2018 FIELD DAY

July 26 8 a.m. to 1 p.m.

Intermountain Research and Extension Center

2816 Havlina Road

Tulelake, CA 96134

530/667-5117

Irec.ucanr.edu

Welcome to our Annual Field Day

This Field Day 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 the research our Center is conducting 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
Darrin Culp	Superintendent of Agriculture
Laurie Askew	Business Officer
Kevin Nicholson	Staff Research Associate II
Skyler Peterson	Staff Research Associate II
Tom Tappan	Farm Machinery Mechanic
Seferino Salazar	Senior Agricultural Technician
Josefina Vallejo	Seasonal Farm Worker
Robert Carver	Seasonal Farm Worker

http://irec.ucanr.edu

We’ve redesigned our website! Below is a list of some information available.
Thanks for bookmarking!

Home:

Welcome to IREC and Tulelake

Stay current with upcoming IREC events

Subscribe to and read our blog

About Us:

Learn about the history of IREC

Get to know the IREC staff

Check out our facilities

Get directions to IREC

Research:

Learn how to submit a proposal

Keep up on current research

Read results of past research

Extension, Outreach & Education:

Read about the Center activities

Peruse our newsletters and Field Day booklets

Watch IREC videos

Study our cost studies

Weather, Physical & Biological Data:

Check out Tulelake weather and CIMIS

Use the Crop Water Use Table

Potato Projects

132- Potato Variety Selection Evaluation & Development

Principle Investigator: Rob Wilson, Center Director/Farm Advisor, 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

- 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.

151- Comparison of Nitrogen-Fixing Cover Crops and Organic Amendments for Nitrogen Fertilization in Organic Potatoes

Principle Investigator: Rob Wilson, Center Director/Farm Advisor, Intermountain Research and Extension Center; Darrin Culp, Principal Superintendent of Agriculture, Intermountain Research and Extension Center; Brian Charlton, Cropping Systems Specialist, Oregon State University, Klamath Basin Research and Extension Center

- Determine which nitrogen-fixing cover crops are best suited for Northern California potato production.
- Estimate the nitrogen credit to spring-planted potatoes from nitrogen-fixing cover crops.
- Estimate the nitrogen credit to spring-planted potatoes from fall-applied chicken manure, steer manure and compost.
- Determine the influence of fall-incorporated manures and fall-incorporated nitrogen fixing cover crops on potato yield and potato quality

Small Grains Projects

213- California Small Grain Variety Selection Trial

Principle Investigator: Mark Lundy, UC Specialist, Dept. of Plant Sciences, Davis

- To determine productivity, phenological information and disease incidence for small grains relevant to the intermountain region.

231- Osprey Herbicide Trial

Principle Investigator: Rob Wilson, Director/Farm Advisor Intermountain REC, Tulelake, CA.

- Evaluate winter wheat tolerance to Osprey herbicide
- Evaluate weed control from Osprey herbicide and Osprey Xtra
- Determine fit of this herbicide in the region including favorable tank-mixes and rates

238- Wheat Genetic Resources & Mapping Experiments

Principle Investigator: 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

- To grow and make observations on agronomic and disease resistance on advanced breeding and genetic lines
- To make the genetic resources available to any researchers who have interest for their breeding or research
- To genetically characterize two populations of recombinant inbred lines for morpho-physiologic and agronomic traits
- 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

260- Development of Wheat Varieties for California

Principle Investigator: 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

To produce new varieties & improved germplasm and distribute them to growers, breeders and other researchers. A multi-objective project will be conducted which:

- Introduces new germplasm for evaluation and breeding
- Develops breeding populations through hybridization, selection and evaluation
- 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
- 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

266- Cereal Leaf Beetle Parasitoid Support

Principle Investigator: Charlie Pickett, Staff Environmental Research Scientist (Entomology), CDFA, Sacramento; Rob Wilson, Director/Farm Advisor, IREC; Darrin Culp, Supt. of Ag, IREC.

- To provide an area for the survival and production of parasitic wasps.
- To maintain a high population of CLB eggs and larvae throughout the spring and summer as food for the wasps.
- To provide a low-cost, effective alternative to controlling cereal leaf beetle infestations in our local area.
- To provide a supply of parasitic wasps for redistribution to infested areas.

274- Use of Palisade PGR to Prevent Barley Lodging in Tulelake

Principle Investigator: Rob Wilson, Center Director/Farm Advisor, UC Intermountain Research & Extension Center

- Test different rates and timings of Palisade to determine the PGR's influence on barley lodging, barley yield, and barley grain quality.

Alfalfa Projects

340- Alfalfa Variety Evaluation in Mountain Valleys of Northern California

Principle Investigator: Dan Putnam, Extension Agronomist, Dept. of Plant Science, UC Davis; Craig Giannini, UC SRA, UC Davis

Evaluate certified cultivar differences in alfalfa forage yield, quality, and persistence, and to communicate these results to clientele

- Develop and provide forage yield and performance data on alfalfa experimental germplasm to public and private alfalfa scientists

342-Improved Management of Alfalfa Weevil in California to Facilitate Water Quality Protection and Crop Sustainability

Principle Investigator: Rachael Long, Farm Advisor for Field Crops, Pest Management, UCCE Capitol Corridor, Woodland, California.

345- Cutting Schedule Effects on Reduced Lignin & Conventional Alfalfa

Principle Investigator: Dan Putnam, Extension Agronomist, Department of Plant Sciences, UC Davis

- 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
- Determine the appropriate cutting management schedule for low-lignin alfalfa compared with conventional non-genetically engineered alfalfa

366- Clover Root Cucurlio Management in Alfalfa Production

Principle Investigator: Rachael Long, Farm Advisor for Field Crops, Pest Management,UCCE Capitol Corridor, Woodland, California.

- Track the activity of CRC life stages during the season to improve our understanding of CRC biology and life history and of the conditions where CRC may be problematic, thus improving the timing and effectiveness of management decisions.
- Evaluate biological and chemical pesticides for CRC suppression given that there are no registered soil active products.
- Evaluate alfalfa varieties/lines that show resistance toward insect pests on CRC feeding and oviposition.
- Collaboratively conduct multistate Extension programs that help alfalfa growers understand CRC activity and adopt CRC management strategies.

397- Alfalfa Germplasm Evaluation-Fall Dormancy

Principle Investigator: Charles Brummer, Director, Plant Breeding Center, UC Davis; Dan Putnam, Extension Agronomist, Department of Plant Science, UC Davis.

- To develop a measurement method to assess dormancy in swards.
- To evaluate fall dormancy of the standard check cultivars and selected other modern cultivars in both swards using the new protocol and in spaced plants using the current protocol.

Onion Projects

451-Management of White Rot of Onions with Fungicides

Principle Investigator: Rob Wilson, Center Director/Farm Advisor, UC Intermountain Research & Extension Center

Demonstrate the effectiveness of DADS in lowering soil levels of white rot sclerotia.

- Demonstrate fungicidal control of white rot in onions and garlic in plots with reduced soil sclerotia levels.

458-Management of Seedcorn Maggot and Onion Maggot in Processing Onions

Principle Investigator: Rob Wilson, Center Director/Farm Advisor, UC Intermountain Research & Extension Center; Kevin Nicholson, Staff Research Assistant, UC Intermountain Research & Extension Center

- Evaluate different seed treatment options for applying insecticides and fungicides to onion seed.
- Determine compatibility of seed treatments with in-furrow sprays.

Peppermint Projects

511-Mint Variety Trial

Principle Investigator: Isabelle Henry, UC Davis.

- Characterize Plant Morphology
- Characterize the Oil Profile of Diverse Materials
- Characterize Oil Yield

569-Weed Control in Peppermint

Principle Investigator: Rob Wilson, Center Director/Farm Advisor, UC Intermountain Research & Extension Center

- Investigate winter dormant herbicides for control of groundsel in peppermint.
- Investigate winter dormant herbicides efficacy for providing pre-emergent control of summer annual weeds.
- Investigate spring post-emergent herbicides for control of emerged pigweed.

Forage Projects

731-Investigation of Indaziflam for Invasive Annual Grass Control and Perennial Grass Establishment

Principle Investigator: Tom Getts, Weed Ecology & Cropping Systems Advisor, Lassen County, Susanville.

- To determine effectiveness of invasive annual grass control after indaziflam and aminocyclopyrachlor application.
- To assess secondary weed invasion after annual grass herbicide applications.
- To determine perennial species herbicide tolerance, and establishment potential.

762-Tall Fescue Isogenic Population Evaluation

Principle Investigator: Charles Brummer; Co-PI's: Tami Leathers, Leslie Roche, Daniel Putnam, Josh Davy.

- The objective of this project is to determine the adaptation of tall fescue ecotypes with and without endophytes across California.

784-Influence of Fall Defoliation Height on the Productivity of Three Perennial Grasses

Principle Investigator: David Lile, County Director/Farm Advisor, Lassen County, Susanville

- Compare the yield potential of the three most commonly grown perennial grass species in the Intermountain Region.
- Evaluate the effect of three different fall herbage heights on the subsequent growth of tall fescue, orchardgrass and Timothy.
- Determine the effect of fall herbage height on water soluble carbohydrates the following spring and determine the relationship between water soluble carbohydrates and pasture growth.
- Estimate the biomass and nutritive value of fall/winter harvested forage of each treatment (using #1 as benchmark) to demonstrate how much fall forage producers would have to forego to implement higher stubble-height management strategy.

914-Kura Clover Project

Principle Investigator: Dan Putnam, Extension Agronomist, Dept. of Plant Science, UC Davis; Charlie Brummer, UC Davis; N. Ehlke, C. Sheaffer, Univ. Minnesota; Oli Bacchi, UCCE, El Centro; Chris DeBen, UC Davis; Khaled Bali, UCCE El Centro.

- To determine preliminary seed and forage yield possibilities at 3 different locations in California.

Other Research

764-Microbial Water Quality Survey on the Klamath and Modoc National Forests

Principal Investigator: Kenneth W. Tate, Ph.D. Professor and Rangeland Watershed Specialist, Department of Plant Sciences, UC Davis; Leslie Roche Ph.D., Assistant Cooperative Extension Specialist, Department of Plant Sciences; Carissa K. Rivers, County Director/Livestock & Natural Resources Advisor, Siskiyou County; Laura Snell, County Director/Livestock & Natural Resources Advisor, Cooperative Extension, Modoc County.

Qualtify *E.coli* concentrations in surface waters at 6 key grazing areas in the Modoc (n=3) sites) and Klamath (n=5 sites) National Forests for 30 days before (n=5 samples per site) and 30 days after (n=3 samples per site) annual livestock introduction.

931-Weed Management Strategies for Nightshade and Summer Annual Weeds in Garbanzo Beans Grown in Tulelake Basin

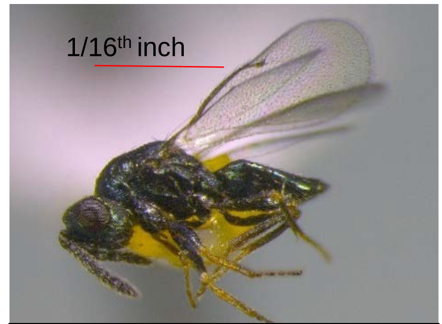
Principle Investigator: Rob Wilson, Center Director/Farm Advisor, UC Intermountain Research & Extension Center, Tulelake, California.

- Compare the efficacy of currently registered herbicides applied at recommended timings
- Determine the weed control benefits and crop safety of herbicide tank-mixes
- Evaluate the potential of using pyroxasulfone (Zidua) and dimethenamid-P (outlook) as a preemergence herbicides

CLB adult, photo by C. H. Pickett

Biocontrol of Cereal Leaf Beetle
July 26, 2018

UC Intermountain Research and Extension Center
Tulelake Cooperative Extension Field Station
C. H. Pickett[1], R. Wilson[2], and D. Culp[2]
cpickett@cdfa.ca.gov



Tetrastichus julis, photo by C. H. Pickett

Problem

Cereal leaf beetle (CLB), *Oulema melanopus* (Chrysomelidae) is a serious pest of wheat, oats, barley and other small grains and forage grasses. Both larvae (juvenile beetles) and adults feed on the growing leaves of grasses and can cause up to 25% yield loss if left unchecked. European in origin, the beetle was first reported in the midwestern region of the United States in 1962. The cereal leaf beetle rapidly became a serious pest in Michigan then spread throughout the Midwest and into Canada. A chemical eradication effort by the USDA failed to stop its spread to other grain producing, neighboring states. By 1984 the beetle had spread to Utah, Montana, and Idaho. It was first reported in Washington in 1999, then was soon found in Oregon. CLB was first reported in California at the UC Intermountain Research and Extension Center, Tulelake in 2013.

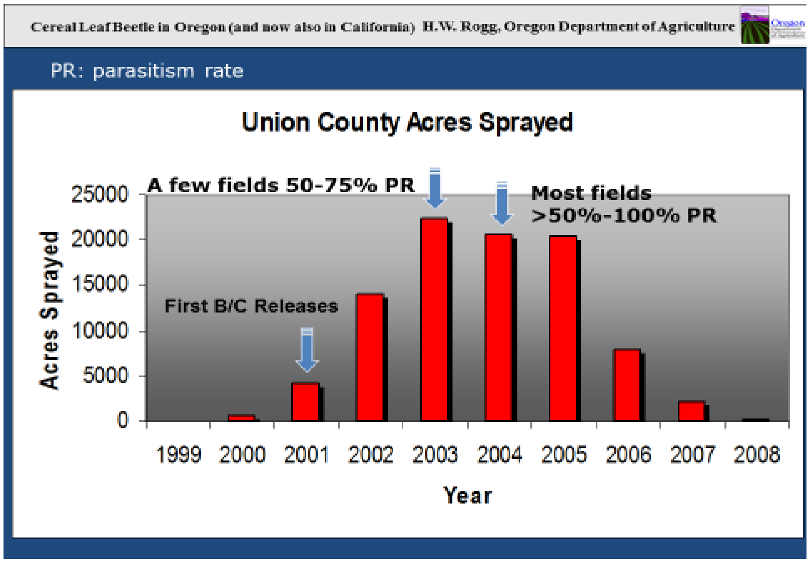
Solution:

In the early 1960's there were no known, effective natural enemies attacking CLB in the Midwest therefore exploration for parasitoids coevolving with the beetle in its native home was initiated. Three hymenopterous parasitoids (stingless wasps) were found attacking the larval stage of this pest in various countries in Europe and imported into the United States. The most successful parasitoid attacking CLB in Washington and Oregon is *Tetrastichus julis* (Eulophidae). We know that this parasitoid is highly specific for CLB because when given a choice of attacking and reproducing on 6 different beetles in North America, it failed to reproduce on any. It could only attack and reproduce on CLB. A biological control program to rear and spread *T. julis* throughout Northwestern United States has been extremely successful. An economic analysis by the Oregon Department of Agriculture shows a clear correlation between spray applications (lack of) and the buildup of *T. julis* in grain fields (Fig. 1).

---

[1]CDFA, Sacramento
[2] University of California Intermountain Research & Extension Ctr, Tulelake

Fig. 1. Spray applications on grains in Oregon from 1999 to 2007

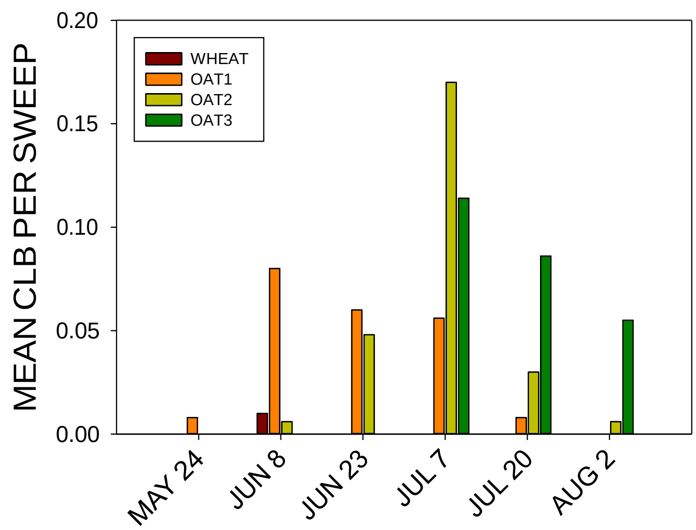


A similar effort to establish and spread *T. julis* throughout the Klamath Basin and south is currently underway. A field insectary designed after those used in Washington and Oregon has been planted at the UC Intermountain Research and Extension Center, Tulelake for the last 4 years. With help from the state of Oregon and the USDA APHIS, *T. julis* was collected in northern Oregon in 2014 and released into plots of wheat and oats. The field insectary is designed to maximize production of CLB, the food for *T. julis*. A series of four adjacent plots were planted beginning with winter wheat, followed by three plots of oats planted sequentially beginning in mid-April. Planting dates for oats were roughly 3 weeks apart (Fig. 2). By providing a constant, optimal food source to the beetles, their highest survivorship, and egg production are achieved. The more food for the parasitoids, the more beetle-killing, off-spring they produce. Fifty to 100 percent of larvae (CLB worms) collected in the insectary over the last month have been attacked by this parasitoid. In addition, female parasitoids (*T. julis*) will insert 5 to 30 eggs into each beetle worm, and most develop into adults. We have released parasitized beetle larvae into four commercial farms within 50 miles of the station.

The population of CLB in the field insectary begins with fall planted wheat. Adults deposit some eggs into wheat the following spring then move into the first planted oats. CLB prefers feeding and reproducing on oats over most other grasses. Resulting new adults will move into the second and third plantings of oats, preferring to lay eggs into the earlier rather than later stages of this grain. Most of the CLB shown in following graphs are made up of larvae, and a few adults.

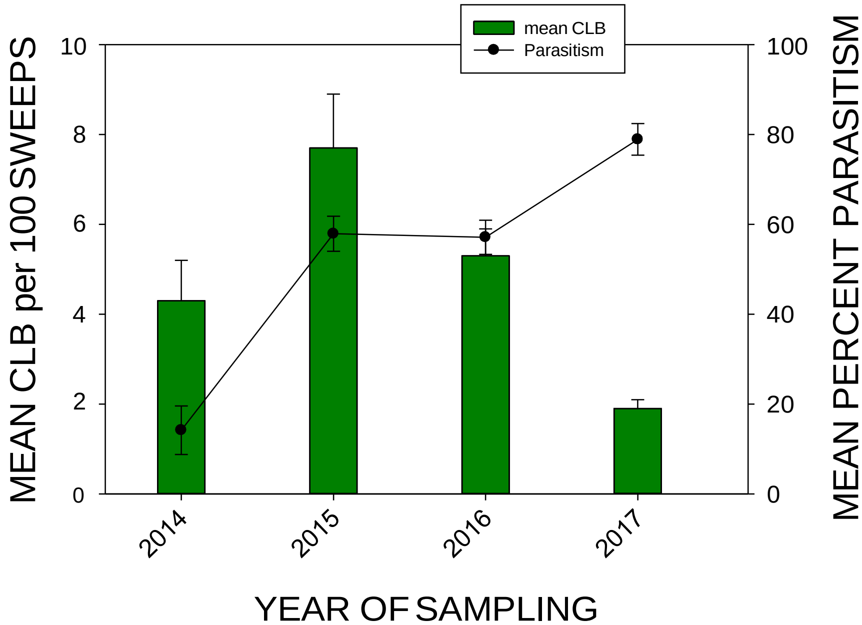
The changes in CLB densities measured in the insectary plot (Fig. 3) shows that the adult CLB are attracted to the greener, younger oats where they lay their eggs. The high number of CLB larvae in plots labeled Oat2 and Oat3 allowed for a high production of parasitoids.

Fig. 3. Plant age and CLB numbers, IREC, Tulelake, 2016. Followoing winter wheat, OAT1 was the first of three oat planting.



The impact of *T. julis* on the CLB population is so great that this beetle is unable to bounce back in numbers from one year to the next. We are now witnessing what appears to be a steady decline in the local population of this pest (Fig. 4). Samples averaged over the season, show a rise and fall in the numbers of beetles found at the UC Intermountain Research and Education Center; see the green bars in graph to right. While at the same time the parasitic wasp, black line in graph above, show a steady increase in numbers, measured as percent parasitism. By releasing this parasitoid into Modoc and Siskiyou counties, our goal is to reduce CLB in everyone's small grain crops.

Fig. 4. Change in Mean CLB (adults and larvae) and Parasitism, UC Tulelake, Insectary Plot, Oats only.



The following table is to aid in making pest management decisions.

cereal leaf beetle model - Fulton et al 1975 OSU
Location: 2013 KLMT Klamath Fls Int

Date	DDs	Event
4-10-13	93	OW gen. ca. 1st adult emerge
4-26-13	150	1st egg laying
5-10-13	270	50%/peak egg laying
5-12-13	303	1st egg hatch
5-14-13	325	early/10% larvae
6-2-13	436	50%/peak egg hatch
6-14-13	619	90% egg laying
6-17-13	659	peak larvae
6-28-13	774	end (90%) egg hatch
7-3-13	915	90% larvae/end larvae
7-4-13	938	end OW adults
7-7-13	999	1st summer adult emerge
7-22-13	1321	50% summer adult emerge
8-2-13	1539	90% summer adult emerge

Action Threshold (Washington State University, Cooperative Extension)

- **Pre-boot:** until flag leaf fully emerged: 3 eggs and or larvae per tiller
- **Boot**: after flag leaf emerged but grain head not emerged: 1 larva per flag leaf

Influence of Fall Defoliation Height on the Productivity of Three Perennial Grasses

University of California
Agriculture and Natural Resources

Research and Extension Center System

By Leslie Roche, Pasture and Range Specialist, UC Davis and David Lile, County Director and Livestock and Natural Resources Advisor, Lassen County

Introduction: Irrigated pasture and grass hay are important crops in the Intermountain area of northern California. The forage produced on these fields is either grazed by cattle or harvested as high-quality hay, a cash crop sold primarily to feed stores outside the local area. Currently, little attention is paid to the defoliation height of perennial grass fields. Growers seek to utilize as much of the available fall forage as possible to capture as much yield as possible or to delay the onset of winter feeding. This grazable fall forage provides a valuable resource as winter feed. In winter, cattle are often put out on these same irrigated pastures or hay fields, reducing stubble height even further. Other growers, lacking a livestock enterprise, may burn their fields in winter, thus fully removing any remaining stubble. What is the effect of these different management practices and is fall stubble height important for perennial grass production?

Residual stubble may provide microclimate effects that protect buds during cold winter temperatures. Reducing stubble height during the fall/winter period could also negatively impact meristematic tissues of any non-dormant plants, potentially curtailing tiller growth in the spring. Hence, fall stubble height could significantly affect pasture productivity in the subsequent growing season. In this project we are evaluating the effect of residual fall stubble height in addition to severe defoliation or burning over the winter months on the subsequent productivity of three common perennial grass species (tall fescue, orchardgrass and Timothy).

The perennial grass species tall fescue (Tuscany II), orchardgrass (Century) and Timothy (Aurora) were planted in blocks (main plots). Six different fall/winter management practices are imposed on each of the species.

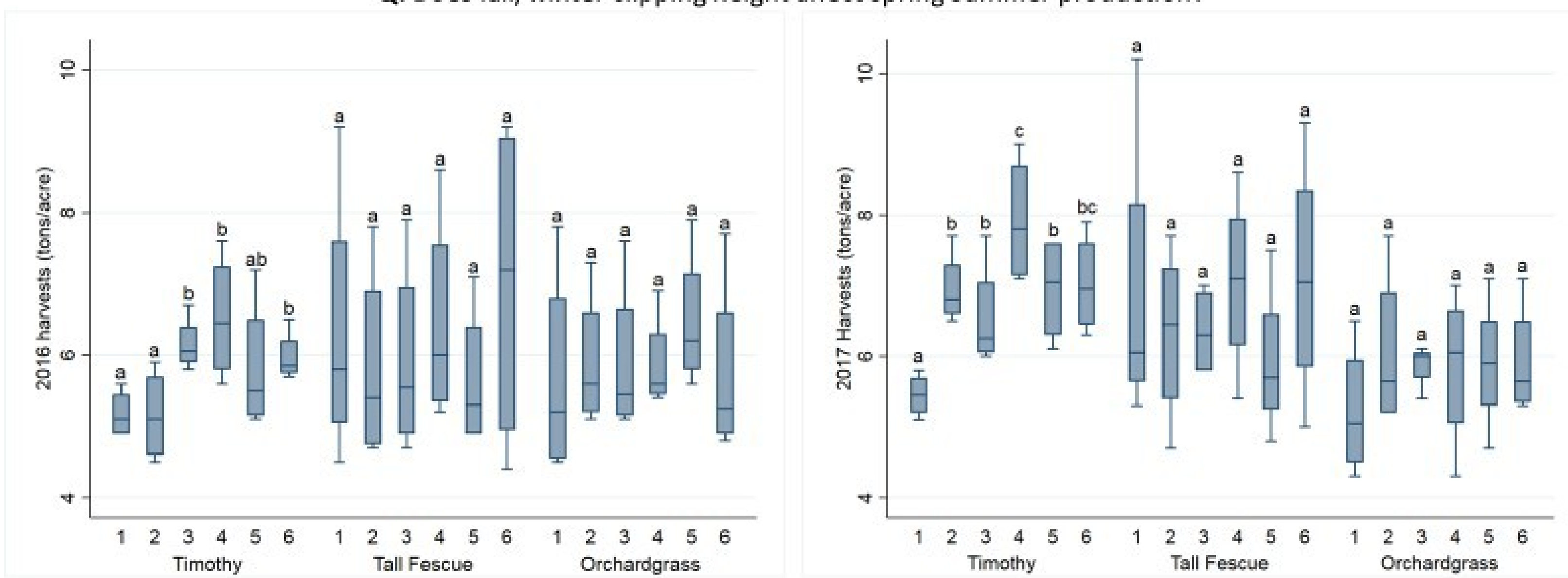
1. Fall harvest height as close to soil surface as possible (approximately 0.5 inch)
2. 2-inch fall harvest height
3. 4-inch fall harvest height
4. 6-inch fall harvest height
5. 4-inch fall harvest height followed by a mid-winter clipping close to the soil surface
6. 4-inch fall harvest height followed by a mid-winter burning

Research Update: Figure 1 shows yield for both 1st and 2nd cutting after fall clipping heights were imposed both years. In the case of timothy, increasing fall cutting height to 4 or 6 stimulated significantly higher hay yield the following season. Conversely, tall fescue and Orchardgrass hay yields were similar across cutting treatments, although there were some apparent yield reductions from lower cutting heights. The second figure shows yield of 1st and 2nd cutting combined with the yield of fall forage harvest from cutting treatments. When considering the fall forage component, yields were generally more similar across cutting treatments suggesting some of the yield lost at 1st and 2nd cutting is regained in the fall with the more intensive harvesting. In the case of tall fescue, preliminary analyses found the shortest fall clipping height produced the highest annual yield across cutting treatments. A formal report will be available at study completion.

Figure 1. 1st and 2nd cutting Hay Yield the Year after Fall Defoliation Treatments. Within each perennial grass species, different letters indicate significant ($p < 0.05$) differences between. Individual boxplots depict the 95th, 75th, 50th (median), 25th, and 5th percentiles.

1st and 2nd harvests combined

Q: Does fall/winter clipping height affect spring summer production?



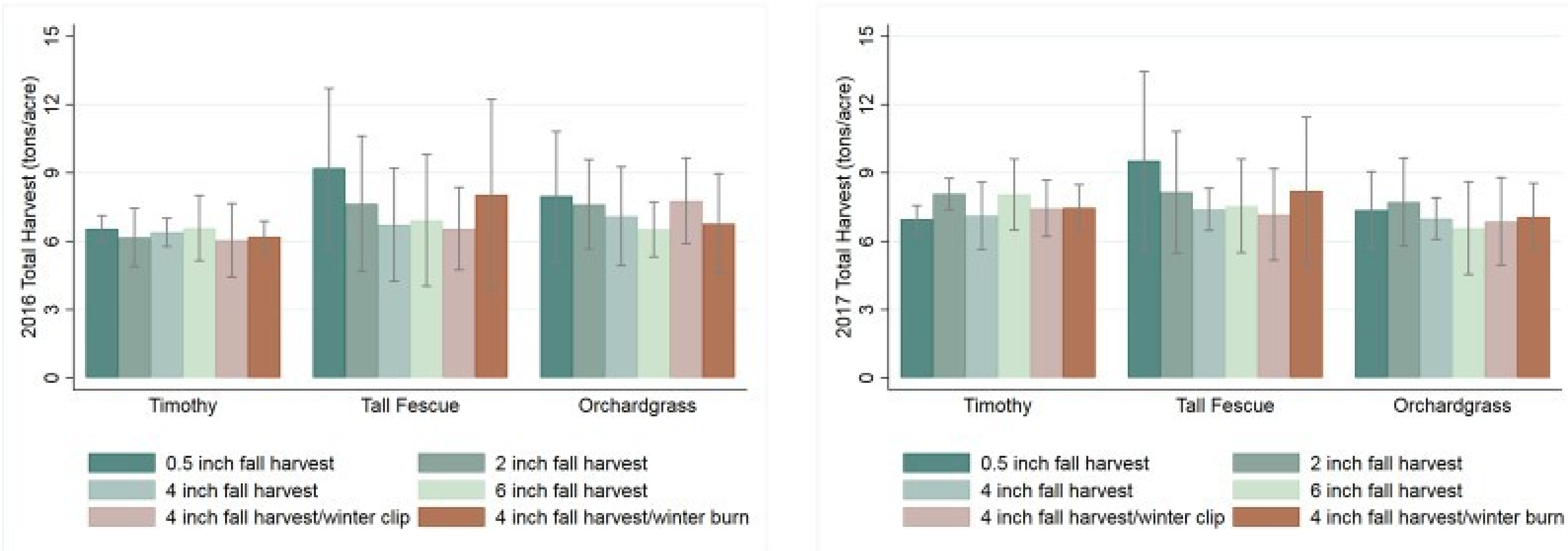
Management Treatments

1	Fall harvest height as close to soil as possible	4	6 inch fall harvest height
2	2 inch fall harvest height	5	4 inch fall harvest height followed by a mid-winter clipping
3	4 inch fall harvest height	6	4 inch fall harvest height followed by a mid-winter burning

Figure 2. Total Annual Yield (1st Cutting, 2nd cutting, and Fall Forage Yield) after Fall Defoliation Treatments. Bars are one SE of mean.

1st and 2nd harvests and treatment harvest combined (total annual yield)

Q: Do any potential gains in spring/summer production from less intensive harvest treatments (e.g., 4 and 6 inch fall harvests) off-set forage left unharvested in fall (i.e., is total annual yield impacted)?



University of California
Agriculture and Natural Resources
Intermountain Research & Extension Center
RESEARCH REPORT
Number 185, 2018

Evaluation of New Fungicides for White Rot Suppression in Processing OnionS

Rob Wilson, Center Director/Farm Advisor; Darrin Culp, Superintendent of Agriculture; Kevin Nicholson & Skyler Peterson, Staff Research Associates. University of California Intermountain Research & Extension Center; Jeremiah Dung, Plant Pathologist, Oregon State University Central Oregon Agricultural Research Center; 2816 Havlina Rd. Tulelake, CA. 96134 Phone: 530/667-2719 Fax: 530/667-5265 Email: rgwilson@ucdavis.edu

Introduction

White rot is a major disease of onion and garlic and is caused by the fungus *Sclerotium cepivorum*. The fungus is spread by small sclerotia produced on decayed bulbs and roots and as few as one sclerotium per liter of soil can result in significant crop losses. Multiple UC experiments over the last 10 years have shown the fungicide tebuconazole (Folicur or Tebustar) is the most effective active ingredient for suppression of white rot. Penthiopyrad (Fontelis), a new fungicide from DuPont, provides similar or slightly less suppression of white rot compared to tebuconazole. The most effective fungicide application method is in-furrow application at planting. Applying fungicides after onion emergence has not improved control of white rot compared to in-furrow application.

In 2017, we evaluated several new fungicides for suppression of white rot including fluopyram (formulated as Velum Prime), solatenol, adepidyn, and fluxapyroxad. Harvest results are not available yet, but in-season leaf dieback ratings collected in September suggest tebuconazole and penthiopyrad (current standards) likely provide similar or superior white rot suppression compared to these new fungicides.

2017 Site Information

- **Soil type-** mucky silty clay loam-4.2% OM
- **Growing season-** early May to late September
- **Irrigation –** solid-set sprinklers
- **Onions-** 36 inch beds with 4 seed-lines spaced 6 inches apart; 2-inch seed spacing; Sensient Technologies processing variety
- **Design-** RCB with 5 blocks (reps)

2017 Study Methods

In early May 2017, the field was tilled and beds were shaped for onion planting. On 5/8/17, white rot sclerotia soil samples were collected to determine sclerotia levels at onion planting. Onions were planted on 5/15/17. Onion beds were spaced 36 inches apart with four seed-lines per bed spaced 6 inches apart. Onion in-row seed spacing was 2 inches. The onion variety was an early maturing Olam processing type. Fungicide treatments were applied in-furrow at planting. In-furrow fungicide was applied using Teejet 8001 EVS nozzles @ 30 psi. The nozzles were mounted on the onion planter to apply a 3 inch band directly over the seed-line after seed placement but before furrow closure with soil.

Onion stand density was measured in each plot by counting the number of green onions in all seed lines for the center two rows for the entire plot length on 7/7/17. Onion vigor was visually estimated in each plot on 7/7/17 and 8/8/17 using a 0 to 10 scale, with 10 = highest vigor in the trial. Visual leaf die back ratings were taken on 8/29/17, 9/13/17, and 9/21/17. Leaf die back was estimated using a 0 to 100% scale. Onion yield was measured by harvesting all onions in each plot on 10/3/17. All onions were run across a grade-line to remove loose soil and green tops. Onion bulbs were then hand-sorted based on the presence of white-rot symptoms. A total weight was recorded for clean, disease-free onions and onions with white-rot symptoms (decay through 1st scale, mycelium, and sclerotia) in each plot. Decay severity on onion bulbs with white-rot symptoms was visually estimated for each plot using a 1-5 scale with 5 equal to most severe decay.

Results

Onion stand and early season onion vigor did not differ among fungicide treatments and the untreated control suggesting all fungicide treatments did not injure the crop. All fungicides increase mid-season onion vigor compared the untreated control (Figure 1). Several fungicides decreased the percentage of onion plants with late season leaf dieback (symptom of white rot) with Tebustar, Fontelis, and Merivon having the lowest levels of leaf dieback (Figure 2). At harvest, Tebustar, Fontelis, and Merivon had the highest clean (disease-free) onion yield and percentage of clean bulbs (Figures 3 & 4). This study showed some of the new SDHI fungicides have activity on white rot especially Merivon, but none of the newly released fungicides provided improved suppression of white rot compared to tebuconazole.

Special Thanks: The research team would like to thank the California Garlic and Onion Research Advisory Board, BASF, Bayer CropScience, Olam International and Syngenta for financial and in-kind support of this research.

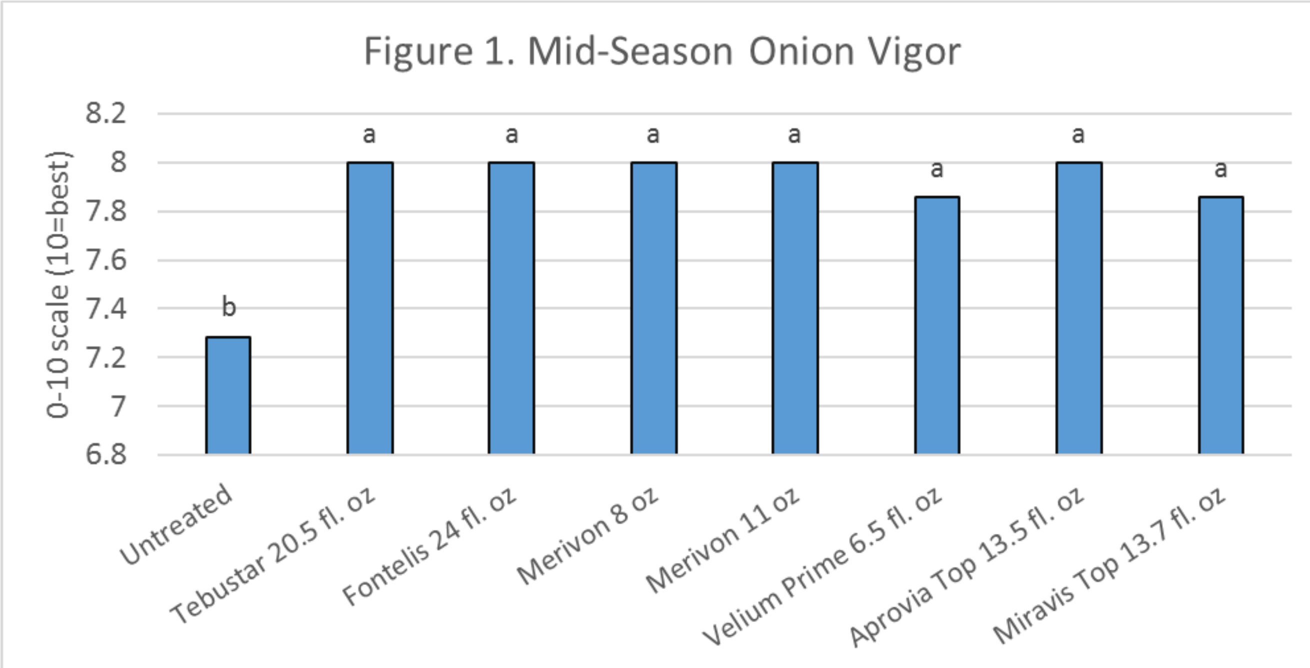


Figure 1. Mid-Season Onion Vigor
0-10 scale (10=best)
8.2
8
7.8
7.6
7.4
7.2
7
6.8
b
a
a
a
a
a
a
a
Untreated
Tebustar 20.5 fl. oz
Fontelis 24 fl. oz
Merivon 8 oz
Merivon 11 oz
Velium Prime 6.5 fl. oz
Aprovia Top 13.5 fl. oz
Miravis Top 13.7 fl. oz

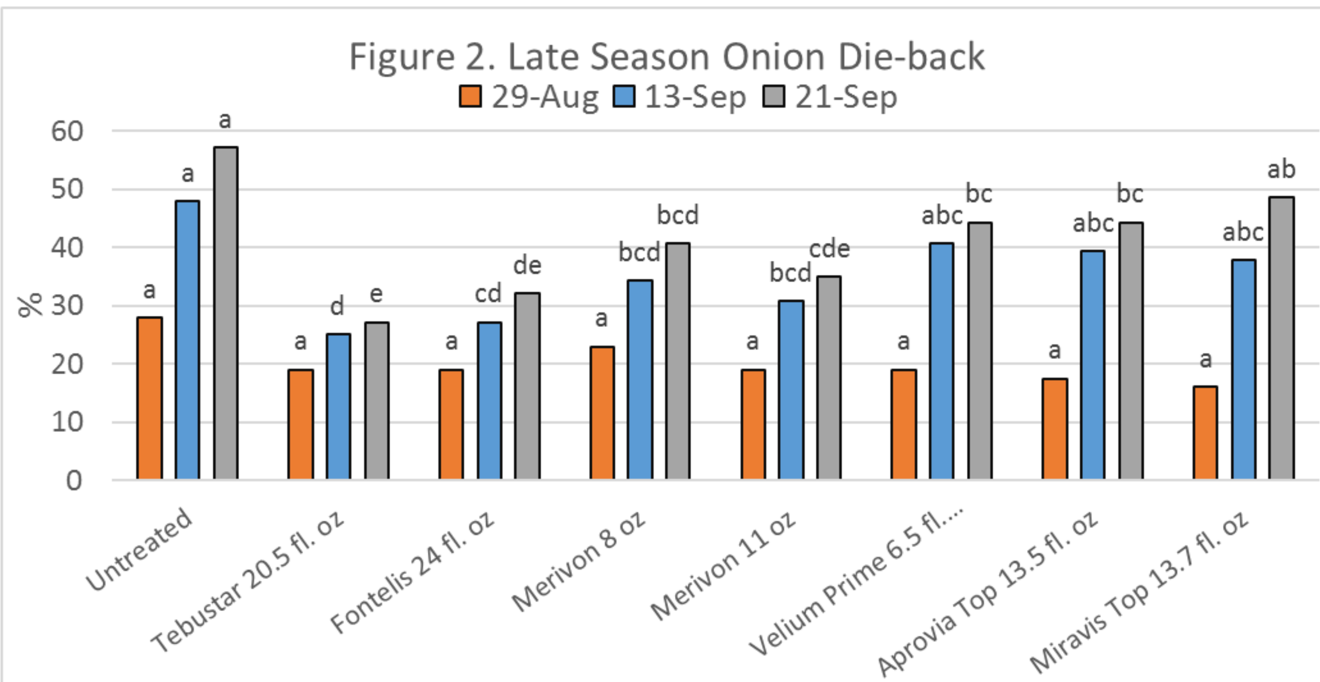


Figure 2. Late Season Onion Die-back
29-Aug
13-Sep
21-Sep
%
60
50
40
30
20
10
0
a a a
a d e
a cd de
a bcd bcd
a bcd cde
a abc bc
a abc bc
a abc ab
Untreated
Tebustar 20.5 fl. oz
Fontelis 24 fl. oz
Merivon 8 oz
Merivon 11 oz
Velium Prime 6.5 fl....
Aprovia Top 13.5 fl. oz
Miravis Top 13.7 fl. oz

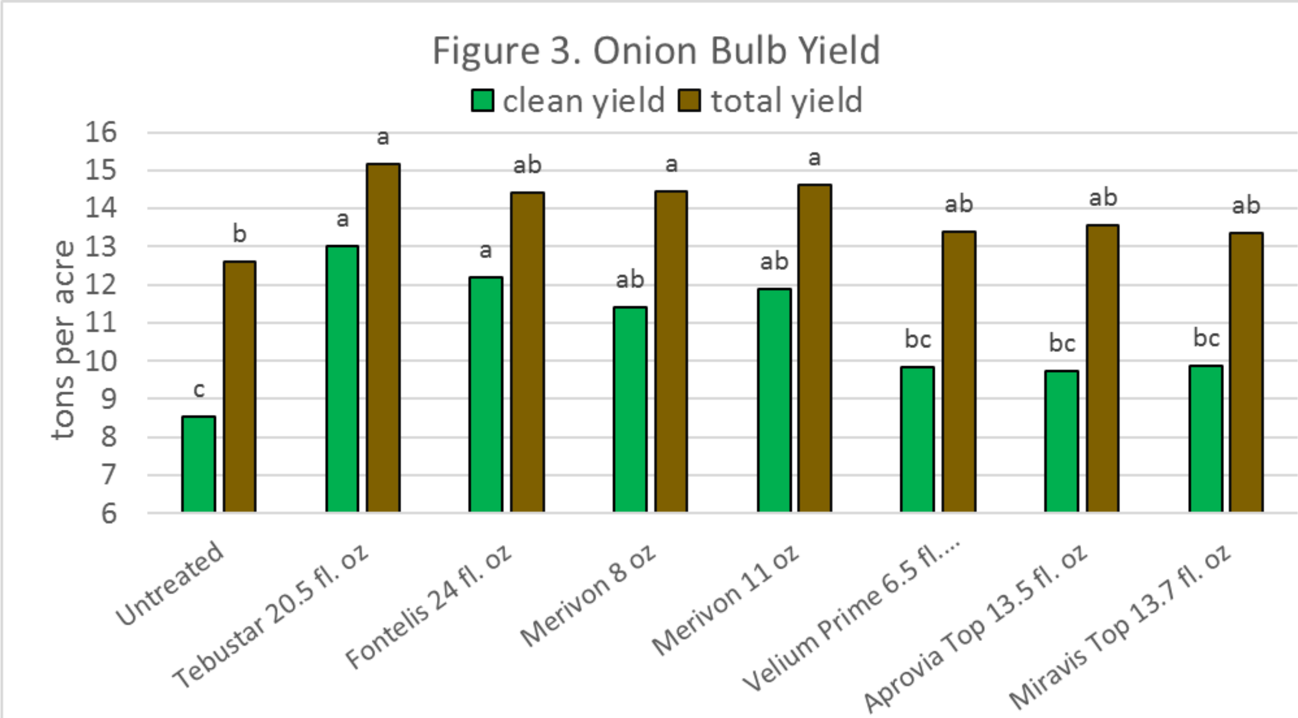


Figure 3. Onion Bulb Yield
clean yield
total yield
tons per acre
16
15
14
13
12
11
10
9
8
7
6
c
b
a
a
a
ab
ab
a
ab
a
bc
ab
bc
ab
bc
ab
Untreated
Tebustar 20.5 fl. oz
Fontelis 24 fl. oz
Merivon 8 oz
Merivon 11 oz
Velium Prime 6.5 fl....
Aprovia Top 13.5 fl. oz
Miravis Top 13.7 fl. oz

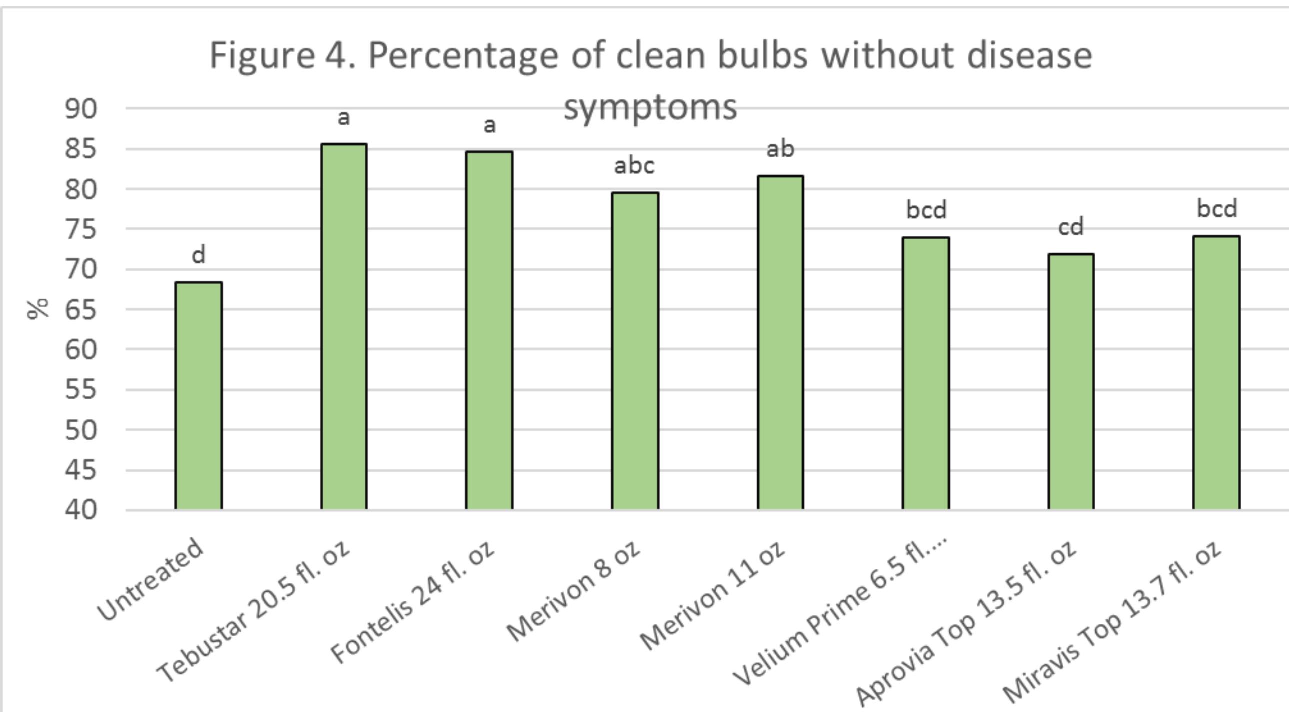


Figure 4. Percentage of clean bulbs without disease symptoms
%
90
85
80
75
70
65
60
55
50
45
40
d
a
a
abc
ab
bcd
cd
bcd
Untreated
Tebustar 20.5 fl. oz
Fontelis 24 fl. oz
Merivon 8 oz
Merivon 11 oz
Velium Prime 6.5 fl....
Aprovia Top 13.5 fl. oz
Miravis Top 13.7 fl. oz

Evaluation of Alternatives to Soil Fumigants and Diallyl Disulfide for the Management of White Rot in Onion and Garlic

Robert Wilson[1], Jeremiah K.S. Dung[2], and Thomas Turini[3]

[1] Division of Agriculture and Natural Resources, University of California, Intermountain Research and Extension Center, Tulelake, Ca; [2] Department of Botany and Plant Pathology, Oregon State University, Central Oregon Agricultural Research Center, Madras, OR;[3] Division of Agriculture and Natural Resources, University of California, Fresno County Cooperative Extension Office, Fresno, CA

Abstract

White rot is a major fungal disease of onion and garlic in California. The pathogen (*Sclerotium cepivorum*) is spread by small, poppy seed-sized sclerotia produced by the fungus on infected bulbs and roots. Control of white rot is difficult because as few as one sclerotium per liter of soil can result in significant crop loss and sclerotia can survive in fields for over 20 years. The goal of the research was to find an IPM solution for white rot that integrates two control methods, sclerotia germination biostimulants and fungicides, that reduces sclerotia levels in infested fields and reduces diseased bulbs to < 10% of total yield. Field studies were conducted in naturally infested fields in Tulelake and western Fresno County that were planted to onion and garlic, respectively. Main plot treatments consisted of sclerotia germination biostimulants (garlic juice or garlic oil) that were shank-injected in the spring and/or fall prior to planting. The Tulelake site also included allyl isothiocyanate (AITC) and metam sodium treatments. Sclerotia germination biostimulants were compared to non-treated plots and plots treated with diallyl disulfide (DADS) at both sites. Tebuconazole was applied in-furrow as a split-plot treatment at both sites at planting. At the Tulelake site, the greatest reductions in sclerotia populations were observed in plots treated with garlic oil in the spring and fall (76.3%), DADS (69.5%), and garlic oil (spring) + AITC (fall) (65.8%). In-furrow applications of tebuconazole significantly increased onion stand and reduced late season onion leaf dieback compared to the no-fungicide control ($P \leq 0.0002$). Although not significantly greater than the untreated control, garlic oil (spring) + AITC (fall), garlic juice (spring), and garlic oil (spring and fall) exhibited the highest yields of disease-free onion bulbs. In-furrow applications of tebuconazole increased disease-free onion yield compared to the no-fungicide control ($P < 0.0001$). At the Fresno site, a significant effect of germination stimulant on pre-plant sclerotia counts was not observed ($P = 0.62$), which may have been due to variability among plots in the commercial field. In-furrow applications of tebuconazole increased total garlic yield ($P < 0.0001$) and decreased the number of garlic bulbs with severe disease symptoms ($P = 0.049$). Tebuconazole increased total and healthy yields compared to the no-fungicide control at both sites ($P < 0.0001$). Sclerotia populations increased greatly from onion and garlic planting to harvest at both sites in plots not treated with an in-furrow application of tebuconazole at ($P < 0.04$), suggesting that tebuconazole helps prevent the buildup of sclerotia in fields after an *Allium* crop. Sclerotia germination stimulants and fungicides suppressed white rot and in many cases increased clean onion and garlic yields, but unfortunately no treatment increased healthy yields to the targeted goal of 90% of total yield.

Abstract taken from the 2018 Department of Pesticide Regulation Final Report. For a copy of the complete report contact Rob Wilson, rgwilson@ucanr.edu

IPM in Alfalfa Hay Production, Tulelake Field Day, 7/26/18

Rachael Long, Farm Advisor, Yolo Co., J. Ramirez Bonilla, R. Wilson, K. Goding, D. Putnam

UC IPM Guidelines for Alfalfa Hay, 2017: ipm.ucdavis.edu

Alfalfa Weevil Management (Current research supported by a grant from CA-DPR)

Larvae feed on plants, causing yield and quality losses mainly to first hay cutting. Generally, one generation per year. Signs of damage: holes in leaves, damage to growing points.

Cultural practices: No resistant varieties

- Overseeding with other forages (oats, berseem clover) that weevils don't like makes up for the loss in alfalfa from weevil damage. Mixed forages change the quality and the marketability of the hay and is only recommended for older stands in the last years of production to help boost yields.

- 'Sheeping off', or close winter grazing, when the alfalfa is dormant reduces weevil numbers and damage to the first alfalfa cutting when sheep feed on stems where weevils lay eggs. Alfalfa must be dormant and watch for excessive soil compaction when it starts raining and overgrazing.

Biocontrol: Predators and parasitoid wasps (parasites) provide minimal weevil control.

Monitoring: Sample alfalfa fields with a sweep net to time insecticide treatments to weevil outbreaks. Sprays applied too early may need a second treatment, which is costly and could lead to more insecticide resistance problems. The economic threshold is about 20 weevils/sweep, depending on the value of the hay and cost of the insecticide treatment (Table 1). The threshold will also depend on the height of the alfalfa and when it is cut relative to the damage by the weevils. Cutting right after weevil damage will result in reduced yields; waiting for damaged hay to regrow will increase yields.

Table 1. Number of larvae/sweep justifying treatment, relative to the insecticide cost and hay value. This is a guide only; thresholds will vary depending on the height of the alfalfa hay.

Cost of application	**Value of Alfalfa, $/ton**						
	180	**200**	**220**	**240**	**260**	**280**	**300**
$15	18	16	15	14	13	12	11
$20	24	22	20	18	17	16	15
$25	31	27	25	23	21	20	18
$30	37	33	30	27	25	24	22
$35	43	38	35	32	30	27	26

Insecticides: Primary tool for weevil control.

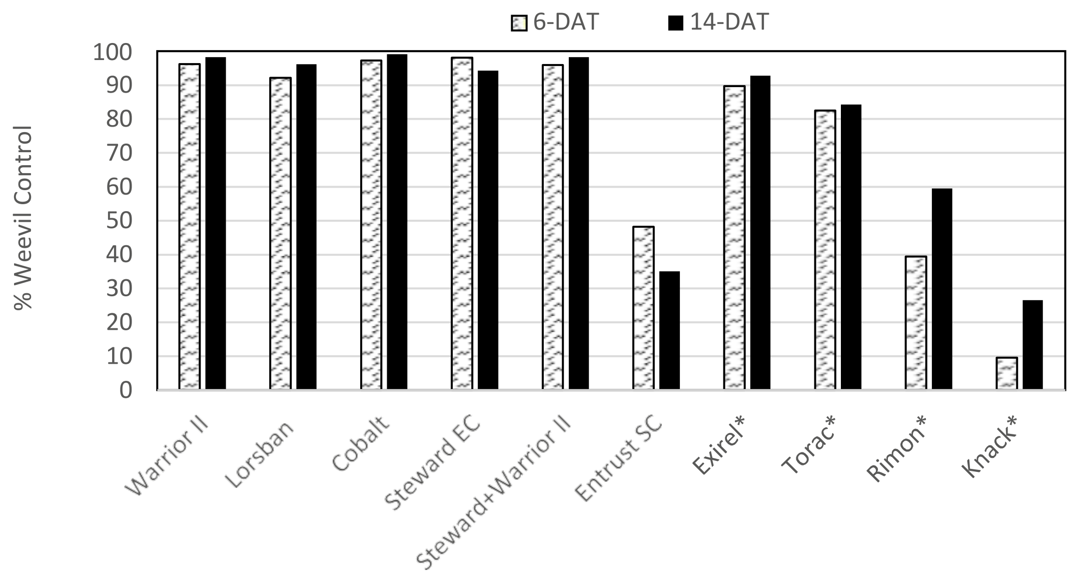
- Organophosphates: chlorpyrifos (Lorsban) is difficult to use due to regulations and may be phased out. Malathion residual activity is too short for good weevil control.

- Pyrethroids (Warrior, Baythroid): Good weevil control, but alfalfa weevils are showing pyrethroid insecticide resistance in the Scott Valley area and in the low desert.

- Indoxacarb (Steward): Good material though a bit more expensive than other insecticides. Needs favorable weather conditions to be effective, gives about 2-weeks residual control (pyrethroids offer closer to 3 weeks), and does not control aphids. Steward is a stomach poison, so the weevils must ingest it to kill them. Lower rates can be used in warmer areas when the weevils are actively feeding; higher rates are needed where it is colder and weevils may not be as active. Good results with longer residuals by mixing Steward with pyrethroids for weevils and aphids.

- Spinosad (Entrust): Entrust for organic alfalfa production.

Figure 1. Alfalfa Weevil Control, Tulelake, 2018. The symbol '*" after insecticide = NOT registered in alfalfa (experimental). Results are for 6 and 14 days after treatment (DAT). Control untreated plots: 45 weevils/sweep 6 DAT and 43 weevils/sweep 14 DAT. Cobalt: Lorsban+Warrior. Rimon and Knack: Insect growth regulators (IGR's), Torac: tolfenpyrad, Exirel: cyantraniliprole (diamide).



Aphid Management (Pea and Blue Alfalfa)

Cultural Practices: Resistant plant varieties help control aphid pests (National Alfalfa & Forage Alliance, http://alfalfa.org, alfalfa variety ratings).

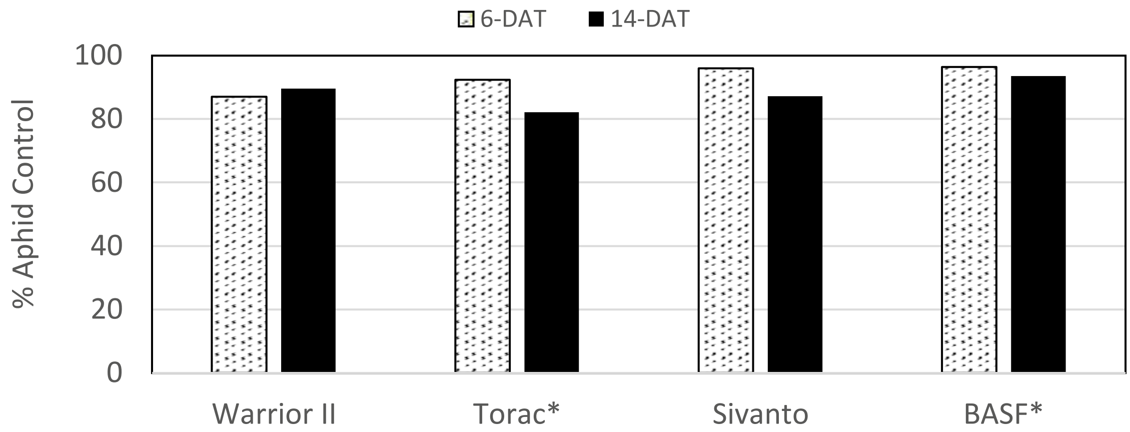
Biocontrol: Natural enemies including ladybugs, parasitoid wasps (parasites) help control aphids.

Monitoring: Randomly choose 5 stems from each of 4 areas per field. Blue alfalfa aphids inject a toxin in the plant, so thresholds are much lower than pea aphids.

Plant height, inches	Pea aphids/stem	Blue alfalfa aphids/stem
Under 10	40 to 50	10 to 12
10 to 20	70 to 80	40 to 50
Over 20	100 +	40 to 50

Insecticides: Sivanto, Warrior, Beleaf (62-day PHI).

Figure 2. Aphid Control, Tulelake, 2018. The symbol '*" after insecticide = NOT registered in alfalfa (experimental). Results are for 6 and 14 days after treatment (DAT). About 45% of total are blue alfalfa aphids and 55% are pea aphids. Torac: tolfenpyrad and BASF product is similar to Sivanto.



Clover Root Cucurlio (beetle) Management, USDA Grant in collaboration with Utah and Idaho
Similar to the alfalfa weevils, but clover root cucurlio larvae feed on alfalfa roots causing yield reductions and entry wounds for secondary pathogens resulting in root rots, and stand loss. Look for stunted and wilted plants (not to be confused with stem nematode that causes a thickening of stems). Primarily found in the Intermountain area (uncommon in the Central Valley).

Cultural practices: Rotate with non-legume crops (hosts include alfalfa and legumes). Will also help control stem nematode (primary host is alfalfa).

Biocontrol: Natural enemies provide minimal control.

Monitoring: Springtime (April) when the weather warms. Clover root cucurlio is known to overwinter in the egg and adult stages (in Tulelake samples, eggs were found on the roots in early April and larvae (also on roots) and adults (in foliage) in early May. Likely 2 generations a year. Eggs are laid at the base of the plant in the soil below the crown.

Research update: Developing a better understanding of the life history of clover root cucurlio and insecticide trials for weevil control. Currently looking at efficacy of pesticides with some movement in the plants, including Coragen and Entrust as well as the experimental pesticides Agri-Mek and Besiege (Coragen+Warrior) that are not registered in alfalfa.

Pulse Crop Options for the Klamath Basin

Rob Wilson, Intermountain REC Director and Farm Advisor

Pulses are legume crops that are harvested for the dry seed. Dried beans, chickpeas, lentils, and dried peas are the most common pulses in the US. Pulse crops are high in protein and fiber and low in fat making them a desirable addition in healthy diets. Their popularity worldwide is on the rise and many consumers and food companies are incorporating pulse crops in human and pet foods. From a farming perspective, pulse crops offer farmers many benefits. They are efficient water users and they require little nitrogen fertilizer as they fix nitrogen from the air. Pulse crops tend to improve growth of future crops by breaking common disease and pest cycles and adding nitrogen back into the soil. The increasing popularity of pulse crops have made their sale price a competitive alternative to growing wheat and barley.

IREC is currently experimenting with growing field peas, lentils, and chickpeas in Tulelake in cooperation with Winema Elevators. All three pulse crops were planted and harvested with the same equipment used for wheat and barley production. The crops were grown with irrigation. Dry peas have been grown in the area for many years and are well adapted to the Klamath Basin. Both winter and spring pea varieties are available and when grown under irrigation they have high yield potential compared to most of the US. Field peas are fast-growing and quite competitive with weeds making weed control easier than growing other pulse crops. Lentil are primarily a spring sown crop and they are quite frost tolerant making early spring planting possible. Lentils are short only reaching heights of 12-16 inches. There short stature and indeterminate growth habit make harvest more difficult than field peas. Chickpeas (garbanzo beans) are a spring sown crop that are planted later than most other pulse crops, wheat, and barley. They are sensitive to frost and require a longer growing season compared to other pulse crops. Chickpeas are also more susceptible to weed competition and certain diseases. On the up side, chickpeas are the most valuable pulse crop and they develop a deep and extensive root system allowing them to extract moisture from deep soil depths.

Pulse Crop Type	2017 Yield at IREC	2018 Market Price	2018 Market Revenue
Spring field peas	54.6 cwt/acre	$10.5/cwt	$573/A
Spring lentils	20.6 cwt/acre	$20/cwt	$412/A
Spring chickpea	25 cwt/acre	$35/cwt	$875/A

It is important manage irrigation, fertility, and pests with all pulse crops. Water requirements are similar or less than small grains and careful soil moisture monitoring is important to prevent seedling and foliar diseases. Fertility requirements are like alfalfa with the focus being on phosphorus (P), potassium (K), and sulfur (S). In our experience, pulse crops require minimal fertilizer application if P, K, and S soil levels are adequate. Always inoculate seed with the proper inoculant to allow for optimal nitrogen fixation.

Weed management is very important especially in lentils and chickpeas as they are poor competitors with weeds. Yield losses from weeds can be substantial. Herbicide options are limited to preemergence products so it’s extremely important to have a herbicide plan before planting. IREC staff obtained good results using Treflan preplant for weed control in field peas. Current research is investigating several herbicide options for weed control in chickpeas (Table). Preliminary results suggest Sharpen alone and in combination with other herbicides can provide effective weed control. Pulse crops are susceptible to multiple insects and diseases, and fungicide/insecticide seed treatment of chickpeas often greatly improved stand establishment and early season vigor compared to using untreated seed. This was definitely the case at IREC in 2018 when maggots and disease reduced chickpea stands by more than 30% using untreated seed compared to treated seed.

Table. Influence of Herbicides on Weeds and Early Season Chickpea Establishment and Growth.

Herbicide Treatments	Early season crop injury	Crop stand	Early season crop height	Pigweed	Hairy nightshade	Total weeds
	0-10 rating	# plants/plot	cm	# weeds/plot		
1. Untreated Control	1 a	271 a	28 a	32 a	9 a	48 a
2. Hand-weeded Control	0.75 a	238 a	25 a	11 ab	10 a	23 ab
3. Prowl H2O at 2.0 pt/A preplant incorporated shortly before planting	1 a	290 a	26 a	14 ab	3 ab	18 ab
4. Prowl H20 at 2.0 pt/A preplant surface applied	1.25 a	255 a	25 a	17 ab	6 ab	23 ab
5 . Prowl H20 at 2.0 pt/A post-plant preemergence (within a 2 days of planting)	0.75 a	275 a	27 a	29 ab	4 ab	33 ab
6. Sharpen at 2 oz/A + MSO at 1% post-plant preemergence	0.75 a	269 a	26 a	0 b	0 b	0 b
7. Prowl H20 at 2.0 pt/A preplant surface applied & Sharpen at 2 oz/A post-plant preemergence	0.75 a	249 a	26 a	0 b	0 b	2 b
8. Prowl H20 at 2.0 pt/A + Sharpen at 2 oz/A post-plant preemergence	0 a	266 a	27 a	0 b	0 b	0 b
9. Prowl H20 at 2.0 pt/A + Goal 2XL at 8 fl. oz/A + Sharpen at 2 oz/A post-plant preemergence	0.5 a	252 a	27 a	0 b	0 b	0 b
10. Prowl H20 at 2.0 pt/A + Chateau at 1.5 oz/A + Sharpen at 2 oz/A post-plant preemergence	0.75 a	262 a	27 a	0 b	0 b	0 b
11. Zidua at 2.5 oz/A preplant incorporated	0.5 a	247 a	25 a	6 ab	1 b	7 b
12. Zidua at 2.5 oz/A post plant preemergence	1 a	249 a	26 a	16 ab	6 ab	23 ab

Letters next to means represent significant difference. Treatments with different letters are statistically different using Tukey's HSD test.

Influence of Cover Crops and Organic Amendments on Nutrient Levels in Organic Potatoes

By Rob Wilson, Center Director/Farm Advisor,
Darrin Culp, Principal Superintendent of Agriculture, Kevin Nicholson and Skyler Peterson, Staff Research Associates, IREC

The Klamath Basin has experienced a large increase in organic agriculture in recent years. Last year there were over 10,000 acres of alfalfa, 10,000 acres of wheat and barley, and 2,000 acres of potatoes produced organically on the California side of the Klamath Basin. Organic production offers growers a niche market and price premiums. Conversely, organic production has limited pest management and fertilization options compared to conventional production. Organic producers are pursuing multiple approaches to increase soil fertility and manage pests, but research and data verifying the effectiveness of these practices is limited at the local level. Practices of most interest to potato growers include the use of certified amendments such as composted manures, application of organically approved pesticides, and cover crops/green manure.

Figure. 2018 spring-seeded Caliente mustard/Flex forage field pea mix at the time of incorporation.

A two-year study was established in 2016 to evaluate cover crops managed as a green manure, amendments, and combinations of cover crops and amendments in an organic potato rotation. Cover crops were grown in 2016 and potatoes in 2017. This report includes a short summary of the results for spring-planted, mid-summer planted, and fall planted cover crops grown in 2016, and the effects of cover crops and amendments on potatoes grown in 2017.

A demonstration study implementing promising treatments from the 2016-17 study was established in spring 2018. The study is funded by CDFA Healthy Soils Program and is being conducted in cooperation with Daniel Geisseler, UC Davis Nutrient Management Specialist, Josh Elke, NRCS Soil Conservationist, and Sonja Brodt, Academic Coordinator with UC SAREP. The study will investigate the influence of cover crops and compost on soil health in conventional and organic crop rotations. The project goal is to accurately estimate the soil practices' environmental and agronomic benefits specific to the region and increase land manager's knowledge and adoption of the practices

2016-2018 Research Highlights

- Legume cover crops including hairy vetch, woollypod vetch, and field peas grew well planted in spring, summer or fall and they added over 100 lbs of nitrogen/acre compared to grasses and mustards at all planting times. In the case of mustard and grass cover crops, spring plantings were most successful. Poor growth of these species in mid-summer and fall was from nitrogen deficiency caused by double-cropping a grain crop immediately prior. A compromise between choosing individual species was growing a cover crop mix. In soil with low nitrogen, legumes dominated mixes at all plantings.

- When evaluating weeds in cover crops, spring plantings had the fewest weeds across species and mid-summer plantings had the most weeds.

- Legume cover crops and chicken manure were most effective at increasing mineralized soil nitrogen for early season potato growth. In most cases, legume cover crops and fall applied chicken manure had similar or higher potato petiole nitrate compared to 150 lbs N/A from conventional nitrogen fertilizer.

- Fall applied compost and steer manure released plant available nitrogen back into the soil much more slowly than chicken manure providing little fertilization benefit to the potato crop.

Figure. Aerial drone photo of 2017 potato crop within the study area. Note the differences in crop vigor and color between amendment and cover crop treatments.

- A common question is what is the best time to grow cover crops. Averaged across species, spring plantings resulted in fewer weeds, more tubers per plant, and higher potato yields compared to mid-summer and fall plantings. Mid-summer and fall plantings had slightly less *Rhizoctonia* black scurf compared to spring plantings, and spring irrigated plantings had slightly less black dot on tubers compared to spring dryland and mid-summer plantings.

- Several legume cover crop treatments provided a favorable crop growth response for 2 years after incorporation. Much of this benefit is likely related to increased soil nutrient availability especially nitrogen but current research is underway to better examine this phenomenon.

Figure. Favorable winter wheat growth response from legume cover crops 2 years after incorporation.

UC Tulelake Field Day, 26 July, 2018

Alfalfa Variety Testing Results, Tulelake

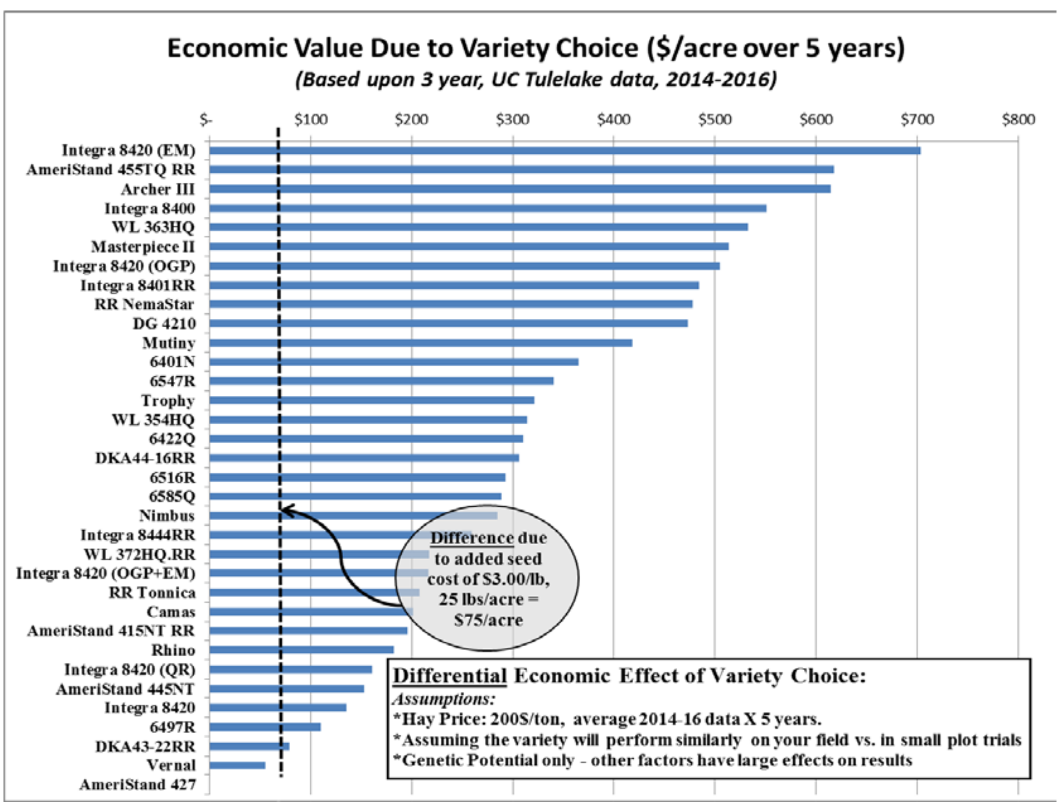
Dan Putnam, Chris DeBen, Brenda Perez, Charlie Brummer, Rob Wilson, Darrin Culp, UCCE and UC Davis

See: http://alfalfa.ucdavis.edu for current variety information

The University of California tests alfalfa varieties at multiple locations throughout the state, from Tulelake through the Central Valley to El Centro, CA. Here, the results from previous multiple-year trials are presented, plus first year data from the 2017-planted trial.

What about Economics? It's actually a little difficult to determine whether choice of variety makes an economic difference just by looking at a variety in a large field. Alfalfa varieties look almost identical in the field. However, looking at data over time reveals significant genetic differences in yield as well as gross revenue. Figure 1 shows the economic differences due only to variety choice. The maximum differences between varieties in seed costs might be $75/acre (e.g. the lowest cost seed might be $2.50 and the highest cost $5.50/lb at 25 lb./a, not counting biotech traits, which is a different calculation). This difference in seed cost is typically easily paid for with higher performance, often in the first production year. This yield improvement is in addition to other characteristics like pest resistance or quality, or biotech traits such as Roundup Ready of HarvXtra.

Past Results/Current Results. Below, the 2014-2016 data is shown. Additionally, the seeding-year data from the 2017-planted trial is shown. Please note that single-year data should not be used to judge the performance of alfalfa varieties. Some varieties may take a year to become established and exhibit genetic potential.



2014-2016 YIELDS, TULELAKE ALFALFA CULTIVAR TRIAL. TRIAL PLANTED 8/21/13

		2014		2015		2016				
		Yield		Yield		Yield		Average		
	FD	Dry t/a								
Released Varieties										
Integra 8420 (EM)	4	10.06	(4)	8.55	(6)	7.36	(2)	8.65	(1)	A
AmeriStand 455TQR	4	9.99	(8)	8.69	(2)	7.03	(10)	8.57	(3)	A B C
Archer III	5	10.04	(5)	8.48	(7)	7.17	(6)	8.56	(4)	A B C
Integra 8400	4	9.93	(10)	8.55	(5)	7.02	(11)	8.50	(7)	A B C D E F
WL 363HQ	5	10.03	(6)	8.47	(8)	6.95	(18)	8.48	(8)	A B C D E F G
Masterpiece II	4	10.33	(1)	8.45	(10)	6.61	(40)	8.46	(9)	A B C D E F G H
Integra 8420 (OGP)	4	9.93	(9)	8.14	(24)	7.29	(3)	8.45	(10)	A B C D E F G H
Integra 8401RR	4	9.62	(24)	8.22	(18)	7.46	(1)	8.43	(11)	A B C D E F G H I
RR NemaStar	4	10.01	(7)	8.21	(20)	7.06	(8)	8.43	(12)	A B C D E F G H I J
DG 4210	4	9.67	(22)	8.65	(3)	6.95	(16)	8.42	(13)	A B C D E F G H I J
Mutiny	4	9.55	(30)	8.60	(4)	6.95	(17)	8.37	(14)	B C D E F G H I J K
6401N	4	9.79	(15)	8.21	(19)	6.94	(20)	8.31	(16)	B C D E F G H I J K L
6547R	4	9.68	(21)	8.36	(11)	6.84	(30)	8.29	(17)	C D E F G H I J K L M
Trophy	4	9.68	(20)	8.04	(32)	7.09	(7)	8.27	(18)	D E F G H I J K L M N
WL 354HQ	4	9.61	(25)	8.32	(13)	6.86	(26)	8.26	(20)	D E F G H I J K L M N
6422Q	4	9.90	(11)	8.20	(21)	6.68	(35)	8.26	(21)	E F G H I J K L M N
DKA44-16RR	4	9.71	(19)	8.26	(16)	6.81	(31)	8.26	(22)	E F G H I J K L M N
6516R	5	9.59	(26)	8.16	(23)	6.98	(14)	8.24	(23)	E F G H I J K L M N
6585Q	5	9.73	(18)	8.28	(14)	6.71	(33)	8.24	(24)	F G H I J K L M N
Nimbus	5	9.66	(23)	8.05	(31)	6.99	(12)	8.23	(25)	F G H I J K L M N
Integra 8444RR	4	9.57	(28)	8.08	(29)	6.98	(15)	8.21	(26)	G H I J K L M N O
WL 372HQ.RR	4	9.74	(17)	8.12	(26)	6.64	(39)	8.17	(28)	I J K L M N O
Integra 8420(OGP+E	4	9.47	(33)	7.99	(36)	7.04	(9)	8.17	(29)	I J K L M N O
RR Tonnica	5	9.58	(27)	8.23	(17)	6.67	(37)	8.16	(30)	I J K L M N O
Camas	4	9.35	(38)	8.26	(15)	6.85	(28)	8.15	(31)	J K L M N O
AmeriStand 415NTR	4	9.45	(34)	8.14	(25)	6.85	(27)	8.15	(32)	K L M N O
Rhino	4	9.43	(36)	8.10	(27)	6.87	(25)	8.13	(33)	K L M N O
Integra 8420 (QR)	4	9.56	(29)	7.86	(39)	6.91	(22)	8.11	(34)	K L M N O
AmeriStand 445NT	4	9.55	(31)	8.08	(28)	6.68	(36)	8.10	(35)	K L M N O
Integra 8420	4	9.43	(35)	7.89	(38)	6.94	(21)	8.09	(36)	L M N O
6497R	4	9.50	(32)	8.03	(34)	6.65	(38)	8.06	(37)	L M N O
DKA43-22RR	4	9.18	(41)	8.03	(33)	6.87	(24)	8.03	(38)	M N O
Vernal	2	9.27	(39)	7.85	(40)	6.89	(23)	8.00	(39)	N O
AmeriStand 427	4	9.25	(40)	7.82	(41)	6.79	(32)	7.95	(40)	O
Experim ental Varieties										
FG 49W202	5	10.28	(2)	8.73	(1)	6.70	(34)	8.57	(2)	A B
SW4332	4	10.07	(3)	8.33	(12)	7.21	(5)	8.54	(5)	A B C D
FG 49W201	5	9.88	(12)	8.45	(9)	7.22	(4)	8.52	(6)	A B C D E
SW4351	4	9.80	(14)	8.19	(22)	6.99	(13)	8.33	(15)	B C D E F G H I J K L
SW4328	4	9.88	(13)	8.08	(30)	6.85	(29)	8.27	(19)	D E F G H I J K L M N
FG R49W215	4	9.75	(16)	7.90	(37)	6.95	(19)	8.20	(27)	H I J K L M N O
FG R57OK217	5	9.36	(37)	8.02	(35)	6.46	(42)	7.94	(41)	O
SW3304	3	7.97	(42)	7.29	(42)	6.51	(41)	7.26	(42)	
MEAN		9.66		8.20		6.91		8.26		
CV		4.44		4.47		5.00		2.82		
LSD (0.1)		0.51		0.44		0.41		0.28		

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. Also, included in this trial were plots inoculated with 4 seed treatment combinations using alfalfa variety Integra8420. These treatments include: Optimize Gold Plus (OGP), Rhizobia with an LCO promoter; An isoflavinoid (EM-09009); and Quick Roots (QR), a microbial seed inoculant.

2017 YIELDS, TULELAKE ALFALFA CULTIVAR TRIAL. TRIAL PLANTED 5/22/17

Note: Single year data should not be used to evaluate alfalfa varieties or choose alfalfa cultivars

		Cut 1		Cut 2		YEAR			% of
		28-Jul		11-Sep		TOTAL			VERNAL
	FD	Dry t/a							
Released Varieties									
PGI459	4	2.05	(4)	2.12	(2)	4.16	(3)	A B	137.2
Dekalb 43-13	4	1.82	(11)	1.99	(10)	3.81	(8)	C D E F G	125.5
WL365HQ	5	1.80	(14)	1.99	(9)	3.80	(9)	D E F G	125.1
WL363HQ	5	1.80	(13)	1.97	(11)	3.78	(10)	D E F G	124.5
Integra 8450	4	1.90	(7)	1.86	(20)	3.76	(11)	D E F G	124.0
SW5210	6	1.75	(19)	2.00	(8)	3.74	(12)	E F G H	123.4
Nexgrow 6585Q	5	1.79	(16)	1.95	(12)	3.74	(13)	E F G H	123.4
Genuity-RR	4	1.84	(9)	1.90	(17)	3.74	(14)	E F G H	123.3
Integra 8444R	4	1.78	(18)	1.94	(13)	3.72	(15)	E F G H	122.7
FG R513M225S	5	1.79	(17)	1.92	(15)	3.71	(16)	E F G H	122.3
4R200	4	1.81	(12)	1.87	(19)	3.67	(17)	E F G H	121.1
FG R513W224S	5	1.79	(15)	1.85	(21)	3.64	(18)	F G H	120.1
FG R410W253	4	1.83	(10)	1.78	(22)	3.61	(20)	F G H	118.9
Xtra-3	4	1.63	(23)	1.91	(16)	3.54	(21)	F G H I	116.8
SW5213	5	1.48	(25)	2.03	(6)	3.51	(22)	G H I	115.7
AmeriStand 545NT RR	5	1.64	(22)	1.77	(23)	3.41	(23)	H I	112.5
FG R513W227S	5	1.64	(21)	1.63	(24)	3.27	(24)	I J	107.8
Ameristand 427TQ	4	1.44	(41)	1.60	(26)	3.04	(25)	J	100.3
Ameristand 445-NT	4	1.49	(24)	1.55	(43)	3.04	(26)	J	100.2
WL377HQ	5	1.46	(38)	1.58	(29)	3.04	(27)	J	100.1
SW4107	4	1.46	(37)	1.58	(30)	3.04	(29)	J	100.1
54Q29	4	1.46	(36)	1.58	(31)	3.04	(30)	J	100.1
Vernal	2	1.46	(35)	1.57	(32)	3.03	(32)	J	100.0
Integra 8420	4	1.44	(43)	1.60	(28)	3.03	(34)	J	99.9
Nexgrow 6422Q	4	1.46	(34)	1.57	(35)	3.03	(35)	J	99.9
Archer III	5	1.47	(27)	1.56	(40)	3.03	(38)	J	99.8
Hi-Gest 360	3	1.46	(31)	1.56	(37)	3.03	(39)	J	99.8
WL 372HQ-RR	5	1.47	(29)	1.56	(42)	3.02	(42)	J	99.6
MEAN		1.67		1.78		3.44			
CV		9.57		8.04		8.16			
LSD (0.1)		0.19		0.17		0.33			

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.

Cutting Schedule Effects on Reduced Lignin Alfalfa

Dan Putnam, Brenda Perez, and Chris DeBen, UC Davis

Introduction Producing high quality alfalfa frequently comes with a tradeoff between yield and quality. Quality is often defined in terms of protein, but frequently the fiber content (ADF and NDF which determine TDN and RFV, see below for abbreviations). Lignin is a fibrous component of the cell wall and is a component of ADF and NDF. Along with cellulose and hemicellulose, lignin enables the crop to 'stand' and not lodge. Unfortunately, lignin, unlike the other components, is nearly completely indigestible to ruminant animals. Thus, lower lignin forages are typically higher in quality. Lignin consists of about 5-8% of the crop. Dry matter reduction in lignin of even a few percentage points can result in much higher digestibility and better milk production.

Cutting Schedule Link: It is well known that 'late harvests' reduce quality but improve yield. This means, as the crop matures, lignification of the stems occurs, and the quality of the alfalfa decreases. Unfortunately, late-harvested stems are increasingly poorer in quality (more lignin), and greatly reduce palatability and milk yield. An increase in stem yield increases the concentration of lignified cell wall material in the whole plant and reduces digestibility. Reduced lignin varieties can potentially offer a way of being able to lengthen the cutting schedule while maintaining forage quality comparable to early-cut forages.

Objectives: To determine the influence of harvest schedule on the yield and quality of reduced lignin lines in comparison to conventional lines in the fall dormancy 3 and 4 groups.

Tulelake Experiments: The Tulelake reduced lignin experiment is part of a multi-state collaboration with Michigan, Ohio, Wisconsin, Minnesota, Iowa, Utah and California. In the spring of 2017, the field was planted with 3 reduced lignin (RL) and 3 check (C) lines (Table 1) in a randomized split plot design. The 'HarvXtra' Lines (#3 and 4) were developed utilizing genetic engineering, while the 'HiGest' line (#6) was developed through traditional plant breeding. The two cutting schedule treatments are a 28-day and 35-day cutting schedule (Main Plots) and were sprinkle irrigated. Plots were harvested with a flail-type harvester. Data on forage quality, yield, mean stage, and lodging were recorded.

Table 1: Varieties used in the Tulelake trial (planted 2017)

Name	FD	Type
Pioneer 54QR04	4	C
WL356HQ.RR	4	C
FGI RLA experimental #H0415A3144	4	RL
FGI RLA experimental #RRL414M377	4	RL
Hi-Gest 360	3	RL
NexGrow 6305Q	3	C

Abbreviations: ADF=Acid Detergent Fiber, NDF = Neutral Detergent Fiber, TDN = Total Digestible Nutrients, RFV = Relative Feed Value. NDFD = NDF Digestibility.

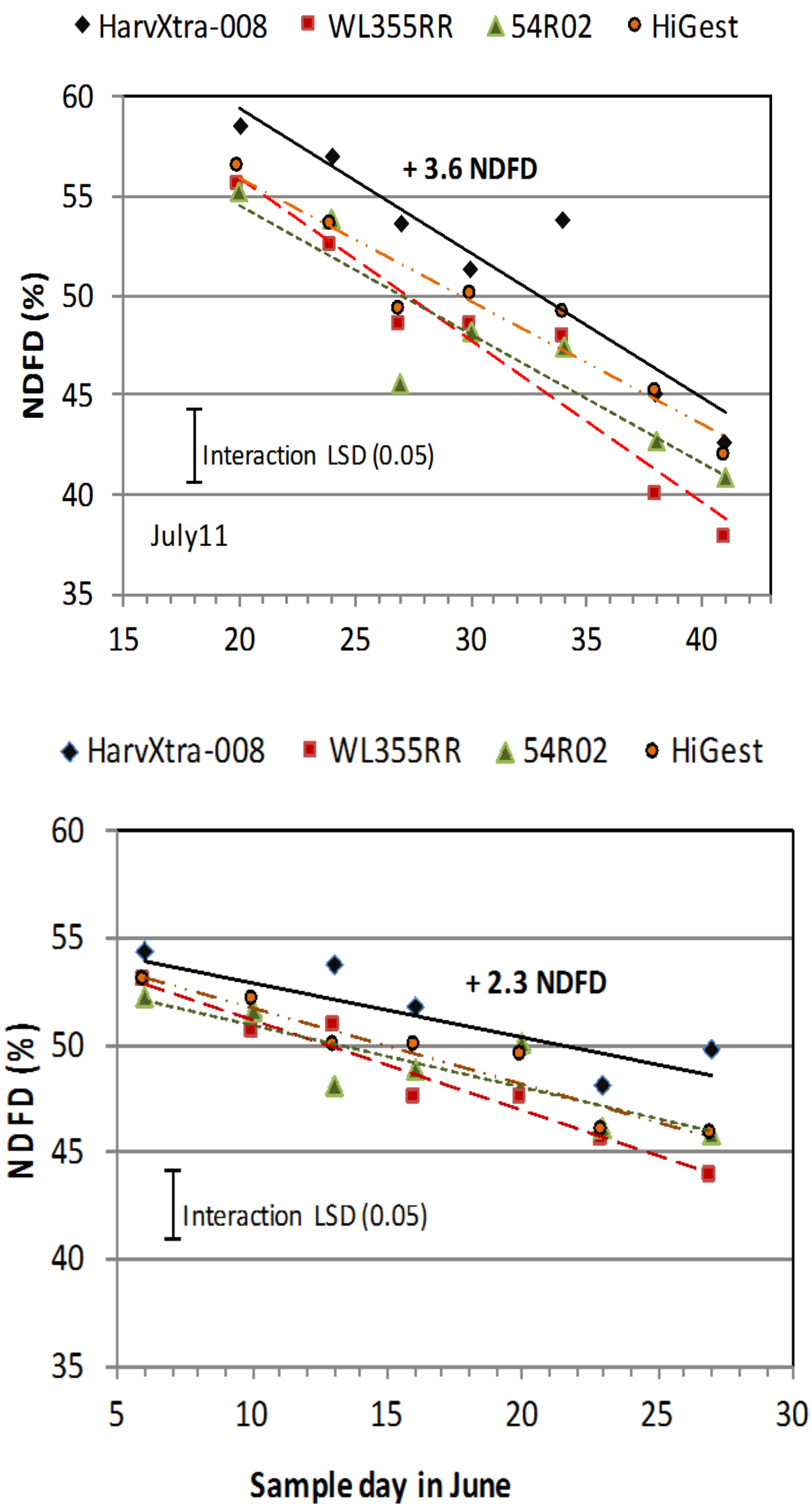
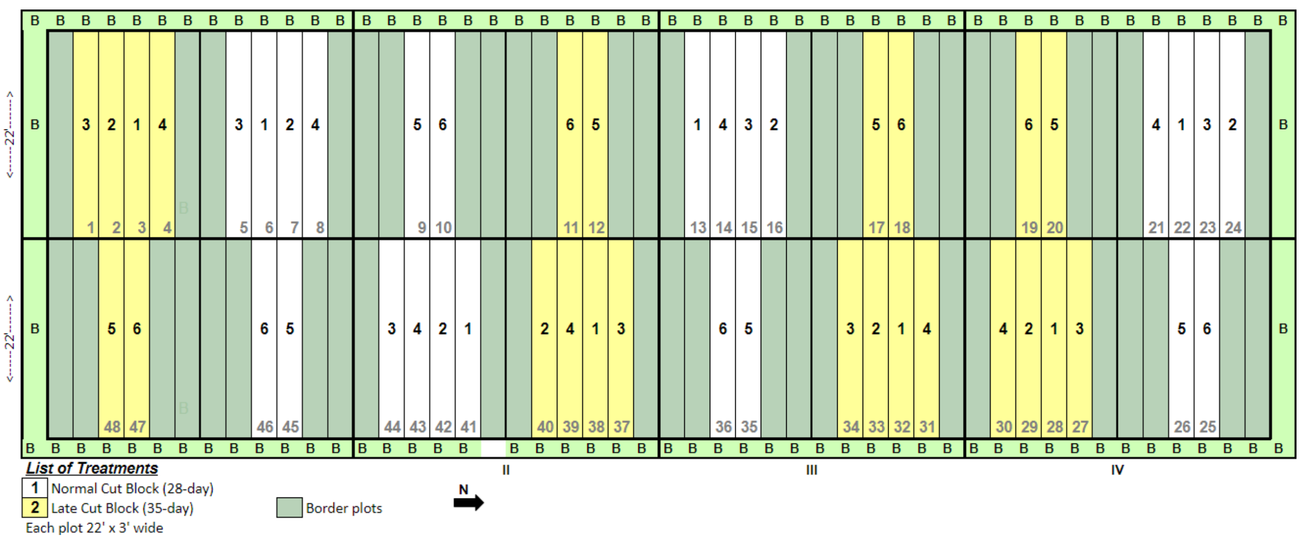


Figure 1. Data from 2016 trial, Tulelake, CA showing differences in NDF Digestibility between varieties as a function of sample date. First cycle (bottom) and second growth cycle (top).

Data. The current experiment was planted in 2017, and thus only seeding-year data is available. We do not recommend utilizing seeding-year data for variety comparisons. However, in Figure 1, the effect of the 'HarvXtra' trait can be seen from 2016 data generated at Tulelake. While all varieties decline in digestibility over time, the HarvXtra variety declined more slowly (Figure 1). The 'HiGest' variety tested here was more similar to a high-qualtiy traditional variety, but somewhat higher in digestibility than typical alfalfa varieties.

Importance of Digestibility. A major missing component of many marketing systems is the lack of interest in the digestibility of the fiber fraction. This is true of TDN and RFV systems. NDF Digestibility is the measure of the digestibility of the fiber fraction which could range from 35% to almost 60%. Since the major differences in these varieties is in NDFD

Plot Plan:



Other experiments in Davis, Kearney

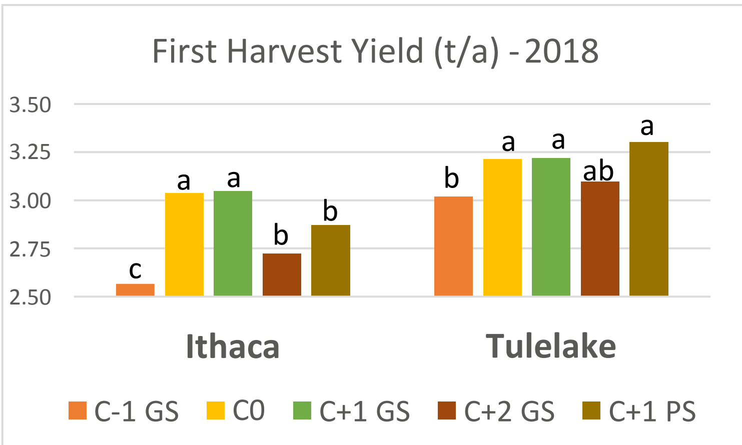
Kearney Experiments: In the fall of 2017, the field was planted with four reduced lignin and four check lines in a randomized split plot design. The three treatments are a 28, 35, and staggered (21-35) day cutting schedule. Evapotranspiration (ET) was monitored using the Parlier CIMIS station and irrigations were applied weekly, in order to meet the crops ET needs. The plots were harvested using a carter machine. Sub samples were taken and subsequently analyzed using and NIRS machine for quality.

UC Davis Experiments: In the spring of 2017, the field was planted with four reduced lignin and four check lines in a randomized split plot design. The blocks were flood irrigated on average every ten days. The two treatments are a 32-day and 42-day cutting schedule. Plots were harvested with a swift current. Sub samples were taken and subsequently analyzed using an NIRS machine for quality.

Charlie Brummer
UC Davis, Forage breeding and genetics
ecbrummer@ucdavis.edu
2018 IREC Forage Field Day – 23 July 2018

Alfalfa

1. *Evaluating the potential of genomic selection to increase alfalfa yield*
   Selected using genetic markers for low yield (C-1GS) or high yield (C+1GS and C+2GS). Also selected plants based on yield in the field (no markers = C+1PS).
   Evaluation of yield plots at IREC and Ithaca, NY (where phenotypic selection was done).
   First cut yield results – some promise using markers



2. *Germplasm pool development and improvement (IREC, Desert REC, Westside REC)*
   Developing regional pools based on germplasm origin
   Northern (FD 1-5) or Southern (FD 6-11) adapted germplasm
   Pre-breeding – new genetic variation for future commercial breeding programs

Pictures taken May 9, 2018. (Left) Germplasm planted at IREC in September 2017 mostly (but not all!) winterkilled. New nurseries being established.

Tall Fescue

1. *Ecotypes and endophytes in California*
   Intermountain REC, Davis, Kearney, Desert REC
   Two ecotypes – summer active (Continental) and summer dormant (Mediterranean)
   Endophytic fungus forms mutualism with (some) tall fescues
   Endophyte gives plants stress tolerance/insect resistance; plant feeds endopyte
   Commonly present endophyte produces toxins that affect animal performance
   Non-toxic endophytes give tolerance without animal injury
   Where do different types of tall fescue fit in California?
   Summer active and summer dormant tall fescue with and without endophyte
   Two irrigation regimes: full and none in summer
   Two clipping treatments: ~weekly and ~monthly
   Monitor survival

2. *Breeding soft leaf tall fescue*
   Higher palatability, better nutritive value
   Selection of plants adapted to California (soft leaf types sensitive to heat, drought)
   Genetic basis of soft leaf phenotype

Desert REC. December 2017. Transplanted Dec. 2016. No irrigation from May to August. Two plots in foreground: Summer dormant germplasm – genetically identical. On left – no endophyte; on right – infected with a non-toxic endophyte. Plot on top of the right plot is summer active – did not survive summer.

2018 IREC Field Day Sponsors

We would like to take this opportunity to sincerely thank the following sponsors. The support they provide allows us to offer the morning refreshments, the informational publication, and the excellent catered lunch and dessert.

- BASF
- Basin Fertilizer & Chemical Co.
- California Garlic & Onion Research Advisory Board
- DuPont
- JW Kerns Irrigation
- Macy's Flying Service
- Northwest Farm Credit Service
- Sensient Natural Ingredients, LLC
- Syngenta Crop Protection, LLC
- Winema Elevators, LLC
- Umpqua Bank


WE MISS YOU, STEVE

2018 IREC Field Day
Thursday, July 26
Tulelake, CA

8:00 am		*Registration Opens*
8:30 am		*Introductions and Opening Remarks* Rob Wilson, IREC Center Director/Farm Advisor, Tulelake, CA
8:40 am	**Stop 1**	*Biological Control of Cereal Leaf Beetle, N. California Update* Charlie Pickett, Staff Environmental Research Scientist (Entomology), California Department of Food and Agriculture, Sacramento, CA
9:00 am	**Stop 2**	*Influence of Fall Harvest Management of Irrigated Grass Hays* David Lile, UCCE-Lassen County Director & Livestock Advisor, Susanville, CA
9:25 am	**Stop 3**	*Onion White Rot Research Update* Rob Wilson, IREC Director & Farm Advisor, Tulelake, CA
9:45 am	**Stop 4**	*Managing Alfalfa Weevil and Clover Root Cucurlio* Rachael Long, UCCE-Capitol Corridor Field Crops & Pest Management Advisor; Jasmin Ramirez Bonilla, Junior Specialist, Dept. of Entomology/Nematology, UC Davis, CA; and Rob Wilson, IREC Director & Farm Advisor, Tulelake, CA
10:00 am	**Stop 5**	*Pulse Crop Options for the Klamath Basin* Rob Wilson, IREC Director & Farm Advisor, Tulelake, CA
10:15 am		*Break and Refreshments*
10:35 am	**Stop 6**	*Demonstration of Cover Crops and Amendments in Tulelake Cropping System* Rob Wilson, IREC Director & Farm Advisor, Tulelake, CA
10:55 am	**Stop 7**	*Cutting Schedule Effects on Low Lignin Alfalfa* Dan Putnam, Extension Agronomist & Forage Specialist, UC Davis, CA
11:15 am	**Stop 8**	*Germplasm Evaluation of Alfalfa and Tall Fescue* Charlie Brummer, Director Plant Breeding Center, UC Davis, CA
11:35 am	**Stop 9**	*Grand Opening of New Multipurpose Conference/Laboratory Building*
Noon		Lunch