Potato emergence	Potato 10 " tall	Potato row closure	Potato emergence	Potato 10 " tall	Potato row closure	Potato emergence	Potato 10 " tall	Potato row closure	Potato emergence	Potato 10 " tall
					plants per plot **										
1	Untreated	N/A		60	526	334	334	51	53	53	166	145	145	4.5	2
2	Eptam	Pre-plant incorporated w/2 row tiller within 1 hr of application	7 pt	61	401	8	6	31	4	3	62	26	1	1.25	0
2	Matrix + MSO*	Postemergence (Potatoes were 2-4 inches tall)	1.5 oz												
3	Outlook	Immediately after planting/hilling (0.5 inches of water to incorporate)	21 fl. oz	59	253	8	2	26	9	4	1	1	0	0.25	0
3	Matrix + MSO	Postemergence (Potatoes were 2-4 inches tall)	1.5 oz												
4	Outlook +	Immediately after planting/hilling (0.5 inches of water to incorporate)	21 fl. oz	61	246	4	2	16	7	2	2	0	0	1	0
4	Prowl H2O	Immediately after planting/hilling (0.5 inches of water to incorporate)	3 pt												
4	Matrix + MSO	Postemergence (Potatoes were 2-4 inches tall)	1.5 oz												
5	Eptam	Immediately after planting/hilling (0.5 inches of water to incorporate)	7 pt	58	451	4	3	16	2	2	4	2	0	2	0
5	Matrix + MSO	Postemergence (Potatoes were 2-4 inches tall)	1.5 oz												
6	Matrix	Immediately after planting/hilling (0.5 inches of water to incorporate)	1.5 oz	60	405	76	10	10	4	6	0	0	0	0	0
6	Matrix + MSO	Postemergence	1.0 oz												
7	Matrix +	Immediately after planting/hilling (0.5 inches of water to incorporate)	1.5 oz	60	239	22	5	12	5	3	1	0	1	1.25	0
7	Eptam	Immediately after planting/hilling (0.5 inches of water to incorporate)	5 pt												
7	Matrix + MSO	Postemergence (Potatoes were 2-4 inches tall)	1.0 oz												
8	Metribuzin 75DF	Immediately after planting/hilling (0.5 inches of water to incorporate)	0.67 lb	57	228	25	5	3	2	1	1	1	0	0	0
8	Matrix	Immediately after planting/hilling (0.5 inches of water to incorporate)	1.5 oz												
8	Matrix + MSO	Postemergence (Potatoes were 2-4 inches tall)	1.0 oz												
9	Metribuzin 75DF	Immediately after planting/hilling (0.5 inches of water to incorporate)	0.67 lb	60	177	20	2	4	2	1	1	0	0	0.25	0
9	Matrix +	Immediately after planting/hilling (0.5 inches of water to incorporate)	1.5 oz												
9	Eptam	Immediately after planting/hilling (0.5 inches of water to incorporate)	4 pt												
9	Matrix + MSO	Postemergence (Potatoes were 2-4 inches tall)	1.0 oz												
10	Matrix +	Postemergence (Potatoes were 2-4 inches tall)	1.5 oz	60	635	63	51	38	2	3	41	0	1	7.25	0
10	Metribuzin 75DF	Postemergence (Potatoes were 2-4 inches tall)	0.67 lb												
10	NIS	Postemergence (Potatoes were 2-4 inches tall)	.25% v/v												
11	Matrix +	Late postemergence (Potatoes were 8 inches tall)	1.5 oz	60	394	297	82	43	69	5	112	106	0	9.5	8
11	Metribuzin 75DF	Late postemergence (Potatoes were 8 inches tall)	0.67 lb												
11	NIS	Late postemergence (Potatoes were 8 inches tall)	.25% v/v												
12	Matrix + MSO	Postemergence (Potatoes were 2-4 inches tall)	1.5 oz	59	461	16	13	53	13	13	105	35	10	16.5	2
13	Matrix + MSO	Postemergence (Potatoes were 2-4 inches tall)	1.5 oz	59	673	15	2	49	8	4	48	18	0	9.25	0
13	Matrix + MSO	Late postemergence (Potatoes were 8 inches tall)	1.0 oz												
14	Matrix + MSO	Late postemergence (shortly before canopy cover of furrow)	1.5 oz	59	348	255	41	40	57	13	63	52	4	12.5	1
15	Dual +	Immediately after planting/hilling (before potatoes emerge)	1.33 pt	60	372	8	4	8	1	3	0	1	0	0	0
15	Reflex	Immediately after planting/hilling (before potatoes emerge)	1 pt												
15	Matrix + MSO	Postemergence (Potatoes were 2-4 inches tall)	1.5 oz												
16	Boundary	Immediately after planting/hilling (before potatoes emerge)	2 pt	60	136	5	1	4	3	2	0	0	0	0	0
16	Reflex	Immediately after planting/hilling (before potatoes emerge)	1 pt												
16	Matrix + MSO	Postemergence (Potatoes were 2-4 inches tall)	1.5 oz												
		LSD P-value < 0.05		NS	187	79	68	15	12	6	65	46	40	7	2

🟩 Treatments highlighted in green provided greater than 92% control of hairy nightshade, common lambsquarter, purslane, and redroot pigweed by the time of row closure.

* Herbicides were broadcast applied at 30 gallons per acre. Methylated Seed Oil (MSO) was applied at 1% v/v. Hasten was used for MSO. Non-ionic surfactant (NIS) was applied at 0.25% v/v. Induce was used for NIS .

**Plot size was 6ft by 25ft. Treatments were replicated four times in a randomized complete block design.

UC Research and Extension Center - Tulelake Field Day, August, 2013

Characterizing N Fertilizer Requirements of Wheat Following Alfalfa

Dan Putnam, Stu Pettygrove, Steve Orloff, Rob Wilson, and Eric Lin[1]

For more alfalfa information, see: http://alfalfa.ucdavis.edu

Description: This study began in 2012, and is being conducted at three locations in California (Tulelake, Davis, and Fresno County), funded by the Fertilizer Research and Education Program (CDFA-FREP). Since N fertilizers are a major cost of production for wheat, corn and other crops, it's very important to accurately match the needs of the crop with fertilizer applications. It is well known that perennial legumes such as alfalfa contribute substantial quantities of residual soil N from N_2 fixation that can be absorbed by the following crop. Alfalfa can produce between 250 and almost 1,000 lbs. of N per acre per year (above ground), greater than 90% originating from the atmosphere through N_2 fixation. The actual amount depends upon yield and protein concentration (Table 1). Although most of this N is removed in the crop, some

Table 1. Crop removal of Nitrogen at different alfalfa yield and protein levels. Shaded area indicates most likely range for California Central Valley locations.

	Crude Protein of Alfalfa Forage					
	16	18	20	22	24	26
	%Nitrogen in Forage					
Tonnage	2.56%	2.88%	3.20%	3.52%	3.84%	4.16%
(t/a)	Crop Removal of N					
	lbs N/acre					
5	256	288	320	352	384	416
6	307	346	384	422	461	499
7	358	403	448	493	538	582
8	410	461	512	563	614	666
9	461	518	576	634	691	749
10	512	576	640	704	768	832
11	563	634	704	774	845	915
12	614	691	768	845	922	998
Shaded area representas most likely outcome						

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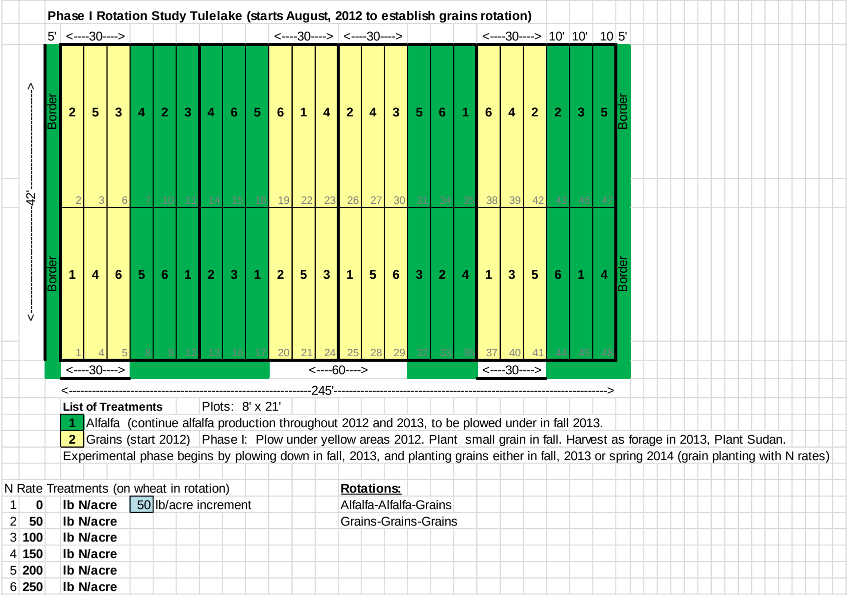
[1] Dan Putnam, Cooperative Extension Forage Specialist, University of California Department of Plant Sciences, One Shields Ave., 530-752-8982 dhputnam@ucdavis.edu; Stu Pettygrove, CE Soils Specialist, Department of Land Air and Water Resources, University of California, Davis, One Shields Ave. 530-752-2533 gspettygrove@ucdavis.edu; Eric Lin, Graduate Student, UC Davis.

portion remains to benefit the following crop. Our objective is to determine the impacts of rotation with alfalfa on the N fertilization needs of the following wheat crop, to develop an ‘N credit’ recommendation for management of N fertilizers in non-legumes rotated with alfalfa. In this experiment, we have removed portions of an existing vigorous alfalfa field, and established wheat-sudangrass as a rotation at least 1 year in advance, with the objectives of removing any of the residual N. In the fall, we plow up both the alfalfa and the grains and establish wheat again. N fertilizers are applied at different rates to the wheat crop, and yield and quality response to N measured. Thus we have wheat following grains and wheat following alfalfa as treatments, along with N rates to estimate the N credit. Soil samples will characterize N profile prior to planting the test wheat crop. The ‘difference method’ will be used to estimate N credits ascribed to the legume (see graph)—this includes non-N rotation benefits (such as soil tilth, diseases, or other benefits) which may be present. This study will enable farmers to use N fertilizers more efficient and save money on N fertilizers, and to reduce the possible effects unnecessary N applications on groundwater quality.



Phase I Rotation Study Tulelake (starts August, 2012 to establish grains rotation)

Border	2	5	3	4	2	3	4	6	5	6	1	4	2	4	3	5	6	1	6	4	2	2	3	5	Border
	2	3	6	7	10	11	14	15	18	19	22	23	26	27	30	31	34	35	38	39	42	43	46	47	
Border	1	4	6	5	6	1	2	3	1	2	5	3	1	5	6	3	2	4	1	3	5	6	1	4	Border
	1	4	5	8	9	12	13	16	17	20	21	24	25	28	29	32	33	36	37	40	41	44	45	48	

List of Treatments Plots: 8' x 21'

🟩 **1** Alfalfa (continue alfalfa production throughout 2012 and 2013, to be plowed under in fall 2013.

🟨 **2** Grains (start 2012) Phase I: Plow under yellow areas 2012. Plant small grain in fall. Harvest as forage in 2013, Plant Sudan.

Experimental phase begins by plowing down in fall, 2013, and planting grains either in fall, 2013 or spring 2014 (grain planting with N rates)

N Rate Treatments (on wheat in rotation)

1	**0**	**lb N/acre**	50 lb/acre increment
2	**50**	**lb N/acre**	
3	**100**	**lb N/acre**	
4	**150**	**lb N/acre**	
5	**200**	**lb N/acre**	
6	**250**	**lb N/acre**	

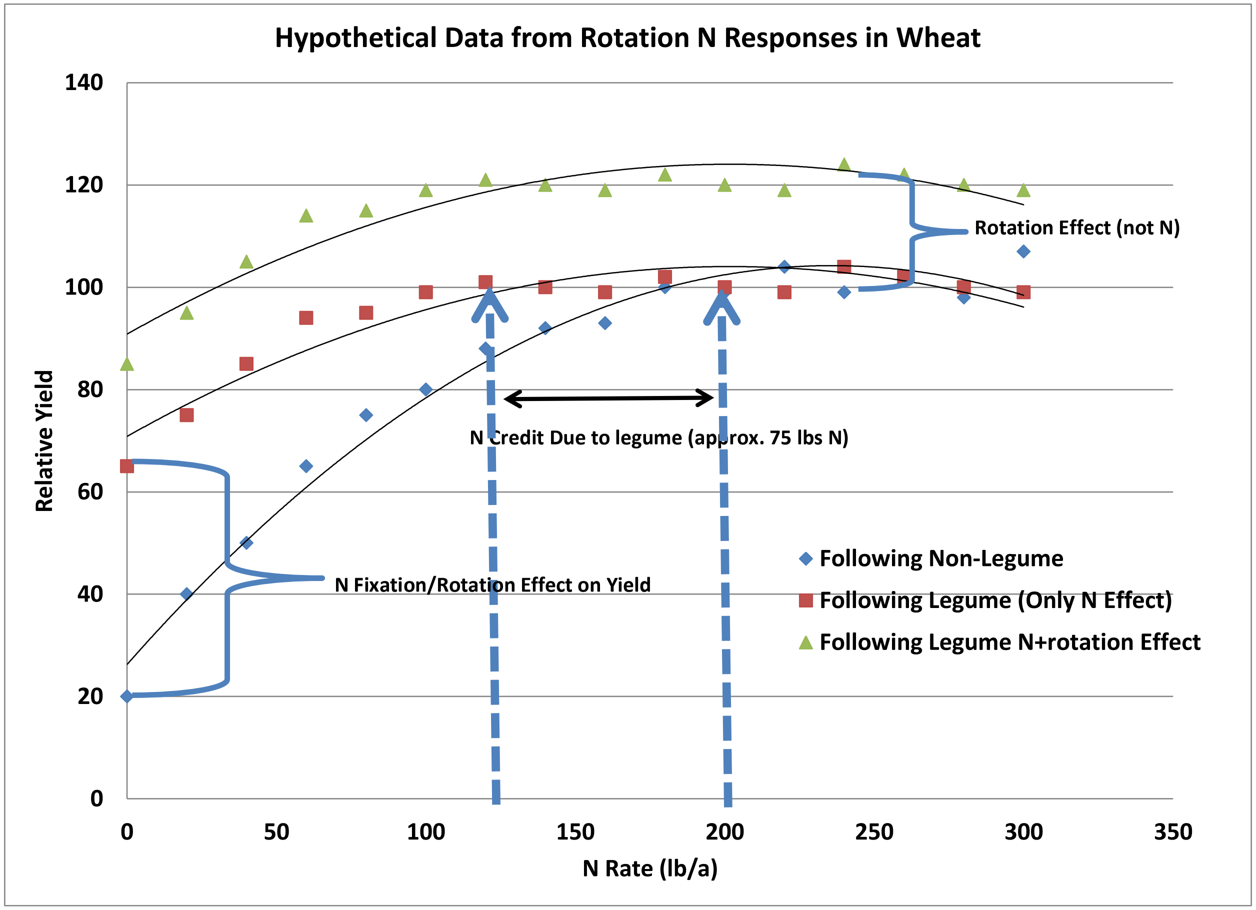
Rotations:

Alfalfa-Alfalfa-Grains

Grains-Grains-Grains

Table 1. Crop Sequence for the alfalfa-wheat rotation studies.

	Year 1 (2012)	Year 1 (2013)	Year 2 (2014)	Year 3 (2015)
Tulelake Phase 1	Establish sudan strips	Continue Rotation Strips - Fall Wheat Establishment	Measure N response in wheat	
Tulelake Phase 2	Continuous alfalfa	Establish non-legume rotation	Continue Rotation Strips - Fall Wheat Establishment	Measure N Response in wheat
Davis Phase 1	Establish Sudan strips	Continue Rotation Strips - Fall Wheat Establishment	Measure N response in wheat	
Davis Phase 2	Continuous alfalfa	Establish non-legume rotation	Continue Rotation Strips - Fall Wheat Establishment	Measure N Response in wheat
Kearney Phase 1	Establish sudan strips	Continue Rotation Strips - Fall Wheat Establishment	Measure N response	
Kearney Phase 2	Continuous alfalfa	Establish non-legume rotation	Continue Rotation Strips - Fall Wheat Establishment	Measure N Response


Hypothetical Data from Rotation N Responses in Wheat
Relative Yield
140
120
100
80
60
40
20
0
N Rate (lb/a)
0
50
100
150
200
250
300
350
Rotation Effect (not N)
N Credit Due to legume (approx. 75 lbs N)
N Fixation/Rotation Effect on Yield
◆ Following Non-Legume
■ Following Legume (Only N Effect)
▲ Following Legume N+rotation Effect

Tulelake Field Day, August, 2013
UC ALFALFA VARIETY TRIALS

Dan Putnam, Steve Orloff, Rob Wilson, and Craig Giannini, UC Davis and UCCE[2].

We have had several alfalfa trials at the UC Intermountain Research and Extension Center:

- **2007 Trial (5 year dataset, completed 2012) 56 lines.**
- **2010 Trial (3 year dataset, to be completed 2013) 32 lines.**
- **2013 Trial (to be planted August, 2013)**

How to Choose? Growers often choose cultivars based upon promotion, price or habit. Ah, those hats! However, the choice of a variety can make a large long-term difference in profitability. Carefully consider your choice of variety, since 1) cultivars can have a large impact upon yield, 2) Varieties can help cope with diseases or insects, and 3) Growers are 'stuck' with their choice for many years.

Almost Like getting Married! Although some marriages don't last too long, most would at least like their marriages to last more than just a few months. Just like a spouse, why not take a little time to determine whether an alfalfa variety is a good one?

UC Variety Testing Program

The University of California provides an independent source of variety information that can be used to judge performance of alfalfa varieties. We have plots ranging from Tulelake and Scott Valley (Intermountain), to Davis and Kearney (Central Valley), and El Centro (Desert).

Yields are important, but are not the only criteria for variety selection. Take a look at fall dormancy, disease resistance, and the quality characteristics, too. Research is continually underway to improve the performance of alfalfa varieties.

Many thanks to CA Crop Improvement Association and alfalfa seed companies for supporting the UC alfalfa trials

For Variety Information, see:
http://alfalfa.ucdavis.edu

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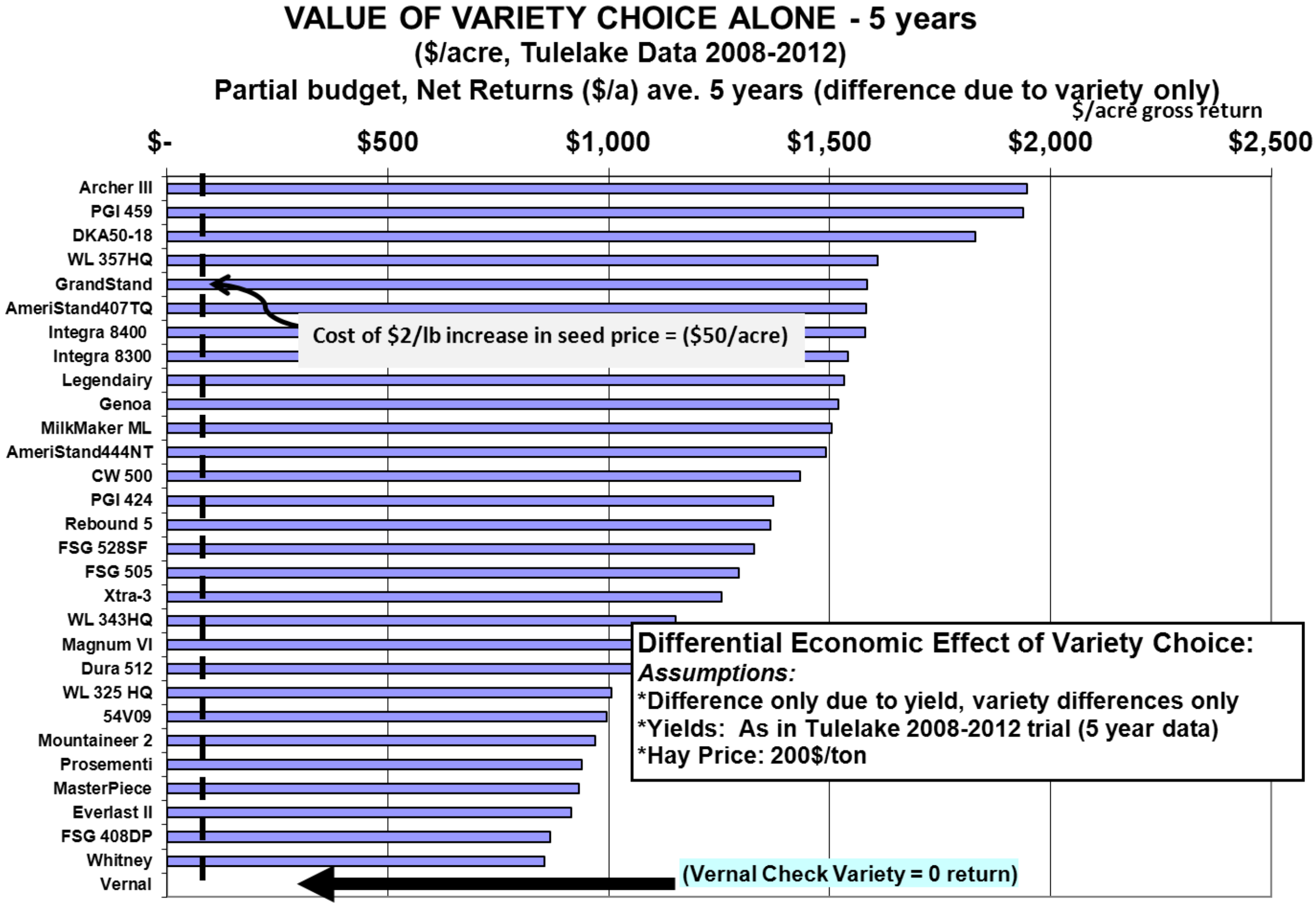
Variety Choice – Does it pay?

You bet. Although sometimes varieties don't appear to be very different, economically, they are. Growers don't always see these differences in the field: one must plant the varieties side-by-side and carefully measure them. The maximum difference between the highest and lowest yielding variety at Tulelake has been close to 2 tons/acre/year, but even among the better varieties, there are some important (but smaller) yield differences. Here, we've calculated the gross economic return (below) based only upon the differences between the varieties (e.g. a 2 ton difference is about $400/year or 2000/5 years), Even if an improved alfalfa seed were $2/lb more than a 'run-of-the-mill' variety, it would still be worth it if that variety yielded more, since only $50/acre is required for the cost of that seed. Growers often pay too much attention to seed price, and should instead pay more attention to how that variety performs.



Steps for Choosing Alfalfa Varieties:

- **1) Choose group of high yielding certified varieties**
- **2) Determine Fall Dormancy requirements**
- **3) Determine pest resistance requirements for your area (emphasize those you expect).**
- **4) Consider Biotech Traits (e.g. RR)**
- **5) Look for evidence of better persistence**
- **6) Consider Forage quality**
- **7) Price/availability, and of course, hats**

Suggested minimum alfalfa cultivar pest resistance and fall dormancy ratings[1] for alfalfa pests found in six California climate zones[2].

Zone[2]	FD	SAA	PA	BAA	PRR	BW	FW	San	Stn	RKN	VW
Intermountain	2--4	S	R	MR	R	R	HR	R	HR	R	R
Sacramento Valley	4--8	MR	HR	HR	HR	MR	HR	R	R	R	R
San Joaquin Valley	7--9	R	HR	HR	HR	MR	HR	R	HR	HR	R
Coastal	5--7	MR	HR	HR	HR	MR	HR	R	HR	HR	R
High Desert	4--7	R	R	R	R	MR	HR	MR	HR	HR	R
Low Desert	8--9	HR	HR	HR	HR	S	HR	HR	R	HR	S

[1] Pest Resistance abbreviations described below.

NOTE: These pest Resistance Ratings were originally developed by Dr. Vern Marble, Extension Agronomist, UC Davis, based upon decades of experience with alfalfa variety response in various locations in California.

[2] Zones correspond to the principle regions of alfalfa Production in California.

Resistance Abbreviations		**Percent resistance[1]**
HR	Highly Resistant	>51%
R	Resistant	31-50%
MR	Moderately Resistant	15-30%
LR	Low Resistant	6-14%
S	Susceptible	<5%
T	Tolerance	(see definition)

[1] Percent of plants in a population resistant to a given pest

2008-2012 DATASET

TABLE 2. 2008-2012 YIELDS, TULELAKE ALFALFA CULTIVAR TRIAL. TRIAL PLANTED 07/27/07

		2008 Yield	2009 Yield	2010 Yield	2011 Yield	2012 Yield	Average		% of VERNAL
	FD			Dry t/a					%
Released Varieties									
Archer III	5	8.6 (1)	8.3 (2)	7.5 (3)	9.8 (1)	8.7 (2)	8.6 (1)	A	129.4
PGI 459	4	8.5 (2)	8.3 (4)	7.8 (1)	9.3 (9)	9.0 (1)	8.6 (2)	A	129.3
DKA50-18	5	8.3 (11)	8.5 (1)	7.6 (2)	9.3 (10)	8.6 (3)	8.5 (3)	A B	127.6
WL 357HQ	5	8.3 (12)	8.1 (6)	7.2 (8)	9.2 (12)	8.4 (5)	8.2 (4)	B C	124.3
GrandStand	4	8.2 (20)	8.0 (10)	7.3 (6)	9.3 (5)	8.3 (10)	8.2 (5)	B C D	123.9
AmeriStand407TQ	4	8.1 (30)	8.0 (9)	7.2 (12)	9.3 (8)	8.4 (4)	8.2 (6)	B C D	123.9
Integra 8400	4	8.0 (34)	8.3 (3)	7.5 (4)	8.9 (22)	8.3 (8)	8.2 (7)	B C D	123.8
Integra 8300	3	8.3 (15)	8.1 (7)	7.2 (9)	9.1 (14)	8.2 (16)	8.2 (8)	B C D E	123.3
Legendairy	3	8.0 (33)	8.1 (5)	7.2 (11)	9.1 (13)	8.4 (7)	8.2 (9)	B C D E	123.1
Genoa	4	8.4 (6)	7.7 (27)	7.3 (5)	9.1 (16)	8.2 (12)	8.1 (10)	B C D E	122.9
MilkMaker ML	5	8.4 (3)	7.6 (37)	6.9 (31)	9.4 (4)	8.4 (6)	8.1 (11)	C D E F	122.7
AmeriStand444NT	4	8.4 (4)	7.7 (31)	7.2 (14)	9.2 (11)	8.1 (24)	8.1 (14)	C D E F	122.5
CW 500	5	8.2 (18)	7.9 (14)	6.8 (38)	9.1 (15)	8.3 (9)	8.1 (15)	C D E F G	121.6
PGI 424	4	8.3 (10)	7.9 (13)	7.0 (24)	8.9 (20)	7.9 (33)	8.0 (18)	C D E F G H I J	120.7
Rebound 5	4	7.9 (38)	8.0 (8)	7.2 (13)	8.6 (33)	8.2 (13)	8.0 (19)	C D E F G H I J	120.6
FSG 528SF	5	8.4 (7)	7.7 (26)	6.9 (35)	8.9 (21)	7.9 (35)	8.0 (24)	C D E F G H I J K	120.1
FSG 505	5	7.8 (46)	7.7 (25)	7.2 (7)	8.7 (29)	8.2 (18)	7.9 (25)	C D E F G H I J K L	119.5
Xtra-3	4	8.4 (5)	7.5 (45)	6.8 (41)	8.6 (31)	8.1 (20)	7.9 (30)	E F G H I J K L M N	119.0
WL 343HQ	4	7.6 (52)	7.7 (34)	6.9 (29)	8.6 (34)	8.0 (26)	7.8 (36)	G H I J K L M N O P Q R	117.4
Magnum VI	4	7.8 (47)	7.8 (18)	6.8 (44)	8.7 (30)	7.8 (45)	7.8 (38)	G H I J K L M N O P Q R	117.0
Dura 512	5	8.1 (24)	7.8 (21)	6.6 (48)	8.2 (49)	7.9 (38)	7.7 (41)	I J K L M N O P Q R	116.4
WL 325 HQ	4	7.8 (48)	7.7 (32)	6.8 (42)	8.1 (52)	7.8 (40)	7.6 (45)	L M N O P Q R	115.2
54V09	4	8.1 (29)	7.6 (39)	6.7 (46)	8.2 (45)	7.5 (54)	7.6 (47)	L M N O P Q R	115.0
Mountaineer 2	5	7.9 (39)	7.3 (50)	6.6 (51)	8.3 (44)	7.8 (39)	7.6 (48)	M N O P Q R	114.6
Prosementi	ND	8.1 (28)	7.2 (53)	6.3 (54)	8.2 (48)	8.1 (21)	7.6 (49)	N O P Q R	114.2
MasterPiece	4	8.0 (37)	7.4 (49)	6.7 (45)	7.9 (55)	7.8 (43)	7.6 (51)	P Q R	114.1
Everlast II	4	7.7 (51)	7.5 (43)	6.8 (43)	8.2 (50)	7.6 (51)	7.5 (52)	Q R	113.8
FSG 408DP	4	7.6 (53)	7.3 (52)	6.8 (40)	8.0 (53)	7.8 (42)	7.5 (53)	R	113.1
Whitney	4	7.9 (41)	6.9 (54)	6.3 (53)	8.8 (26)	7.5 (53)	7.5 (54)	R	112.9
Vernal	2	6.7 (56)	6.5 (56)	5.6 (56)	7.3 (56)	7.0 (56)	6.6 (56)		100.0
Experimental Varieties									
R56Bx214	4	8.3 (9)	7.6 (38)	7.1 (19)	9.5 (2)	8.2 (15)	8.1 (12)	C D E F	122.6
R46Bx164	6	8.1 (26)	8.0 (11)	7.0 (23)	9.4 (3)	8.1 (22)	8.1 (13)	C D E F	122.6
R46Bx197	8	8.3 (8)	7.8 (17)	7.2 (16)	8.9 (24)	8.0 (29)	8.0 (16)	C D E F G H	121.3
R56BD190	ND	8.2 (19)	7.8 (24)	7.2 (15)	8.9 (23)	8.1 (25)	8.0 (17)	C D E F G H I	121.0
R56BD191	ND	8.3 (13)	7.8 (16)	7.1 (17)	9.1 (17)	7.7 (48)	8.0 (20)	C D E F G H I J	120.6
R46Bx218	6	8.1 (31)	7.8 (15)	6.8 (39)	9.3 (6)	7.8 (41)	8.0 (21)	C D E F G H I J K	120.4
R56BD188	ND	8.2 (22)	8.0 (12)	7.2 (10)	8.5 (36)	8.0 (31)	8.0 (22)	C D E F G H I J K	120.3
R46Bx165	8.5	8.0 (36)	7.8 (20)	6.9 (32)	9.0 (19)	8.2 (17)	8.0 (23)	C D E F G H I J K	120.3
R46Bx160	5	7.9 (40)	7.8 (22)	7.1 (20)	9.0 (18)	7.8 (44)	7.9 (26)	C D E F G H I J K L	119.5
R46BD201	ND	8.2 (17)	7.8 (19)	7.0 (22)	8.5 (38)	8.0 (27)	7.9 (27)	D E F G H I J K L	119.5
R46Bx777	ND	8.1 (32)	7.8 (23)	7.1 (18)	8.4 (42)	8.2 (11)	7.9 (28)	D E F G H I J K L M	119.3
R46Bx163	4	8.1 (25)	7.4 (48)	6.9 (30)	8.8 (25)	8.2 (14)	7.9 (29)	D E F G H I J K L M	119.2
R46Bx162	8	8.2 (16)	7.7 (28)	7.0 (28)	8.4 (40)	8.0 (28)	7.9 (31)	E F G H I J K L M N O	118.8
R46Bx211	4.1	7.9 (44)	7.3 (51)	7.0 (25)	9.3 (7)	7.9 (37)	7.9 (32)	E F G H I J K L M N O P	118.7
R46Bx167	4	8.2 (23)	7.7 (29)	7.0 (27)	8.5 (37)	7.9 (34)	7.9 (33)	E F G H I J K L M N O P Q	118.5
R46BD203	ND	8.3 (14)	7.4 (47)	6.9 (33)	8.6 (32)	7.9 (36)	7.8 (34)	F G H I J K L M N O P Q	118.0
R56Bx212	6	7.9 (42)	7.5 (42)	6.8 (37)	8.6 (35)	8.1 (23)	7.8 (35)	G H I J K L M N O P Q R	117.5
R46Bx778	ND	8.2 (21)	7.5 (41)	6.6 (50)	8.7 (27)	7.7 (47)	7.8 (37)	G H I J K L M N O P Q R	117.1
R46Bx173	5	7.7 (50)	7.5 (44)	6.9 (36)	8.5 (39)	8.2 (19)	7.7 (39)	H I J K L M N O P Q R	116.8
TS 4028	4	7.9 (43)	7.5 (40)	7.0 (26)	8.2 (47)	8.0 (30)	7.7 (40)	I J K L M N O P Q R	116.5
R46Bx775	ND	8.1 (27)	7.7 (30)	7.0 (21)	8.1 (51)	7.5 (52)	7.7 (42)	I J K L M N O P Q R	116.3
R46Bx161	6	7.5 (55)	7.7 (33)	6.9 (34)	8.4 (41)	7.9 (32)	7.7 (43)	J K L M N O P Q R	116.0
R56BD202	ND	7.8 (45)	7.6 (35)	6.5 (52)	8.7 (28)	7.6 (49)	7.7 (44)	K L M N O P Q R	115.7
R46Bx217	8	8.0 (35)	7.4 (46)	6.6 (47)	8.3 (43)	7.7 (46)	7.6 (46)	L M N O P Q R	115.0
R46Bx776	ND	7.7 (49)	7.6 (36)	6.6 (49)	8.2 (46)	7.6 (50)	7.6 (50)	O P Q R	114.1
R66BD108	ND	7.6 (54)	6.8 (55)	5.9 (55)	7.9 (54)	7.1 (55)	7.1 (55)	S	106.7
MEAN		8.05	7.69	6.93	8.71	7.99	7.87		
CV		5.8	4.5	4.5	8.7	4.9	3.8		
LSD (0.1)		0.49	0.37	0.33	0.81	0.42	0.32		

Trial seeded at 25 lb/acre viable seed at Intermountain Research and Extension Center, Tulelake, CA.

Entries followed by the same letter are not significantly different at the 10% probability level according to Fisher's (protected) LSD.

FD = Fall Dormancy reported by seed companies.

2011-2012 DATASET

TABLE 4. 2011-2012 YIELDS, TULELAKE ALFALFA CULTIVAR TRIAL. TRIAL PLANTED 8/17/10

		2011 Yield	2012 Yield	Average		% of VERNAL
	FD		Dry t/a			%
Integra 8400	4	8.2 (8)	8.9 (1)	8.6 (1)	A	110.9
R57M130 FG	5	8.3 (4)	8.8 (4)	8.5 (2)	A B	110.5
MS Sunstra 803	4	8.8 (1)	8.2 (23)	8.5 (3)	A B C	110.0
HybriForce 2400	4	8.3 (3)	8.6 (12)	8.5 (4)	A B C D	109.5
WL 357 HQ	4	8.2 (7)	8.7 (7)	8.5 (5)	A B C D	109.5
Archer III	5	8.0 (14)	8.9 (2)	8.4 (6)	A B C D E	109.2
R57M129 FG	5	8.3 (2)	8.5 (17)	8.4 (7)	A B C D E	108.9
WL 363 HQ	5	8.2 (10)	8.7 (8)	8.4 (8)	A B C D E	108.9
PGI 459	4	8.2 (9)	8.5 (16)	8.4 (9)	A B C D E	108.4
AmeriStand407TQ	4	8.1 (12)	8.6 (13)	8.3 (10)	A B C D E F	108.0
Syngenta 6422Q	4	8.0 (17)	8.7 (5)	8.3 (11)	A B C D E F	108.0
R46Bx162	4	8.0 (13)	8.6 (11)	8.3 (12)	A B C D E F	107.9
DG4210	4	8.2 (5)	8.4 (20)	8.3 (13)	A B C D E F	107.8
R46Bx163	4	7.9 (20)	8.7 (6)	8.3 (14)	B C D E F	107.5
GrandStand	4	8.2 (6)	8.3 (22)	8.3 (15)	B C D E F	107.4
Lightening IV	4	7.7 (25)	8.8 (3)	8.3 (16)	B C D E F	107.4
R47M312 FG	4	8.0 (15)	8.5 (15)	8.3 (17)	C D E F G	107.0
Syngenta 6422Q-EMD	4	7.8 (23)	8.7 (9)	8.2 (18)	D E F G	106.6
R47M120 FG	4	7.8 (24)	8.6 (10)	8.2 (19)	D E F G H	106.4
Rebound 6.0	4	7.9 (19)	8.5 (18)	8.2 (20)	E F G H I	106.2
MasterPiece II	4	7.9 (21)	8.5 (19)	8.2 (21)	E F G H I	106.1
Integra 8300	3	7.8 (22)	8.4 (21)	8.1 (22)	F G H I J	104.9
R48M153 FG	4	7.6 (29)	8.6 (14)	8.1 (23)	F G H I J	104.8
R56Bx212	5	7.9 (18)	8.2 (25)	8.0 (24)	G H I J	104.1
Dura 512	5	8.1 (11)	7.9 (29)	8.0 (25)	G H I J	103.9
Xtra-3	4	7.7 (26)	8.2 (24)	8.0 (26)	H I J K	103.2
Mountaneer II	5	8.0 (16)	8.0 (28)	8.0 (27)	I J K L	103.1
R48W224 FG	4	7.7 (27)	8.2 (26)	7.9 (28)	J K L	102.7
Minerva	5	7.4 (31)	8.1 (27)	7.8 (29)	K L	100.4
Vernal	2	7.6 (28)	7.8 (30)	7.7 (30)	L	100.0
Rugged	3	7.4 (32)	7.4 (31)	7.4 (31)	M	95.9
R65BD278	6	7.4 (30)	7.2 (32)	7.3 (32)	M	94.6
MEAN		7.96	8.41	8.18		
CV		4.0	4.1	2.8		
LSD (0.1)		0.34	0.37	0.25		

Trial seeded at 25 lb/acre viable seed at Intermountain Research and Extension Center, Tulelake, CA.

Entries followed by the same letter are not significantly different at the 10% probability level according to Fisher's (protected) LSD.

FD = Fall Dormancy reported by seed companies.

Management Strategies for Suppressing White Rot in Processing Onions

Mike Davis and Allison Ferry, UC Davis Plant Pathology

INTRODUCTION

White rot, caused by the soil inhabiting fungus *Sclerotium cepivorum*, is the most devastating (and arguably most important) disease of onion and garlic worldwide. There are several factors in what makes the disease so severe. The first is that a very small amount of the fungus present in the soil can cause significant disease losses. The disease overwinters by small, hardened, black spores called sclerotia. There only needs to be 2-3 sclerotia per kilogram of soil to cause a significant number of plants to be diseased. It is very difficult to reduce the number of the sclerotia in the soil because they can remain viable for more than 30 years in the soil, even when no onion or garlic has been planted.
The best way to reduce numbers of sclerotia in the soil is by the application of a germination stimulant (SGS). When an SGS is sprayed onto a fallow (or non white rot host plant) and incorporated, it induces sclerotia to germinate. Once they start to grow, they cannot find a suitable host, so they die. Sclerotia germination stimulants can reduce numbers of sclerotia in the soil up to 98%, which would be more than adequate to control most diseases; however, a very small number of sclerotia can cause significant disease. In most situations, SGS applications must be combined with a fungicide application for adequate disease control.

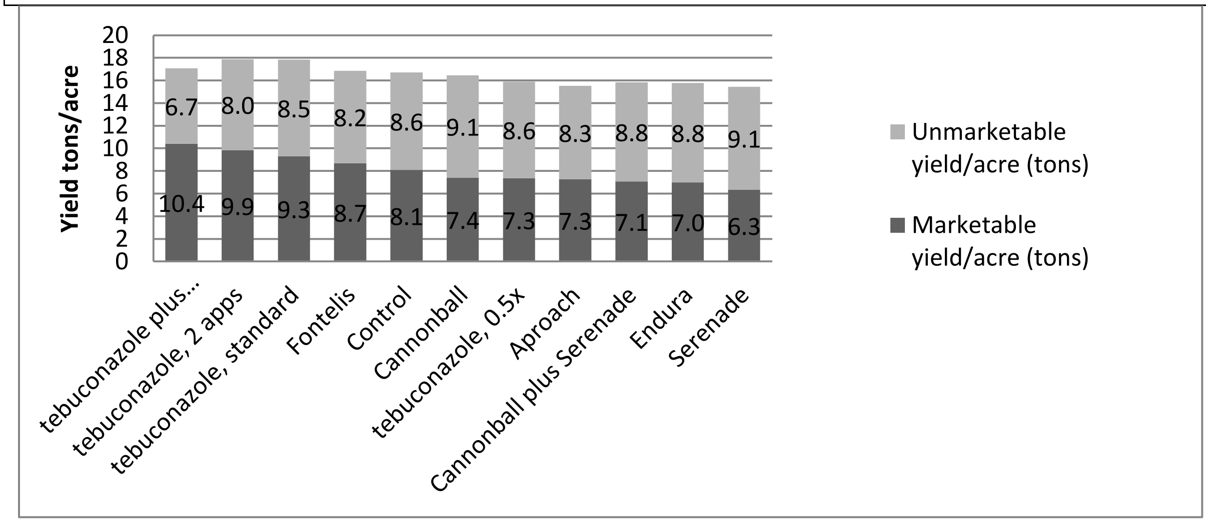
Currently Labeled Fungicides

- **Orius/ Folicur (tebuconazole): Group 3, DMI**
- **Cannonball (fludioxonil): Group 12, MAPHK osmotic signal transduction**
- **Endura (boscalid): Group 7, SDHI, complex II**

New Fungicides (not currently labeled)

- **Luna Privilege (fluopyram): Group 7, SDHI, complex II**
- **Luna Experience (fluopyram plus tebuconazole)**
- **Fontelis (penthiopyrad): Group 7, SDHI, complex II**
- **Mervion (fluxapyroxad and pyraclostrobin): SDHI and strobilurin**

2012 FUNGICIDE TRIAL RESULTS



Results: Disease pressure was extremely high, there were no significant differences between treatments.

2013 TRIALS

Fungicides and Biological Controls, 2013

#	Treatment	Active Ingredient	application at planting	application 1 month after planting	application 2 months after planting	application 3 months after planting
1	Control	n/a	n/a			
2	tebuconazole	tebuconazole	tebuconazole: 20.5 fl oz/A			
3	Cannonball	fludioxonil	Cannonball: 7 oz/A			
4	Fontelis	penthiopyrad	Fontelis: 20 fl/A			
5	Serenade, single application	*Bacillus subtilus* QST713	Serenade: 4 qts/A			
6	tebuconazole plus Cannonball	tebuconazole plus fludioxonil	tebuconazole: 20.5 fl oz/A, Cannonball: 7 oz/A			
7	Mervion	xemium and pyraclostrobin	Mervion: 11 fl oz/A			
8	Serenade soil, monthly applications	*Bacillus subtilus* QST713	Serenade: 2 qts/A	Serenade: 2 quarts/A	Serenade: 2 quarts/A	Serenade: 2 quarts/A
9	Serenade soil and Luna Experience, single application	Serenade: *B. subtilis* QST713 Luna Experience: fluopyram and tebuconazole	Serenade: 4 qts/A, Luna Experience: 17 fl oz/A			
10	Luna Experience, single app and Serenade, monthly apps	Serenade: *B. subtilis* QST713 Luna Experience: fluopyram and tebuconazole	Serenade: 2 qts/A, Luna Experience: 17 fl oz/A	Serenade: 2 quarts/A	Serenade: 2 quarts/A	Serenade: 2 quarts/A
11	tebuconazole plus Fontelis	tebuconazole plus penthiopyrad	tebuconazole: 20.5 fl oz/A Fontelis: 20 fl oz/A			
12	tebuconazole plus Fontelis plus Cannonball	tebuconazole plus penthiopyrad plus fludioxonil	tebuconazole: 20.5 fl oz/A Fontelis: 20 fl oz/A Cannonball: 7 oz/A			

SGS 2012, Fungicides 2013

2012 Treatments

Treatment		Rate
1	DADS	1 gallon per acre
2	Garlic oil	1 gallon per acre
3	Untreated	n/a

2013 Treatments

	Treatment		Rate (at planting)
1	tebuconazole	tebuconazole	20.5 fl oz/acre
2	Cannonball	fludioxonil	7 oz/acre
3	Fontelis	penthiopyrad	20 fl oz/acre
4	Serenade	Bacillus subtilis QST713	4 qts/acre
5	Folicur plus Cannonball	tebuconazole and fludioxonil	tebuconazole: 20.5 fl oz/acre, fludioxonil: 7 oz/acre
6	Untreated	n/a	n/a

SGS 2013, Fungicides 2014

#	Treatment	Rate
1	Control	n/a
2	Garlic Juice formulation 1, full rate	1 gallon/acre
3	Garlic Juice formulation 2, full rate	1 gallon/acre
4	Garlic Juice formulation 1, half rate	0.5 gallon/acre
5	Garlic Juice formulation 2, half rate	0.5 gallon/acre
6	DADS	1 gallon/acre

Preliminary Recommendations

To Prevent New Infected Fields:

- Use clean, disease free garlic seeds and onion transplants
- Clean tractor equipment, shoes, etc. between infected and uninfected fields
- Don’t let irrigation water in infected fields to spread to clean fields

When You Find a New Infected Field:

- Reduce further spread of the disease to new areas
    - Wash equipment between healthy and infected fields
    - If possible, prevent the spread of irrigation water between healthy and infected fields
    - After harvest, do not compost or till under infected bulbs; dispose of them
- Reduce irrigation, which may slow disease progress
- Once infected plants are found, there are NO chemical controls which will stop or reduce disease during the current season.
- Note the field location and disease severity, and report it to Bob Ehn. This is very important for providing funding and justification for new control research.

When You Want to Plant Alliums in a Field that is Known to have White Rot:

- **Apply a sclerotia germination stimulant** (such as garlic oil/juice), 1 year before planting any Allium crop. Shank apply 1 gallon of product per acre in moist soil under moderate temperature conditions (50-70F). There cannot be any garlic or onion plant debris in the field during application, or the fungus can complete another life cycle and produce more sclerotia. After application, other crops can be grown in the treated area (such as wheat, etc.) but not Allium crops. After at least 1 year, Alliums can be planted in the treated area.
- **At planting, apply a fungicide in furrow**. Apply chemical in a 4-6” bandwidth. Options include:
    - **tebuconazole (Folicur, Orius, Tebuzole)-20.5 fl oz/A**
    - **fludioxonil (Cannonball)- 8 oz/A**
    - **boscalid (Endura)-6.8 oz/A**
- Tebuconazole is the most effective fungicide for white rot control. Please note that tebuconazole is phytotoxic on onions if it is applied at a higher concentration than the recommended 20.5 fl oz/acre. Phytotoxicity can also occur if the bandwidth is narrowed, even at the recommended rate per acre. If a narrower bandwidth is applied, then the tebuconazole concentration per acre must also be reduced.
- Fludioxonil and boscalid are also effective in reducing white rot.
- **It is not effective to apply fungicides multiple times throughout the season, and once white rot symptoms are visible, no controls are available**

http://uspest.org/mint/twospotmanagement.htm

Spider Mites on Peppermint in California

Project researchers: Kris Tollerup, Rob Wilson, Dan Marcum, and Larry Godfrey

Presenter: Kris Tollerup

The twospotted spider mite, *Tetranychus urticae* Koch, commonly attacks mint. Feeding damage can have a negative impact on oil yield and quality, however, this impact is not fully understood. Effectively managing spider mites requires that pest control advisors and growers have a monitoring method to efficiently and accurately determine when and if treatment is necessary. Spider mite monitoring techniques and treatment thresholds were developed at Oregon State University in the mid-1980s for mint grown in the Pacific Northwest. During 2010 and 2011 we investigated spider mite management methods for California conditions.

<u>Miticides and Yield Loss due to Mite Infestation.</u> At the Intermountain Research and Extension Center (IREC) in Tulelake, we conducted an experiment in a research mint field using 18' x 40' plots. We evaluated 12 treatments: an untreated control, Omite 6E at 44fl oz/A, Onager at 20 fl oz/A, Agri-Mek 0.15EC at 12 fl oz/A, Fujimite 5EC at 2 pts/A, Zeal at 3 oz/A, Acramite 4SC at 24 fl oz/A, and Oberon 2SC at 16, 12, 8, and 2 oz/A, and Requiem at 1 qt/A. We assessed mite populations by sampling 45 leaves per plot for the presence or absence of mites then washed the leaves to obtain the average number of mites per leaf.

With the exception of Acramite, Requiem and Zeal, a decreasing trend in mite populations occurred between 9 and 36 days after treatment (DAT) (Fig. 1). All miticide treatments, except Requiem, reduced populations of TSM below five mites up to 36 DAT (Fig. 1).

<u>Biopesticides against Twospotted Spider Mite.</u> In 2013 and 2014, we will evaluate the biopesticide, PFR-97 (Certis USA) against twospotted spider mite. During 2011, our miticide trial included the botanical insecticide, Requiem. The product did not perform well under the condition of a heavy mite infestation. In the current trials, Requiem will be applied when populations reach ~3 mites per leaf.

In early September of 2010, 2011, and 2012, we harvested and distilled mint from each plot to estimate oil yield and quality. We found a negative relationship between spider mite density and yield loss in 2011(Fig. 2), although not in 2012 (Fig. 3). Winter-kill, or stand loss, was negatively associated with spider mite density (Fig. 4). Results from analyses of oil quality data suggest that there is no relationship between mite density and oil quality.

Sampling of Mite Populations for Management Decisions. Analyses indicate that mite populations tend to aggregate within fields. Within-plant distribution of mites i.e. the percentage of mite-infested leaves in the top, middle and bottom strata of mint plants, during the growing season was not aggregated. Our presence / absence and enumerative sampling models indicate that at a mean of 5 mites / leaf, ~20 or 23 leaves respectively per seven locations per 30 acres, provides a sufficient sample number to estimate mite density. Our findings are an improvement to the Pacific Northwest sampling model which recommends 45 leaves per 14 locations per 30 acres (Table 1).

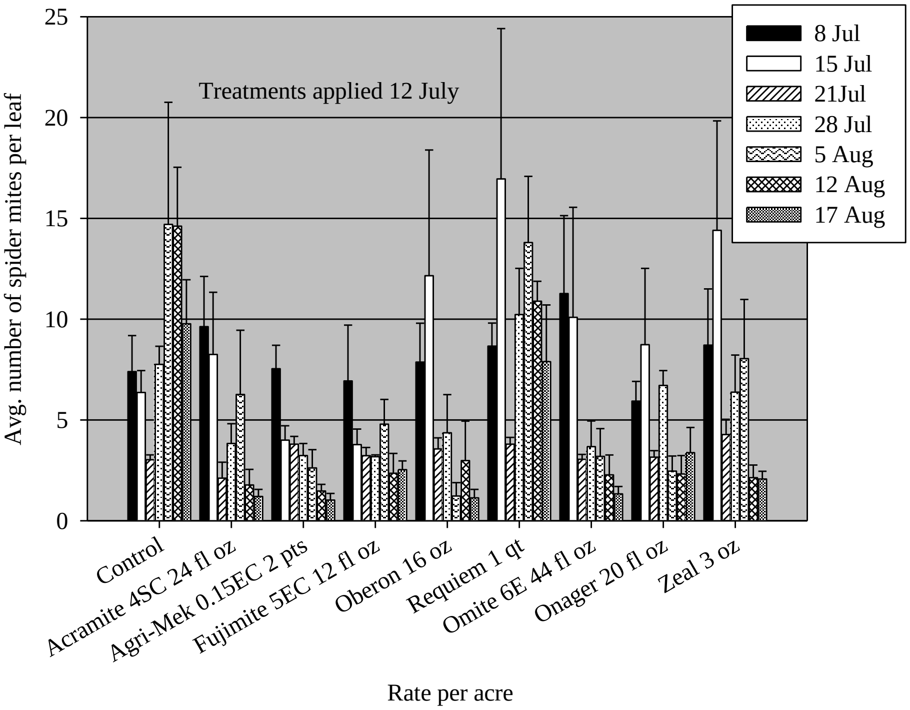


Fig. 1. The average number of mites per leaf for miticide treatments applied in 2011.

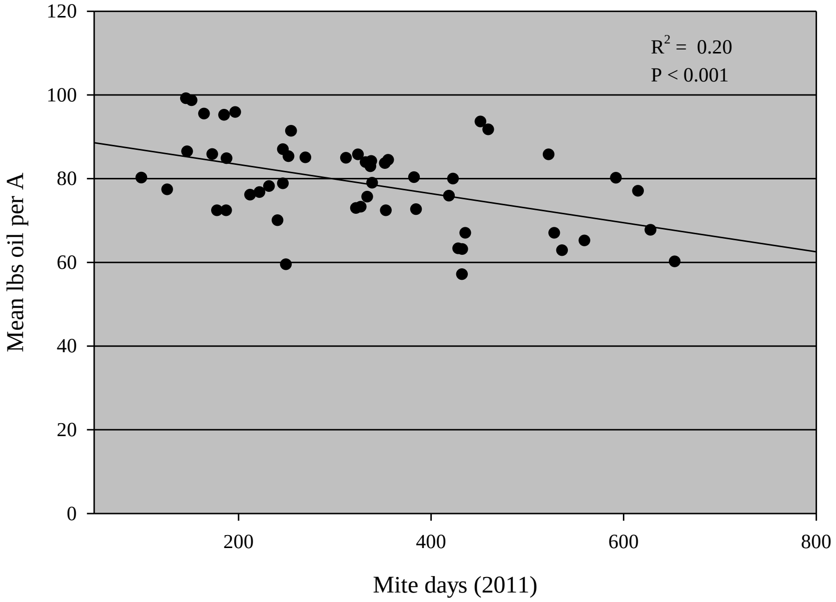


Fig. 2. Relationship between oil yield and mite-days in 2011.

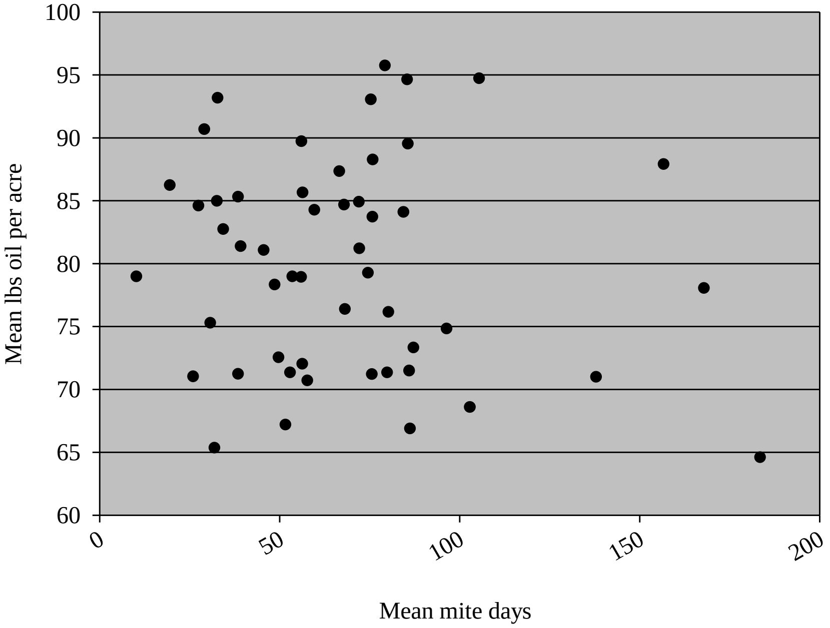


Fig. 3. Relationship between oil yield and mite-days in 2012.

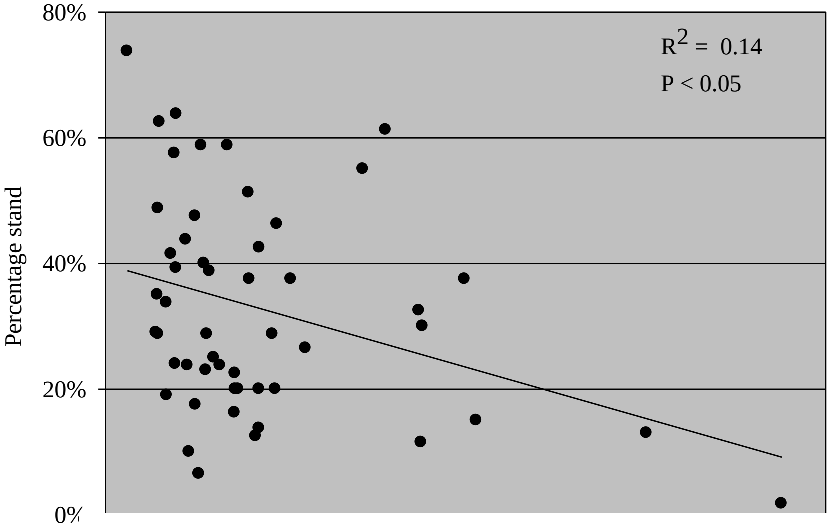


Fig. 4. Relationship between winter kill (stand loss), and mite-days in 2011.

Table 1. Characteristics of binomial sampling plans developed in the Pacific Northwest and California

	Plan	
	Pacific Northwest	California
Locations	14 per field	7 locations
Number of leaf samples	45 leaves per location	20 leaves per location
Stem strata	15 leaves each in top, middle, and bottom	Random
Tally threshold	5 ≥ mites per leaf	1 ≥ mites per leaf
Precision	D = 0.50	D = 0.25

Improving IPM for Management of Mint Root Borer on Peppermint Grown in California.

Project researchers: Kris Tollerup, Rob Wilson, Dan Marcum, and Larry Godfrey

Presenter: Kris Tollerup

In California, mint production occurs in the northeast counties of Shasta, Lassen, Modoc, and Siskiyou. The Lepidoptera pest, mint root borer (MRB), *Fumibotys fumalis* Hodges, commonly attacks mint and has a negative impact on oil yield and quality. This pest poses a significant management challenge and is the target of considerable pesticide use. Adults emerge from the soil beginning in mid-June through September. Newly emerged females mate and lay disc-shaped eggs on the upper or lower leaf surface and eggs hatch in approximately 3-5 days. Larvae feed on the foliage for a short time then drop to the soil surface, burrow in and begin feeding on the plant rhizomes. This moth has a single generation per year. Developmental models and treatment thresholds for MRB were developed at Oregon State University in the late 1980s for mint grown in the Pacific Northwest. During 2010 and 2011 we investigated MRB development and management methods for California conditions.

<u>Sampling Mint Root Borer Populations.</u> In 2011, a total of thirty-nine traps baited with MRB sex pheromone were distributed at three commercial mint fields in Shasta, one in Lassen, and two in Siskiyou counties. Dates at which biofix (beginning date of first sustained seasonal flight), peak flight, and 90% flight completed were determine for each county (Table 1). Observed dates were compared against dates predicted by the MRB development model (Table 1). We are working to develop an improved method for sampling MRB that assess the amount of feeding damage on rhizomes. Also, we are working to better understand the amount of damage peppermint plants can sustain without a significant decrease in oil yield.

<u>Effectiveness of Reduced Risk Insecticides.</u> In the McArthur and Tulelake areas we have set up experimental sites to collect data on the efficacy of five recently-registered reduced risk insecticides (Table 1): Avaunt (DuPont), Coragen (DuPont), Intrepid (Dow AgroSciences), Radiant (Dow AgroSciences), and Voliam flexi (Syngenta). Theses RR insecticides were compared against the industry standards, Lorsban (Gowan) and Mocap (Bayer CropSciences). We assessed MRB populations in the soil prior to harvest using Berlese funnels. In both 2010 and 2011 too few MRB larvae were extracted from soil samples to assess the treatments.

<u>Biopesticides to Manage Mint Root Borer Populations.</u> In 2013 we will evaluate the biopesticides, Agree (*Bacillus thuringiensis* subs aizawai strain GC-91), to manage mint root borer populations.

Table 1. Reduced risk insecticides registered in California on peppermint.

Insecticide Trade name	Active ingredient	Mode of action	Route	Labeled against MRB
Avaunt	Indoxacarb	Voltage-dependent sodium channel blockers	Contact	-
Coragen	Chlorantraniliprole	Ryanodine receptors	Some contact/primarily ingestion	+
Intrepid 2F	Methoxyfenozide	Ecdysone agonists / molting disruptors	Ingestion	-
Radiant	Spinetoram	Nicotinic Acetylcholine receptor agonists (allosteric) (not group 4)	Contact/ingestion	-
Voliam Flexi	Chlorantraniliprole Thiamethoxam	Ryanodine receptors. Nicotinic Acetylcholine receptor agonists /antagonists	Some contact/primarily ingestion	+
Various	Azadirechtin	Octopaminergic agonists	Ingestion	-
	Bt	Microbial disruptors of insect midgut membranes (includes transgenic crops expressing Bacillus thuringiensis toxins)	Ingestion	-
	Spinosad	Nicotinic Acetylcholine receptor agonists (allosteric)	Contact/ingestion	-

Table 2. Observed and predicted dates of mint root borer flight at three critical periods.

Flight/year	Shasta Co		Lassen Co		Siskiyou Co	
	observed	predicted	observed	predicted	observed	predicted
Biofix						
2010	17-Jun	24-Jun	17-Jun	4-Jul	24-Jun	4-Jul
2011	28-Jun	22-Jun	28-Jun	3-Jul	7-Jul	3-Jul
Peak						
2010	20-Jul	19-Jul	14-Jul	31-Jul	20-Jul	31-Jul
2011	14-Jul	24-Jul	26-Jul	8-Aug	14-Jul	8-Aug
90%						
2010	29-Jul	13-Aug	5-Aug	4-Sep	5-Aug	4-Sep
2011	2-Aug	19-Aug	8-Aug	8-Sep	10-Aug	8-Sep

Cutting Schedule Effects on Reduced Lignin and Conventional Alfalfa

Steve Orloff, Steve Orloff, UCCE Siskiyou County and

Dan Putnam, Forage Specialist, UC Davis

Cutting frequency, or more precisely the maturity of the alfalfa when it is cut, has a more profound effect on forage quality and yield than any other single factor under growers' control. As the alfalfa plant matures, yield increases but forage quality decreases. This dilemma is often referred to as the Yield/Quality Tradeoff and is the scourge of every alfalfa grower. This inverse relationship between yield and forage quality has been well documented over the years in trials conducted in the Intermountain area as well as other areas of California and the US. As the alfalfa crop matures and yield climbs, the increase in forage yield is primarily stems over leaves– thus lowering the leaf:stem ratio. In addition to the increase in the stem fraction, the digestibility of the stem declines more rapidly than the leaves due to the high cell wall concentration and lignification of the stem.

An idealized relationship between alfalfa yield and quality and the relative proportion of leaf and stem yield with advancing maturity is shown in the figure below. Much of the yield increase and quality decrease with advancing maturity is attributed to increased stem yields, which increases the concentration of lignified cell wall material in the whole plant greatly reducing digestibility.

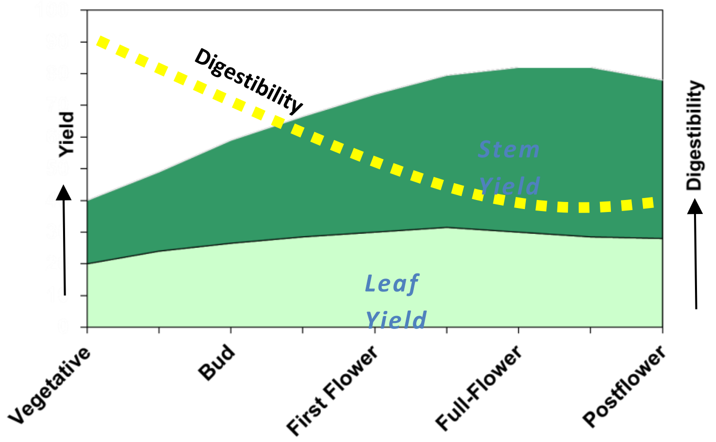


Figure 1. Idealized relationship between yield and quality at different alfalfa growth stages

The Effect of Lignin

Lignin is a structural component of the cell wall. It has been compared to the rebar in a concrete building. It strengthens the plant and allows the vascular system of the plant to transport water without leakage. The amount of lignin increases greatly with advancing alfalfa maturity. The drawback with lignin is that it is indigestible and reduces the ability of ruminant animals to digest fiber. This is because lignin molecules fill the spaces between the cellulose, hemicellulose and pectins in the cell wall and as the plant matures it binds to the cellulose. This then reduces digestion of the cellulose in the rumen.

In general, legumes tend to have higher lignin content than grasses so it is possible to reduce the lignin content of alfalfa while still maintaining desired agronomic characteristics (i.e., standability or a plant that doesn't lodge severely). So, if we could somehow reduce the lignin content of alfalfa plants, the fiber digestibility should improve and we could still have a plant that stands up and can be harvested. This goal has now been accomplished with biotechnology.

Previous Research with Reduced Lignin Alfalfa

In previous research conducted at IREC and other locations in the US we evaluated two reduced lignin transgenic alfalfa lines and compared them with their nulls (same varieties without the reduced lignin trait) and a conventional control variety (LegenDairy 5.0). Unfortunately, the trails in IREC and Davis had to be discontinued to due stand problems. However, the trials in the Midwest continued and they determined the change in yield and forage quality for all the varieties. Harvests began at late vegetative stage and continued at 5 day intervals for 5 total harvests. Forage samples were analyzed for crude protein (CP), neutral detergent fiber (NDF), acid detergent lignin (ADL), and neutral detergent fiber digestibility (NDFD).

The low lignin lines had consistently higher fiber digestibility at each harvest date—both lines had lower acid detergent lignin and significantly higher NDFD. This indicates that if the varieties are harvested on the same harvest schedule, the low lignin varieties would have higher quality than the conventional varieties. An alternative way to consider these results is that the low lignin varieties had the same NDFD as the nulls or commercial check variety when they were harvested 8 to 12 days earlier. The potential practical ramifications of these results are that when these varieties become available, producers may be able to delay harvest and maintain forage quality. Delaying harvest will increase the yield for that cutting and potentially it may be feasible to reduce the number of cuttings per year from 4 to 3, improving yield while still producing dairy-quality alfalfa. A longer interval between cuttings may also increase the level of carbohydrate root reserves improving plant vigor and stand persistence.

Current Research Effort

The breeding effort to develop alfalfa varieties with the reduced lignin trait has continued and commercial varieties should be available in the not too distant future. Research is needed to evaluate the latest germplasm and compare these low lignin varieties with their conventional counterparts to determine if growers in the Intermountain Region could utilize a 3-cut schedule rather than a 4-cut schedule and still produce dairy quality alfalfa hay.

A cutting schedule trial was established in August 2012 at IREC with similar trials at UC Davis with Forage Specialist Dan Putnam and in Wisconsin with Forage Specialist Dan Undersander. Four high yielding well adapted conventional varieties were selected to compare with four recently developed low-lignin lines. Each variety is being evaluated under 3-cut and 4-cut harvest management regimes. The experimental design is a factorial with a split plot arrangement with the harvest schedule as the main plot and alfalfa cultivar as the subplot. Each variety/harvest schedule treatment is replicated four times.

Low-lignin alfalfa varieties could have a dramatic effect on alfalfa harvest management and transform our understanding of the yield quality tradeoff as it currently exists. Data on yield and quality changes with advancing maturity for new GE low-lignin alfalfa cultivar is needed to understand the impact this technology might have on alfalfa production as well as animal nutrition. The development of low lignin varieties should result in a greater and faster improvement in forage quality than what has occurred in previous breeding efforts using conventional plant breeding methods.

Weed Control Strategies in Processing Onions

Rob Wilson and Steve Orloff

IREC Director/Farm Advisor and Siskiyou County Director/Farm Advisor

High weed populations in processing onions dramatically decrease yield, reduce onion stand density, and cause problems with harvest. In 2013, a weed control study was conducted at IREC to test if low rates of sulfentrazone (unregistered product) have a fit for weed control in onions. The trial also tested the appropriate rate range for Dacthal on silty clay loam soil when used alone and in combination with Prowl H_20 at loop stage.

Results are presented in the Table on page 40. Treatments highlighted in green provided the best control of kochia. Treatments highlighted in red caused unacceptable crop injury and onion stand loss. Dacthal applied post-plant was most effective at controlling kochia when combined with Prowl H_20 at loop stage. Dacthal at rates ≥ 4 pt/A reduced kochia density by more 85% when combined with Prowl H_20. When used alone, Dacthal at rates ≤ 6 pt/A had minimal efficacy at controlling kochia, and the high Dacthal rate of 8 pints per acre failed to reduce kochia density by more than 60%.

Sulfentrazone appears to have a potential fit as both a preemergence and postemergence herbicide in processing onions, but choosing the proper rate of sulfentrazone for individual soil types is critical to assure crop safety. Zeus (sulfentrazone) applied at 3 fl. oz/A preemergence (immediately after planting) and postemergence (3-4 leaf stage) gave ≥ 88% kochia control. The 3 fl. oz/A rate of Zeus applied preemergence and postemergence caused minimal crop injury and no onion stand loss on IREC soil. Zeus at rates less than 3 fl. oz/A applied immediately after planting was safe on onions, but the low rates provided mediocre weed control. Conversely, Zeus at 4 fl. oz/A applied after planting gave great weed control, but the 4 fl. oz/A rate caused unacceptable crop injury. Zeus applied at the loop stage at 2 fl. oz/A caused unacceptable crop injury. Onion yield for all treatments will be collected this fall.

Special Thanks to the California Garlic and Onion Research Advisory Board for Funding Support of this Research!!

Onion Injury, Onion Stand, and Weed Densities for Herbicide Treatments Tested in Processing Onions at IREC in 2013.

	Herbicide Application Time					1-leaf	4-leaf	7-leaf	1-leaf	4-leaf	1-leaf	4-leaf	4-leaf
trt #	Post-Plant Product/A	Loop stage Product	1.5 leaf stage Product	2.5 leaf stage Product	3-4 leaf stage Product	Onion Injury	Onion Injury	Onion Injury	Onion Stand	Onion Stand	Kochia Density	Kochia Density	Total Weed Density
	Goal Tender and Goal 2XL + Buctril applied via chemigation					%	%	%	plants per 25 ft row		plants per 50 ft row		
1	Untreated	No Herbicide	No Herbicide	No Herbicide	No Herbicide	5	2	1	544	549	132	112	113
2		Prowl H_20[2]	Goal Tender[3]	Goal + Buctril[4]		10	1	0	527	566	73	44	45
3	Dacthal 2.5 pt/A		Goal Tender[3]	Goal + Buctril[4]		8	0	0	546	566	157	78	79
4	Dacthal 4 pt/A		Goal Tender[3]	Goal + Buctril[4]		6	2	0	572	581	185	102	104
5	Dacthal 6 pt/A		Goal Tender[3]	Goal + Buctril[4]		8	1	0	558	595	118	72	72
6	Dacthal 8 pt/A		Goal Tender[3]	Goal + Buctril[4]		10	3	0	540	544	85	44	45
7	Dacthal 2.5 pt/A	Prowl H_20[2]	Goal Tender[3]	Goal + Buctril[4]		10	2	0	578	589	42	19	21
8	Dacthal 4 pt/A	Prowl H_20[2]	Goal Tender[3]	Goal + Buctril[4]		10	2	0	554	569	34	15	16
9	Dacthal 6 pt/A	Prowl H_20[2]	Goal Tender[3]	Goal + Buctril[4]		10	2	0	539	566	17	7	7
10	Dacthal 8 pt/A	Prowl H_20[2]	Goal Tender[3]	Goal + Buctril[4]		10	6	0	543	559	19	9	11
11	Zeus 1 fl oz/A		Goal Tender[3]	Goal + Buctril[4]		12	4	0	547	561	63	52	54
12	Zeus 2 fl oz/A		Goal Tender[3]	Goal + Buctril[4]		11	4	0	552	560	49	36	37
13	Zeus 3 fl oz/A		Goal Tender[3]	Goal + Buctril[4]		14	8	0	535	547	21	13	13
14	Zeus 4 fl oz/A		Goal Tender[3]	Goal + Buctril[4]		17	16	4	507	513	10	11	12
15	Zeus 2 fl oz/A	Prowl H_20[2]	Goal Tender[3]	Goal + Buctril[4]		12	8	0	560	550	8	7	8
16	Zeus 2 fl oz/A	Zeus 2 fl oz/A	Goal Tender[3]	Goal + Buctril[4]		30	29	15	398	397	9	5	7
17		Zeus 2 fl oz/A	Goal Tender[3]	Goal + Buctril[4]		30	21	15	458	458	13	8	9
18		Prowl H_20[2]	Goal Tender[3]	Goal + Buctril[4]	Zeus 3 fl oz/A	8	4	0	549	598	69	10	12
1a		Prowl H_20[2]	Goal Tender[3]	Goal + Buctril[4]		10	0	0	571	592	90	63	64
2a	Prowl H_20 1.5 pt/A	Prowl H_20[2]	Goal Tender[3]	Goal + Buctril[4]		11	1	0	570	597	11	4	4
3a	Prowl H_20 3 pt/A	Prowl H_20[2]	Goal Tender[3]	Goal + Buctril[4]		14	6	0	567	584	1	0	0
4a	Prowl H_20 1.5 pt/A Dacthal 2.5 pt/A	Prowl H_20[2]	Goal Tender[3]	Goal + Buctril[4]		13	0	0	583	593	5	1	1
	LSD (P-value < 0.05)					2	5	1	27	34	25	19	19

[2] Prowl H_20 applied at 1.5 pt/A at Loop (broadcast applied)

[3] GoalTender at 4 fl oz/A (chemigated)

[4] Goal 2XL at 4 fl oz/A + Buctril 2EC at 8 fl oz/A (chemigated)

Plot size: 4 rows (12ft) by 25ft

Reps: 5

Untreated
Prowl H20 at Loop
Dacthal Post-Plant
Zeus
Prowl H20 Post-Plant
GoalTender 1.5 leaf
Goal + Buctril 2.5 leaf

🟩 Herbicide treatments that provided the best control of kochia

🟥 Herbicide treatments that caused unacceptable crop injury and stand loss

Maggot Control in Processing Onions

Rob Wilson, IREC Farm Advisor

Maggots (the larval stage of flies) including the onion maggot, *Delia antiqua*, and the seed corn maggot, *Delia platura*, are problem pests in Klamath Basin onion fields. Larvae attack seedlings and young onion plants feeding on the developing epicotyls and roots. A single maggot can kill up to 10 seedlings. Maggot feeding can result in greater than 50% onion stand loss in fields with a large amount of decaying crop residue.

A maggot control study was conducted at the Intermountain Research and Extension Center with funding support from the California Garlic and Onion Research Board in 2011, 2012, and 2013. Study objectives were to compare insecticides and insecticide application methods (in-furrow at planting versus seed treatment) to the current in-furrow standard (Lorsban). The preceding crop at the study site was alfalfa which was rototilled shortly before planting the onions. The abundant decaying organic matter after alfalfa stand removal created optimal conditions to attract maggot flies. During May and June, sticky traps placed throughout the trial area captured high numbers of seed corn maggot and onion maggot flies all three years.

Onion stand results from the 2013 insecticide treatments are presented in the Table. Insecticide seed treatments with clothianidin (Sepresto) or spinosad (Regard) provided the best protection from maggot related onion stand loss. Applying Vydate in-furrow at planting or Folicur in-furrow at planting in combination with Regard seed treatment provided similar or better protection from maggot related stand loss when compared with Regard alone.

The Influence of In-furrow Maggot Insecticide Treatments on Onion Stand in 2013

Insecticide Treatment[1]	Insecticide Rate/Acre	Onion Stand Density 1 leaf	 5-leaf
		plants per plot[2]	
Regard (spinosad) seed trt + Vydate in-furrow at planting	0.2 mg ai/seed + 32 fl. oz	662	677
Regard (spinosad) seed trt + Folicur & Lorsban 4E in-furrow at planting	0.2 mg ai + 20.5 fl. oz + 32 fl. oz	641	643
thiamethoxam + spinosad seed trt (similar ai to FarMore FI500)	0.1 mg + 0.2 mg ai/seed	625	597
Regard (spinosad) seed trt + Folicur in-furrow at planting	0.2 mg ai/seed + 20.5 fl. oz	583	586
Regard (spinosad) seed trt	0.2 mg ai / seed	581	572
Sepresto (clothianidin+imidacloprid) seed trt	0.24 mg ai / seed	561	568
Regard (spinosad) seed trt + Admire Pro in-furrow at planting	0.2 mg ai/seed + 14 fl. oz	542	531
Lorsban 4E (chlorpyrifos) in-furrow at planting	32 fl. oz/A	374	361
Cruiser (thiamethoxam) seed trt	0.2 mg ai / seed	269	256
Lorsban 15-G (chlorpyrifos) in-furrow at planting	6.6 lbs/acre	179	172
Vydate (oxamyl) in-furrow at planting	32 fl. oz/A	102	99
Untreated Control (raw seed)	none	85	73
Untreated Control with Thiram	none	67	65
Admire Pro (imidacloprid) in-furrow at planting	14 fl. oz/A	70	62
95% Confidence Interval		*35*	*38*

[1] Thiram 42S at 188 mg ai/100 g seed applied as a seed treatment was included in all treatments except the untreated control

[2] Seeding rate was based on achieving a desired seed spacing of 2 inches or 1200 plants per plot.

Management Practices for Improved Thrips Control in Klamath Basin Onions

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[1]UC Cooperative Extension, Siskiyou County,[2] Director IREC, Tulelake
[3]Department of Entomology, UC Davis

Introduction

Thrips, both onion thrips (Thrips tabaci) and western flower thrips (Frankliniella occidentalis), are a serious insect pest in California onion fields. Their feeding causes leaf scaring and can lower bulb size and reduce yield. They are an annual problem in Klamath Basin onion fields, especially with the large number of crops grown in the area that serve as alternative hosts.

Figure 1. Immature thrips feeding on onion foliage.

Research was conducted during the 2012 growing season to follow up on findings from 2010 and 2011. The focus was to: 1) evaluate new and standard insecticides, and 2) to compare season-long thrips control strategies using different insecticide sequences and numbers of applications over the season. The treatments included an approach proposed by Brian Nault, Department of Entomology Cornell University whereby the same insecticide was used twice in back-to-back applications and then rotating to a different insecticide class. The intent is to maximize thrips control and minimize the number of thrips generations exposed to the same insecticide active ingredient.

Insecticide Comparison Study

At the first evaluation date (5 days after treatment), there was no statistical difference in thrips population (Figure 2). A second application was applied 8 days after the first, and the thrips population was assessed 6 days later. Thrips population was evaluated 5, 14 and 21 days after the second application. The relative ranking of effectiveness of the insecticides remained fairly consistent for the remaining three evaluations with a few exceptions, which will be noted. Warrior initially knocked down the thrips population but the population resurged, and by the evaluation 2 weeks after the second application, the population level was already higher than the untreated control plots and was approximately double the control plots by 21 days after the second application. This was consistent with what was observed in 2010 and 2011. The exact cause for this dramatic resurgence in thrips population is unknown but possible explanations are 1) Warrior is killing some beneficial insects that may play a role in moderating thrips population or 2) hormoligosis (reproductive stimulation by sub-lethal doses of insecticide). Torac, evaluated for the first time in these intermountain trials, was not quite as effective as some of the other treatments, particularly at the evaluation made 3 weeks after the last treatment. The addition of Aza-Direct to Radiant at most evaluation dates resulted in a slight improvement in control over Radiant applied alone, consistent with the results in 2010 and 2011. Movento was effective in 2012, as it was in 2011. This is different from the results in 2010 when only a single application of Movento was used, indicating that perhaps two applications of Movento are needed. This behavior has been observed in other trials as well where the initial control with Movento was mediocre, but control was excellent after the second application. The tank mix combination of Movento and Lannate or Movento and Radiant was particularly effective. It is interesting to note that the thrips population was as low, or lower, in the control plots than the insecticide-treated plots 3 weeks after the second application.

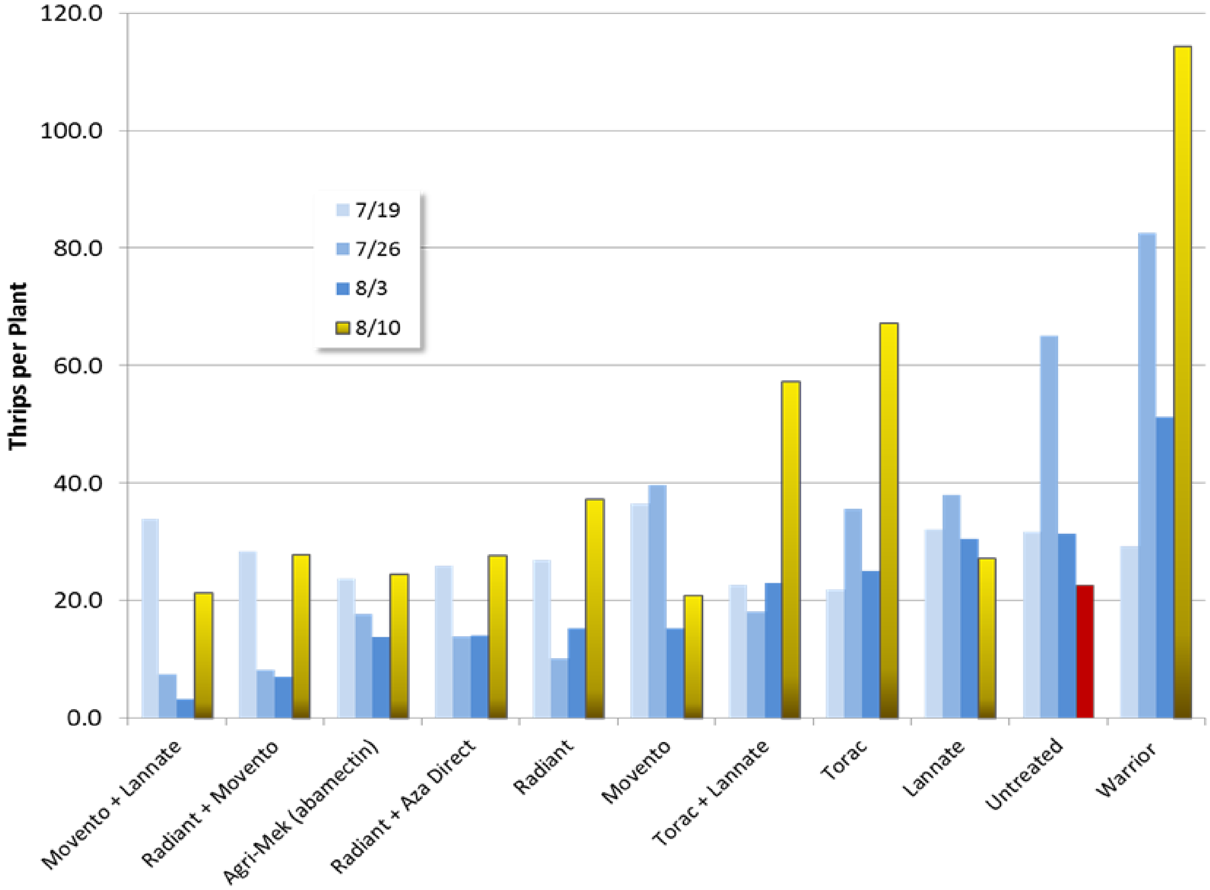

Figure 2. Insecticide treatment effects on thrips population. Each insecticide was applied twice, 7/12/12 and again on 7/20/12.

Comparison of Season-Long Thrips Control Strategies

A treatment of three consecutive Warrior applications was evaluated in the 2012 study. This is obviously not a treatment sequence that we would advocate, but the purpose was to better assess the effect of thrips population level on onion injury and yield (Figure 3). As expected, this treatment resulted in a spike in thrips population, far exceeding any of the other treatments or the control plot. The thrips population at their seasonal peak was 3.5 to 7 times higher than any of the other treatments. One treatment consisted of only two applications over the season, an initial application of Movento followed by a tank mix of Movento plus Lannate (a combination that was highly effective in the insecticide evaluation trials in 2011 and 2012). This treatment provided excellent early season control but did not persist through the season, and at the late August evaluation, had the highest number of thrips per plant (except for the Warrior treatment). The treatment that tended to maintain thrips levels the lowest was two applications of Movento followed by two applications of Radiant (Figure 3). Surprisingly, this appeared to be more effective than the treatment with a total of 6 insecticide applications (Movento twice, Lannate twice, and Radiant twice). Apparently, the applications of Lannate in mid-summer were not as effective as the Radiant applications. The treatment with two applications of Lannate followed by two applications of Radiant was not as effective as other treatments, again because Lannate alone was not as effective as the other insecticides used in this season-long trial.

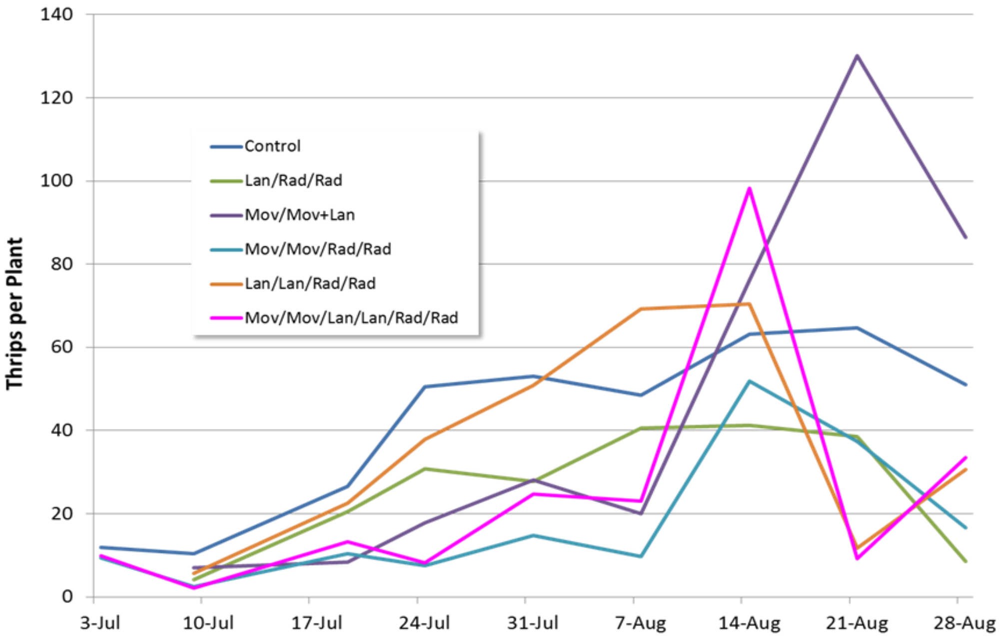

Figure 3. Effect of season-long thrips control program on weekly thrips population monitored weekly over the season (excluding Warrior/Warrior/Warrior treatment to better show differences between other treatments). Klamath Basin, 2012.

Onion yield was also measured. There was no difference in yield between any of the insecticide treatments (Table 1). This is somewhat surprising but may have been due to variable white rot pressure in the field and a slight irrigation pattern. The numerically lowest yielding treatment was the repeated treatment of Warrior—it yielded 2.5 tons lower than the highest yielding treatment (Movento twice/Lannate twice/Radiant twice).

Table 4. Effect of season-long thrips control program on onion yield (Klamath Basin 2012).

1st Application	2nd Application	3rd Application	4th Application	5th Application	6th Application	Yield Tons/A
Untreated						20.4
Warrior	Warrior	Warrior				18.5
Lannate	Radiant	Radiant				20.0
Movento	Mov/Lan					19.4
Movento	Movento	Radiant	Radiant			19.8
Lannate	Lannate	Radiant	Radiant			20.2
Movento	Movento	Lannate	Lannate	Radiant	Radiant	21.0
						NS

Conclusions

Both onion thrips and western flower thrips were found in samples collected over the season from untreated areas in agreement with the 2010 and 2011 data. Unlike previous years the relative proportion of the two species remained fairly constant. In previous years there tended to be a higher proportion of western flower thrips early in the season. In the insecticide comparison study, acceptable thrips control was achieved with several insecticides applied twice in sequential applications spaced 8 days apart. Movento, Movento plus Lannate, or Movento plus Radiant provided very effective control. Agri-Mek, and Radiant alone or in combination with Aza-Direct were also effective. The thrips population was much different in 2012 than 2011 with high population levels early and then crashing late in the season, as shown by weekly counts taken in the untreated control plots. In the season-long study, thrips population increased dramatically with continuous applications of Warrior. This was true in both the insecticide comparison trial and the season-long trial in both 2011 and 2012. Insecticide strategies that included Movento, Lannate, and Radiant in various combinations were effective in the season-long comparisons. Radiant was more effective than Lannate and that appears to be the reason for one of the four application treatments (Movento/Movento/Radiant/Radiant) having lower thrips population levels than a six application treatment (Mov./Mov./Lan./Lan./Radiant/Radiant).

There may be merit to applying the same insecticide for back-to-back applications (especially with Movento) and then switching to another insecticide product but more research is needed. There was no statistical difference in yield among treatments. More research is clearly needed to determine the effect of thrips population level on onion yield in the Klamath Basin and other areas of California. In the absence of Iris Yellow Spot Virus, thrips may not have as great an impact on onion yield as has been believed. A reliable treatment threshold for thrips at various onion growth stages is clearly needed.

Effect of Nitrogen Fertilization Practices on Spring Wheat Protein Content

Steve Orloff, UC Cooperative Extension, Siskiyou County

Achieving high yield with acceptable protein content is essential for profitable wheat production in the intermountain region. Protein content is nearly as important as yield because the price a grower receives is determined by the grain protein content with a discount for wheat with less than 14% for grain marketed in the Pacific Northwest. The primary factors that influence protein content are yield level, nitrogen fertility management and variety selection. Yield and protein content are often inversely related, and is difficult to achieve both, especially without optimum nitrogen fertility management.

The total amount of N applied is important, but the timing of the application is critical as well, especially when it comes to the protein content of the wheat kernel. An adequate supply of N during vegetative growth stages is essential to maximize yield, but does not ensure an acceptable protein concentration. A late-season N application may be required to reach protein goals because only after most of the N required for yield is supplied will additional N applications increase grain protein content. Nitrogen applications made from the boot stage up to 2 weeks after flowering have proven effective for increasing grain protein. Applications close to flowering usually have the greatest impact. If the total amount of N required to reach both yield and protein goals is all applied preplant, there may be insufficient N available at heading to achieve the desired protein level because there is a risk of excessive vegetative growth and lodging and higher potential for leaching. The amount of N needed is a function of the desired protein concentration, the yield level and the wheat cultivar (varieties differ in their ability to accumulate N). The amount of N typically applied with a late-season application intended for protein enhancement is in the neighborhood of 30 to 50 pounds of N per acre. The higher the yield, the more N required to increase the protein content.

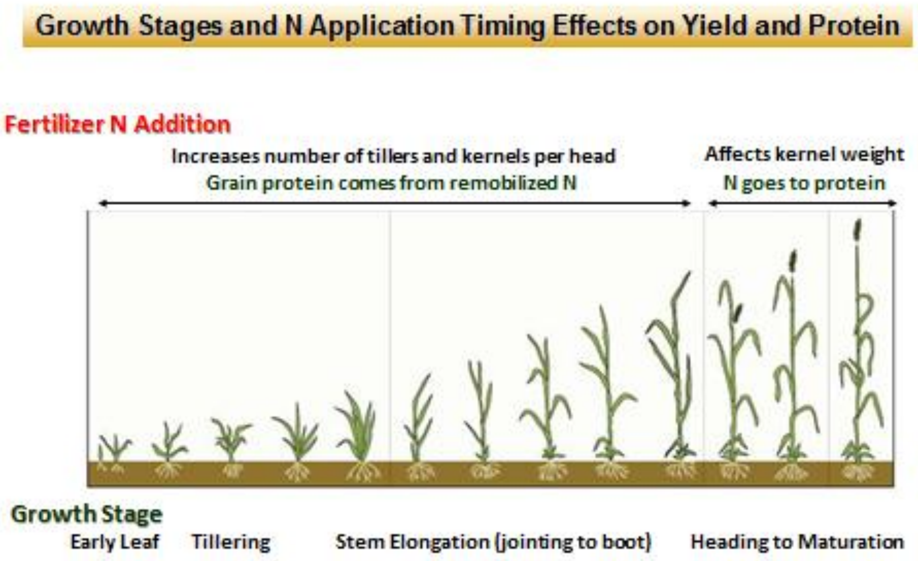

Figure 1. Cereal growth stages and N application timing effects on yield and protein.

It is common for intermountain growers to apply all the nitrogen preplant. The research we conducted in 2011 and 2012 at IREC showed that a preplant application alone at the rates tested was insufficient, and a split application of N was needed to achieve acceptable yield and especially to meet protein goals. Further research is needed to fine tune N fertilization practices to most efficiently achieve desired yield and protein levels.

Current Research Projects

Three different nitrogen management projects on wheat are being conducted at IREC during the 2013 season. One trial is in cooperation with Michael Tarter, a Statistics Professor at UC Berkeley, to evaluate different plant sampling techniques to determine which one is most predictive of the protein content at harvest. Sampling techniques include stem nitrate concentration, flag leaf total N, the total N concentration of the penultimate leaf (leaf below the flag leaf), use of a chlorophyll meter, and measurement of the Normalized Difference Vegetation Index (NDVI). The purpose of this research is to assess whether any of these measurements or combination of measurement would be useful to determine the need for a late-season application of nitrogen fertilizer to attain protein goals. A total of 80 different nitrogen rates were applied to individual plots. The measurements listed above were conducted when the wheat was at the 50 percent heading growth stage. The plots will be harvested and yield and protein content determined.

A second trial was established to compare different nitrogen fertilizer sources and their effect on yield and protein content. This study involves the use of several slow-release nitrogen products. The fertilizer sources included are Agrotain (a urease inhibitor), ESN (a urea granule coated with a micro-thin polymer coating) and NutriSmart (a fertilizer and humate soil amendment). These products are being evaluated at different rates and compared with urea to determine if by using these slow release fertilizers the total amount of N fertilizer applied could be reduced. They are also applied with and without a late-season application of urea at flowering to determine if by using a slower release fertilizer it is possible to eliminate a late-season application of N to increase grain protein content.

The third project evaluates the most efficient time to apply nitrogen to wheat. Specifically, what proportion of the total nitrogen should be applied at each growth stage? Can nitrogen-use-efficiency be improved by applying N at timings that more closely match periods of peak crop uptake? As mentioned above, most wheat growers in the Intermountain Region apply all or nearly all of the N fertilizer preplant. Research was needed to determine if nitrogen use efficiency could be improved by applying less of the N at planting and more of the N later in the season closer to peak uptake.

Treatments in this study included an untreated control with no fertilizer, a series of treatments with a total of 150 pounds of N per acre, a series of treatments with a total of 250 pounds of N per acre, and a single treatment with 350 pounds of N per acre. The 150 pound per acre rate represents a typical application rate for the Intermountain region and the 250 pound per acre rate represents a rate that is more likely needed to achieve maximum yield and protein based on our previous research. The 350 pound per acre rate was evaluated to be certain that we bracketed the rates needed for maximum yield at the desired protein content. Different proportions of the total amount of nitrogen fertilizer were applied at each of four application timings (preplant, tillering, boot and flowering). The fertilizer treatments were applied to a single variety, Yecora Rojo, which is the most popular variety in the area. The N was applied as urea at all treatment timings.

The untreated control plots yielded over 1.5 tons/acre less per acre than the most effective fertilized treatments (Table 1). Plots that received 250 pounds of N per acre yielded higher than the 150 pound rate but the difference was only a little over 0.1 tons when compared at the same treatment timing. The single treatment that received 350 pounds of nitrogen per acre did not yield higher than most of the 250 pound treatments and, in fact, was numerically slightly less than the most effective 250 rate timing. This was likely because the majority of the N applied with this treatment was applied preplant.

Table 1. Effect of nitrogen rate and the proportion applied at different growth stages on the yield and protein content of Yecora Rojo wheat grown at the Intermountain Research and Extension Center (Siskiyou County).

Treat	**Preplant**	**Tillering**	**Boot**	**Flowering**	**Total**	**Yield**	**Protein**
#	**lbs. N/acre**					**Tons/A**	**%**
1	**0**	**0**	**0**	**0**	**0**	2.87	9.6
2	**150**	**0**	**0**	**0**	**150**	4.05	12.0
3	**120**	**0**	**0**	**30**	**150**	4.01	12.4
4	**90**	**60**	**0**	**0**	**150**	4.14	12.1
5	**90**	**0**	**60**	**0**	**150**	4.00	12.7
6	**60**	**60**	**0**	**30**	**150**	4.07	12.7
7	**60**	**0**	**60**	**30**	**150**	3.88	14.3
8	**0**	**60**	**60**	**30**	**150**	4.16	13.7
9	**0**	**120**	**0**	**30**	**150**	4.43	13.2
10	**250**	**0**	**0**	**0**	**250**	4.17	13.4
11	**200**	**0**	**0**	**50**	**250**	4.22	13.8
12	**150**	**100**	**0**	**0**	**250**	4.27	13.2
13	**150**	**0**	**100**	**0**	**250**	4.27	14.2

14	**100**	**100**	**0**	**50**	**250**	4.32	14.2
15	**100**	**0**	**100**	**50**	**250**	4.17	14.5
16	**0**	**100**	**100**	**50**	**250**	4.30	15.3
17	**0**	**200**	**0**	**50**	**250**	4.53	14.1
18	**150**	**150**	**0**	**50**	**350**	4.35	14.3
LSD 0.05						0.18	0.8

It is interesting to note that the highest yielding treatment timing was the same for both the 150 and 250 pound rates. These high-yielding treatments (9 and 17) received no preplant N but had a high rate at tillering. The treatments (8 and 16) where no N was applied preplant and the bulk of the N was split between tillering and boot did not yield as well as when the majority was applied at tillering. This may be due to the fact that the period of peak N uptake is from tillering to boot, so the majority of the N is needed at tillering, which is the beginning of the maximum uptake period. Treatments where all, or the majority, of the N was applied preplant (2, 3, 10 and 11) tended to be the lowest yielding treatments. A treatment that received a moderate rate of N preplant and then an equal amount at boot (7 and 15) did not yield nearly as well as when the same amount of N was all applied at tillering. This suggests that tillering may be a critical time to apply N, at least under the environmental conditions experienced this year. A significant amount of the total annual precipitation this year occurred in spring. Perhaps some of the N with a preplant application leached below the root zone and was subsequently unavailable for uptake, but this is not very likely in Tulelake soils (heavy clay loam with high OM) and with the careful irrigation management employed.

Nitrogen fertilization had a profound effect on protein content. There was nearly a 6 percentage point difference in protein between the control and the most effective treatment. The 250 or 350 pound per acre applications of N had significantly higher protein content than the 150 pound per acre rate. In fact, with only one of the 150 pound application rates was the protein goal of 14 percent achieved. Not only is the total amount of N applied important, timing is critical. Appling the same quantity of N had a broad range of effect on protein content depending on the timing of the application. This trial illustrated the importance of late-season N to meet protein requirements. As was observed with yield, it was better to apply less of the N preplant (or none at all) and apply more of the N at tillering, boot and flowering. For example, applying all 250 pounds of N preplant resulted in a protein content of 13.4 percent, while applying more of the N at boot or flowering raised the protein content over 14 percent. However, when the 250 was just split between a 200 pound preplant application and 50 pounds at flowering, the protein content was only 13.8 percent. It is difficult to identify the single most effective treatment, but the treatment with zero preplant N, 200 pounds at tillering, and 50 at flowering resulted in the yield of 4.53 tons and a protein content of 14.1 percent.

Conclusion

A preplant N application alone has been a common fertilizer program for many growers in the intermountain area. However, this trial and others we have conducted at IREC and in the Scott Valley clearly demonstrate that a preplant application alone is insufficient. This study suggests that shifting away from high preplant applications and applying more of the N later in the season may have merit for both yield and protein improvement. Applying most of the N at tillering followed by an application at boot or flowering resulted in higher yield and much improved protein content—high enough to avoid dockage. These results represent just a single year of research (2012) and additional research is needed to confirm the 2012 results and is the rationale for duplicating the trial this year.

2013 WINTER WHEAT
TULELAKE

PLOT 1 IS IN THE
SOUTH WEST CORNER

		REPLICATE		
NO	ENTRY	1	2	3
1	Stephens	164	16	130
2	Tubbs-06	63	126	150
3	Goetze	18	56	131
4	Skiles	157	77	128
5	Mary	142	104	134
6	Kaseberg	121	117	91
7	Ladd	99	136	94
8	Bruneau	58	64	69
9	02-10606A	178	24	148
10	99-06202A	160	37	28
11	03-29902A	141	106	110
12	IDO 1108	144	177	89
13	LCS Artdeco	161	67	149
14	LWW10-1018	139	55	107
15	LWW04-4009	158	105	129
16	WA 8151	80	47	127
17	WA 8153	1	5	71
18	YS 221	122	86	154
19	YS 461	101	96	87
20	YS 434	3	35	53
21	Trifecta	41	6	32
22	WB Junction	179	145	93
23	Exp 427 - Stephen	59	65	169
24	Exp 458	180	45	49
25	Legion	162	135	29
26	SY 107	138	27	147
27	AP Badger	120	95	151
28	SY Ovation	159	26	168
29	ORCF-101R	60	66	92
30	ORCF-102	22	17	72
31	ORCF-103	163	36	90
32	ORI2101840 - 2 ge	119	14	113
33	ORI2101841 - 2 ge	103	116	114
34	WA 8143 - 2gene E	79	165	12
35	AP 700 CL	2	44	133
36	WB 1070 CL	143	125	52
37	Cara	118	15	33
38	ARS 010669-2C	23	97	51
39	OR2071071	78	57	48
40	OR2080641	43	4	73
41	OR08047P94	21	156	167
42	OR2080924	123	74	13
43	OR2080637	39	124	170
44	OR2080926	19	46	70
45	OR2090473	20	54	109
46	GALGALOS	137	75	112
47	NORWEST 553	98	25	152
48	BOUNDARY	38	115	108
49	YAMHILL	102	155	9
50	WHETSTONE	62	34	132
51	ARROWHEAD	100	76	153
52	RIMROCK	61	146	111
53	KELDIN	140	7	68
54	EXPRESSO	42	166	88

NUMBER OF TREATMENTS = 54

PLANTING DATE
11/15/2012
PREVIOUS CROP

SURROUNDING CROP

PRE-PLANT FERTILIZE

SOIL TYPE

2013 WINTER WHEAT

TULELAKE PLANTING DATE 11/15/2012

Field: 71 HARVEST DATE

FILL 10	FILL 11	FILL 30	FILL 31	FILL 50	C 38 51	C 44 70	C 17 71	C 31 90	C 6 91	C 11 110	C 52 111	C 1 130	C 3 131	C 2 150	C 27 151	C 43 170	FILL 171
C 49 9	C 34 12	C 25 29	C 21 32	C 24 49	C 36 52	C 8 69	C 30 72	C 12 89	C 29 92	C 45 109	C 46 112	C 15 129	C 50 132	C 13 149	C 47 152	C 23 169	FILL 172
FILL 8	C 42 13	C 10 28	C 37 33	C 39 48	C 20 53	C 53 68	C 40 73	C 54 88	C 22 93	C 48 108	C 32 113	C 4 128	C 35 133	C 9 148	C 51 153	C 28 168	FILL 173
B 53 7	B 32 14	B 26 27	B 50 34	B 16 47	B 45 54	B 13 67	B 42 74	C 19 87	C 7 94	C 14 107	C 33 114	C 16 127	C 5 134	C 26 147	C 18 154	C 41 167	FILL 174
B 21 6	B 37 15	B 28 26	B 20 35	B 44 46	B 14 55	B 29 66	B 46 75	B 18 86	B 27 95	B 11 106	B 48 115	B 2 126	B 25 135	B 52 146	B 49 155	B 54 166	FILL 175
B 17 5	B 1 16	B 47 25	B 31 36	B 24 45	B 3 56	B 23 65	B 51 76	FILL 85	B 19 96	B 15 105	B 33 116	B 36 125	B 7 136	B 22 145	B 41 156	B 34 165	FILL 176
B 40 4	B 30 17	B 9 24	B 10 37	B 35 44	B 39 57	B 8 64	B 4 77	FILL 84	B 38 97	B 5 104	B 6 117	B 43 124	A 46 137	A 12 144	A 4 157	A 1 164	B 12 177
A 20 3	A 3 18	A 38 23	A 48 38	A 40 43	A 8 58	A 2 63	A 39 78	FILL 83	A 47 98	A 33 103	A 37 118	A 42 123	A 26 138	A 36 143	A 15 158	A 31 163	A 9 178
A 35 2	A 44 19	A 30 22	A 43 39	A 54 42	A 23 59	A 50 62	A 34 79	FILL 82	A 7 99	A 49 102	A 32 119	A 18 122	A 14 139	A 5 142	A 28 159	A 25 162	A 22 179
A 17 1	A 45 20	A 41 21	FILL 40	A 21 41	A 29 60	A 52 61	A 16 80	FILL 81	A 51 100	A 19 101	A 27 120	A 6 121	A 53 140	A 11 141	A 10 160	A 13 161	A 24 180

2012 Tulelake Winter Wheat Trial

Entry	Name	Yield (lbs/acre)		Test Wt (lbs/bu)	Plant Ht (in)	Days To Heading From (1/1)	Lodging Harvest
1	Stephens	6680	(26)	57.4	37	177	1.0
2	Madsen	6470	(31)	57.9	38	180	1.0
3	Tubbs-06	7280	(7)	58.2	39	177	1.0
4	ORSS-1757	6020	(40)	56.9	35	173	1.0
5	Goetze	5850	(44)	56.7	35	172	1.0
6	Skiles	6660	(27)	59.2	35	175	1.0
7	Mary	7350	(4)	58.7	33	174	1.0
8	Brundage 96	6860	(17)	57.7	36	172	1.0
9	Bruneau	6940	(15)	57.7	37	177	1.0
10	96-16702A	7540	(2)	59.1	41	172	1.0
11	IDO 663	6840	(18)	58.5	35	176	1.0
12	WA 8134	7120	(10)	58.5	39	173	1.0
13	ARS-Amber	7060	(11)	57.3	36	179	1.0
14	970161-3L	6550	(29)	59.3	35	180	1.0
15	YS 221	7330	(5)	59.9	35	176	1.0
16	YS 215	7540	(1)	59.5	35	177	1.0
17	NSA 94-2351A	6730	(23)	58.1	33	173	1.0
18	LWW 04-4009	6690	(25)	59.3	35	183	1.0
19	Westbred 528	6200	(37)	57.9	34	174	1.0
20	WB Junction	7210	(8)	59.9	36	169	1.0
21	Legion	7300	(6)	58.4	40	181	1.0
22	AP Legacy	7040	(12)	59.1	37	179	1.0
23	AP Badger	6770	(20)	56.5	34	175	1.0
24	SY Ovation	6960	(14)	59.0	34	176	1.0
25	ORCF-101R	6300	(33)	57.7	34	176	1.0
26	ORCF-102	6270	(34)	58.2	36	176	1.0
27	ORCF-103	6730	(22)	58.2	38	181	1.8
28	ORI2101835	5950	(41)	57.1	38	179	1.0
29	UICF-Brundage	6690	(24)	57.5	32	177	1.0
30	AP700CL	6780	(19)	58.8	39	179	1.0
31	WB 1070CL	6190	(38)	61.3	32	166	1.0
32	WB 1066CL	6210	(36)	61.3	40	169	1.0
33	Coda	6970	(13)	59.7	39	181	1.0
34	Cara	6220	(35)	55.5	36	185	1.0
35	ARS97230-6C	6560	(28)	58.3	34	181	1.0
36	OR2070608	5650	(45)	56.4	35	182	1.0
37	OR2070870	5870	(43)	58.2	33	180	1.0
38	OR2071071	6760	(21)	55.9	34	180	1.0
39	OR2071628	6400	(32)	55.7	33	176	1.0
40	OR2071073	6470	(30)	56.8	33	181	1.0
41	OR2080641	7370	(3)	56.8	35	177	1.0
42	OR08047P94	7200	(9)	56.2	33	179	1.0
43	OR2070422	6070	(39)	56.5	34	181	1.0
44	OR2080764	5920	(42)	54.1	35	179	1.0
45	OR2080924	6930	(16)	57.3	36	179	1.0
46	WINCAL 09196	4930	(46)	61.0	32	169	1.0
	MEAN	6640		58.0	35	177	1.0
	CV	6.1		0.8	5.4	1.1	13.9
	LSD (.05)	570		0.9	3	3	0.2

Rating scale for diseases (area of flag-1 leaf affected), and lodging: 1 = 0-3%, 2 = 4-14%, 3 = 15-29%, 4 = 30-49%, 5 = 50-69%, 6 = 70-84%, 7 = 85-95%, 8 = 96-100%.

Numbers in parentheses indicate relative rank in column.

2013 OSEYT
TULELAKE

PLOT 1 IS IN THE
CORNER

		REPLICATE		
NO	ENTRY	1	2	3
1	Kelse	21	14	52
2	Glee (WA 8074)	19	76	110
3	WA 8166	121	97	129
4	Bullseye	42	7	109
5	Cabernet	63	36	107
6	SY Steelhead (97S	82	64	9
7	Buck Pronto	83	35	127
8	08SB0658-B	120	105	112
9	LNR10-0551	78	96	111
10	11SB0096	20	6	73
11	WB 9879 CL+	60	46	92
12	WB 9518	22	45	113
13	Jefferson	79	104	87
14	IDO 862E	99	115	33
15	IDO 862T	119	5	29
16	Lassik	18	34	90
17	UC 12010/13	80	24	67
18	IDO694C	2	4	68
19	IDO1202S	59	27	94
20	DAYN	40	25	47
21	Patwin 515	117	55	74
22	UC 12010/30	102	106	128
23	UC 12013/22	1	77	114
24	UC 12014/15	101	26	108
25	Alturas	122	125	48
26	UI Stone	98	44	28
27	IDO 852	3	17	130
28	IDO 851	124	85	32
29	IDO 854	123	66	72
30	WB 1035 CL+	100	57	88
31	WB 6341	103	37	49
32	WB 6121	23	86	53
33	Alpowa	58	84	54
34	Louise	41	95	71
35	JD	118	16	12
36	Diva	39	116	13
37	Whit	61	15	91
38	Babe	62	56	93
39	WA 8162	43	75	8
40	WA 8189	38	65	89
41	EXCEDE	81	126	69

NUMBER OF TREATMENTS = 41

PLANTING DATE

PREVIOUS CROP

SURROUNDING CROP

PRE-PLANT FERTILIZE

SOIL TYPE

2013 OSEYT				PLANTING DATE		______						
TULELAKE												
Field: 62				HARVEST DATE		______						
FILL 10	FILL 11	FILL 30	FILL 31	FILL 50	FILL 51	FILL 70	C 34 71	C 16 90	C 37 91	C 2 110	C 9 111	C 27 130
C 6 9	C 35 12	C 15 29	C 28 32	C 31 49	C 1 52	C 41 69	C 29 72	C 40 89	C 11 92	C 4 109	C 8 112	C 3 129
C 39 8	C 36 13	C 26 28	C 14 33	C 25 48	C 32 53	C 18 68	C 10 73	C 30 88	C 38 93	C 24 108	C 12 113	C 22 128
B 4 7	B 1 14	B 19 27	B 16 34	C 20 47	C 33 54	C 17 67	C 21 74	C 13 87	C 19 94	C 5 107	C 23 114	C 7 127
B 10 6	B 37 15	B 24 26	B 7 35	B 11 46	B 21 55	B 29 66	B 39 75	B 32 86	B 34 95	B 22 106	B 14 115	B 41 126
B 15 5	B 35 16	B 20 25	B 5 36	B 12 45	B 38 56	B 40 65	B 2 76	B 28 85	B 9 96	B 8 105	B 36 116	B 25 125
B 18 4	B 27 17	B 17 24	B 31 37	B 26 44	B 30 57	B 6 64	B 23 77	B 33 84	B 3 97	B 13 104	A 21 117	A 28 124
A 27 3	A 16 18	A 32 23	A 40 38	A 39 43	A 33 58	A 5 63	A 9 78	A 7 83	A 26 98	A 31 103	A 35 118	A 29 123
A 18 2	A 2 19	A 12 22	A 36 39	A 4 42	A 19 59	A 38 62	A 13 79	A 6 82	A 14 99	A 22 102	A 15 119	A 25 122
A 23 1	A 10 20	A 1 21	A 20 40	A 34 41	A 11 60	A 37 61	A 17 80	A 41 81	A 30 100	A 24 101	A 8 120	A 3 121

2012 Tulelake Spring Wheat Trial

Entry	Name	Yield		Test Wt	Plant Ht	Days To Heading	Lodging		Xanthomonas
		(lbs/acre)		(lbs/bu)	(in)	From (3/1)	Soft Dough	Harvest	
1	Kelse	6420	(31)	60.6	35	126	1.0	1.3	1.0
2	Glee (WA 8074)	6030	(34)	60.4	36	122	4.3	4.0	1.0
3	Bullseye	7580	(17)	62.6	32	125	1.0	3.3	1.0
4	Cabernet	7760	(14)	63.2	32	125	1.0	1.3	1.0
5	97S621 - 05	7150	(25)	62.2	39	126	1.0	3.0	1.0
6	90314	6520	(30)	59.6	29	127	1.0	1.0	1.0
7	Summit 515	7420	(19)	60.8	33	125	1.0	1.0	1.0
8	Cal Rojo	7690	(16)	61.6	28	125	1.0	1.0	1.0
9	Redwing	7470	(18)	58.5	29	127	1.0	1.0	1.0
10	Jefferson	7170	(23)	60.9	37	125	1.3	2.0	1.0
11	Buck Pronto	7160	(24)	60.9	36	123	1.0	1.3	1.0
12	C-2821	7290	(20)	61.2	42	124	1.0	2.3	1.0
13	BZ-401	6960	(27)	62.0	42	122	2.7	3.3	1.0
14	Lassik	6790	(28)	59.0	33	126	1.0	1.0	1.0
15	UC 1618	6080	(33)	58.6	36	127	1.0	1.0	1.0
16	WB-Rockland	6760	(29)	63.0	32	126	1.0	1.0	1.0
17	WB-Fuzion	8090	(10)	62.4	41	124	1.0	2.0	1.3
18	Volt	7190	(22)	62.7	38	129	1.0	1.3	1.3
19	Patwin 515	7230	(21)	58.5	28	127	1.0	1.0	1.0
20	Clearwhite 515	7980	(11)	60.3	32	122	1.0	2.0	2.7
21	WB-Hartline	8270	(8)	60.8	38	126	1.0	2.0	2.3
22	IDO 694	8710	(4)	63.2	34	122	1.0	1.3	1.0
23	WB 1035 CL+	7700	(15)	61.4	38	123	1.0	1.0	1.0
24	Alturas	8360	(5)	60.7	38	125	1.0	2.0	1.7
25	IDO 671	8100	(9)	60.1	37	126	1.3	2.3	1.0
26	IDO 644	8350	(7)	59.1	34	122	1.0	2.0	1.7
27	IDO 599	9890	(1)	59.7	39	124	1.0	1.7	1.7
28	IDO 686	7910	(12)	61.6	40	127	1.0	2.3	1.0
29	IDO 687	8950	(2)	61.9	39	126	1.0	1.0	1.3
30	Alpowa	8360	(6)	61.4	41	130	2.7	3.3	1.0
31	Louise	6160	(32)	56.4	36	125	2.7	5.7	1.0
32	JD	7040	(26)	61.4	39	127	2.7	3.7	1.0
33	Diva	5020	(35)	57.9	34	127	5.0	6.7	1.0
34	Whit	7860	(13)	61.5	39	123	2.0	2.0	1.0
35	Babe	8850	(3)	62.4	39	126	1.0	2.7	1.0
	MEAN	7490		60.8	36	125	1.4	2.1	1.2
	CV	5.8		1.1	8.2	0.6	35.4	30.8	51.7
	LSD (.05)	710		1.4	5	2	0.8	1.1	ns

Rating scale for diseases (area of flag-1 leaf affected) and lodging: 1 = 0-3%, 2 = 4-14%, 3 = 15-29%, 4 = 30-49%, 5 = 50-69%, 6 = 70-84%, 7 = 85-95%, 8 = 96-100%.

Numbers in parentheses indicate relative rank in column.

2013 SPRING BARLEY
TULELAKE

PLOT 1 IS IN THE
CORNER

		REPLICATE		
NO	ENTRY	1	2	3
204	STEPTOE	98	116	87
900	BARONESSE	23	55	134
960	UC 960	119	15	74
1010	MILLENNIUM	102	14	12
1082	CONRAD	123	135	129
1099	UCD-TL20	38	34	128
1201	TLB 148	59	105	107
1217	AC Metcalfe	3	44	110
1219	BZ502-265	62	84	53
1274	UCD 4B	22	37	72
1278	UCD 10B	18	36	113
1292	UCD 1292	120	125	127
1297	CDC COPELAND	138	86	33
1299	MERIT 57	2	117	68
1300	PINNACLE	42	106	109
1301	CELEBRATION	63	104	89
1302	STELLAR-ND	21	17	54
1328	UCD 1328	41	66	32
1329	UCD 1329	124	16	92
1330	UCD 1330	20	56	73
1332	UCD 1332	19	46	90
1335	UCD 1335	122	65	111
1337	UCD 1337	79	75	94
1339	UCD 1339	118	7	131
1341	UCD 1341	60	85	8
1342	UCD 1342	121	5	133
1344	QUEST	139	25	108
1345	RASMUSSON	99	97	130
1362	UCD 1362	40	115	132
1363	UCD 1363	39	96	47
1364	UCD 1364	61	6	28
1365	UCD 1365	100	35	13
1366	UCD 1366	82	77	88
1367	UCD 1367	83	45	48
1368	UCD 1368	140	4	69
1369	UCD 1369	103	95	9
1370	UCD 1370	81	24	29
1371	UCD 1371	58	126	112
1372	UCD 1372	43	76	114
1373	UCD 1373	78	57	93
1374	UCD 1374	101	26	91
1375	UCD 1375	1	136	67
1376	UCD 1376	80	27	49
1377	UCD 1377	137	64	52

NUMBER OF TREATMENTS = 44

PLANTING DATE

PREVIOUS CROP

SURROUNDING CROP

PRE-PLANT FERTILIZE

SOIL TYPE

2013 SPRING BARLEY

PLANTING DATE ____________

TULELAKE

Field: 70

HARVEST DATE ____________

FILL 10	FILL 11	FILL 30	FILL 31	FILL 50	FILL 51	FILL 70	FILL 71	C 1332 90	C 1374 91	C 1217 110	C 1335 111	C 1345 130	C 1339 131
C 1369 9	C 1010 12	C 1370 29	C 1328 32	C 1376 49	C 1377 52	C 1368 69	C 1274 72	C 1301 89	C 1329 92	C 1300 109	C 1371 112	C 1082 129	C 1362 132
C 1341 8	C 1365 13	C 1364 28	C 1297 33	C 1367 48	C 1219 53	C 1299 68	C 1330 73	C 1366 88	C 1373 93	C 1344 108	C 1278 113	C 1099 128	C 1342 133
B 1339 7	B 1010 14	B 1376 27	B 1099 34	C 1363 47	C 1302 54	C 1375 67	C 960 74	C 204 87	C 1337 94	C 1201 107	C 1372 114	C 1292 127	C 900 134
B 1364 6	B 960 15	B 1374 26	B 1365 35	B 1332 46	B 900 55	B 1328 66	B 1337 75	B 1297 86	B 1369 95	B 1300 106	B 1362 115	B 1371 126	B 1082 135
B 1342 5	B 1329 16	B 1344 25	B 1278 36	B 1367 45	B 1330 56	B 1335 65	B 1372 76	B 1341 85	B 1363 96	B 1201 105	B 204 116	B 1292 125	B 1375 136
B 1368 4	B 1302 17	B 1370 24	B 1274 37	B 1217 44	B 1373 57	B 1377 64	B 1366 77	B 1219 84	B 1345 97	B 1301 104	B 1299 117	A 1329 124	A 1377 137
A 1217 3	A 1278 18	A 900 23	A 1099 38	A 1372 43	A 1371 58	A 1301 63	A 1373 78	A 1367 83	A 204 98	A 1369 103	A 1339 118	A 1082 123	A 1297 138
A 1299 2	A 1332 19	A 1274 22	A 1363 39	A 1300 42	A 1201 59	A 1219 62	A 1337 79	A 1366 82	A 1345 99	A 1010 102	A 960 119	A 1335 122	A 1344 139
A 1375 1	A 1330 20	A 1302 21	A 1362 40	A 1328 41	A 1341 60	A 1364 61	A 1376 80	A 1370 81	A 1365 100	A 1374 101	A 1292 120	A 1342 121	A 1368 140

2012 Tulelake Spring Barley Trial

						Days To	Lodging		Shatter	Xanthomonas
Entry	Name	Yield		Test Wt	Plant Ht	Heading	Soft			
		(lbs/acre)		(lbs/bu)	(in)	From (1/1)	Dough	Harvest		
CULTIVARS										
204	STEPTOE	6940	(30)	50.8	37	181	1.0	5.0	1.3	1.0
900	BARONESSE	4640	(37)	52.7	37	183	1.0	6.0	5.0	1.0
960	UC 960	8260	(12)	50.8	31	178	1.0	2.0	1.0	1.3
1010	MILLENNIUM	8110	(17)	52.5	43	171	1.0	1.0	1.0	1.3
1082	CONRAD	7020	(28)	53.3	36	180	5.7	5.3	1.7	1.0
1217	AC METCALFE	5250	(36)	52.7	38	181	1.0	7.0	3.3	1.0
1297	CDC COPELAND	5520	(35)	53.2	38	182	6.7	7.0	1.0	1.3
1299	MERIT 57	5910	(34)	53.5	36	181	6.3	6.3	1.3	2.7
1300	PINNACLE	6400	(33)	55.0	38	176	5.0	5.0	1.7	3.3
1301	CELEBRATION	7390	(24)	54.3	37	172	1.0	6.0	2.3	1.0
1302	STELLAR-ND	6850	(31)	54.4	38	175	1.0	3.0	2.0	1.0
1344	QUEST	6650	(32)	53.9	43	174	2.7	4.0	2.3	1.0
1345	RASMUSSON	8390	(11)	53.5	37	174	1.0	5.3	1.7	3.0
ADVANCED LINES										
1099	UCD-TL20	8770	(7)	51.2	38	180	1.0	1.3	1.0	4.0
1201	TLB 148	9400	(3)	52.2	38	181	1.0	1.0	1.0	1.7
1219	BZ502-265	7460	(23)	54.7	38	181	5.3	5.3	1.3	1.0
1268	UCD 1A	8160	(15)	48.4	34	180	1.0	1.0	1.0	2.7
1274	UCD 4B	7820	(19)	50.6	35	187	3.0	5.3	1.0	4.0
1278	UCD 10B	8950	(5)	52.9	39	174	1.3	3.3	1.3	2.7
1290	UCD 1290	8650	(8)	52.0	41	174	1.0	2.0	1.0	1.0
1292	UCD 1292	8600	(9)	52.7	37	179	1.0	1.7	1.0	1.0
1328	UCD 1328	7000	(29)	54.4	37	187	2.0	3.3	1.0	1.0
1329	UCD 1329	8200	(13)	50.7	35	184	1.3	3.3	1.0	2.3
1330	UCD 1330	8790	(6)	50.8	36	188	2.0	3.3	1.0	1.0
1331	UCD 1331	8170	(14)	51.2	37	185	1.3	4.0	1.0	3.0
1332	UCD 1332	8530	(10)	51.1	32	184	1.0	2.0	1.0	1.0
1333	UCD 1333	7810	(20)	55.6	33	182	1.0	5.0	1.3	1.0
1334	UCD 1334	7270	(26)	54.9	34	177	1.3	2.0	1.0	1.0
1335	UCD 1335	7740	(21)	55.6	33	185	1.0	3.7	1.3	1.3
1336	UCD 1336	7340	(25)	52.8	42	175	2.0	2.7	1.3	2.3
1337	UCD 1337	9380	(4)	52.3	38	173	1.3	1.3	1.0	2.7
1338	UCD 1338	8000	(18)	51.0	42	176	3.3	4.3	1.3	2.3
1339	UCD 1339	9570	(2)	52.1	42	175	1.3	2.3	1.0	4.0
1340	UCD 1340	8120	(16)	51.3	38	175	2.0	4.7	1.0	1.0
1341	UCD 1341	9720	(1)	50.0	33	184	1.0	1.7	1.0	2.3
1342	UCD 1342	7110	(27)	50.3	37	176	4.7	3.7	1.0	1.0
1343	UCD 1343	7660	(22)	55.0	36	186	1.0	2.7	1.0	1.7
	MEAN	7720		52.5	37	179	2.1	3.6	1.4	1.9
	CV	9.6		2.2	7.1	1.1	45.0	33.5	38.9	43.8
	LSD (.05)	1200		2.4	4	3	1.5	2.0	0.9	1.3

Rating scale for diseases (area of flag-1 leaf affected), lodging, and shatter: 1 = 0-3%, 2 = 4-14%,
3 = 15-29%, 4 = 30-49%, 5 = 50-69%, 6 = 70-84%, 7 = 85-95%, 8 = 96-100%.
Numbers in parentheses indicate relative rank in column.

Thank You for Your Generous and Continued Support!

We would like to take this opportunity to sincerely thank the following sponsors who help make Field Day such a wonderful success. The support they provide allows us to offer the morning refreshments, the informational publication, the excellent catered lunch and drinks and the home-made ice cream.

- AMVAC
- BASF
- Basin Fertilizer
- California Onion and Garlic Research Advisory Board
- California Potato Research Board
- DuPont Crop Protection
- Floyd A. Boyd
- Macy's Flying Service
- Northwest Farm Credit Service
- Sensient Natural Ingredients, LLC
- Siskiyou County Ag Commissioner

2013 IREC Annual Field Day
Thursday, August 1, 2013
Tulelake, CA

7:30 am	*Registration Opens*
8:20 am	*Tour Departs from IREC Headquarters*
8:30 am	*Weed Control in Potatoes* Rob Wilson, Center Director/Farm Advisor, IREC, Tulelake, CA
8:50 am	*Characterizing N Fertilizer Requirements of Crops Following Alfalfa and Alfalfa Experimental Germplasm Evaluation* Dan Putnam, Extension Agronomist, Dept. of Plant Sciences, UC Davis
9:10 am	*Management Strategies for Suppressing White Rot Disease in Processing Onions* Allison Ferry, Grad Student, Dept of Plant Pathology, UC Davis
9:30 am	*Management of Two Spotted Spider Mites and Mint Root Borer in Peppermint* Kris Tollerup, Post-Doctoral Researcher, Dept of Entomology, UC Davis
9:50 am	*Alfalfa Harvest Management: Entering a new era?* Steve Orloff, UC Farm Advisor, Yreka, CA
10:10 am	*New Herbicide Options for Weed Control in Onions* Rob Wilson, Center Director/Farm Advisor, IREC, Tulelake, CA
10:30 am	*BREAK*
10:40 am	*Maggot Control in Processing Onions* Rob Wilson, Center Director/Farm Advisor, IREC, Tulelake, CA
10:50 am	*Year-Long Thrips Insecticide Control Strategies in Onions* Steve Orloff, UC Farm Advisor, Yreka, CA
11:10 am	*Small Grains Genetic Resources and Development* Cal Qualset, Research Professor, Davis, CA
11:30 am	*Nitrogen Management in Wheat to Maximize Yield & Profitability* Steve Orloff, UC Farm Advisor, Yreka, CA
11:50 am	*2013 Potato Research Update* Rob Wilson, Center Director/Farm Advisor, IREC, Tulelake, CA
12:00 pm	Lunch