2021 Spring Research Update

Intermountain Research and Extension Center

University of California
Agriculture and Natural Resources

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Director Message

Everybody put on your rally cap for a wet April! This report contains several short summaries of research conducted at IREC in 2020. The exceptional efforts of IREC staff in 2020 made it possible for us to complete most planned research projects in the face of COVID-19 restrictions and water woes. If you would like additional information on any project, do not hesitate to call, email, or stop by the office. IREC staff are working onsite, and our office and conference facilities are open at limited capacity. Siskiyou County recently moved into California's red COVID-19 tier, thus our conference facilities for 4-H and agriculture are open at 25% capacity with protective measures for events.

2021 is looking like a rough journey regarding irrigation water. The drought and low river inflows to Klamath Lake make 2021's water outlook bleak. If the weather remains dry through April all water users including the ESA fish BiOp will be lacking. I cannot make it rain, but I am more than happy to help land managers during the drought. Don't hesitate to ask questions about deficit irrigation, crop water use, dryland crop options, and ways to manage perennial crops during drought.

I encourage the Klamath Basin to come together during this difficult year. Water is the life blood for agriculture, natural resources, and cities throughout the West. For this reason, it is difficult to look beyond immediate needs. Believe me I think about IREC water needs every day. On the flip side, this year's severe drought may serve as an example to all parties to work more cooperatively as nobody will get enough water. Klamath Basin water managers need to think creatively. All parties frequently refer to the historic pre-reclamation conditions, but it is impossible to revert to these conditions. Historic reefs, marshes, and lakeshores no longer exist, and towns, homes, businesses, and farms now cover these lands. Land managers must develop innovative solutions to make the best use of limited water and improve water quality.

Water for agriculture has always been dependent on what nature gives us, but farms need a more reliable process for determining water availability from year to year. Confidence in water availability before the start of the farming season is critical for planning, sanity, and economic certainty. Tribes and environmental interests ought to rethink water for fish in the context of today's frequent droughts, dam removal, and 20 years of water management that have yielded mixed results. Wildlife interests might want to rethink policies and water uses. For example, is water best used in Lower Klamath refuge with high evaporative loss and difficult access to water? This historic wetland was very important for waterfowl when water was plentiful, but new wetlands or rejuvenated wetlands in other locations may better serve today's needs as inflows can be more easily be diverted and water can be filtered through wetlands before exiting the Klamath project.

Many people in the Klamath Basin think water shortages only affect farmers and tribes, but a halt to irrigation water will have a negative rippling effect on the local economy and people. It is important for our local communities to document these losses and educate the decision makers that live outside our communities that water is a lifeline for all land uses in the Klamath Basin.

Sincerely,

Rob Wilson
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Latest Alfalfa Variety Yield Results

University of California
Agriculture and Natural Resources
Research and Extension Center System

By Dan Putnam, Chris DeBen, Brenda Perez, Charlie Brummer, UCCE and UC Davis

Choosing superior varieties of alfalfa is a significant economic factor for alfalfa growers. Many commercial varieties are currently available, enabling wide range of options. UC trials provide unbiased data from a wide range of environments related to variety performance of alfalfa. In California, alfalfa is grown from the Oregon border to the Mexican border, and throughout the Great Central Valley, which consists of the Sacramento and San Joaquin Valleys. The tables below represent sites using a 3-4 cut system (dormant varieties) in the Intermountain Region. See the University of California Alfalfa and Forages Website for full report and more information. http://alfalfa.ucdavis.edu

Yield Studies: The California Alfalfa Cultivar Yield, Fall Dormancy, and Forage Quality Trials are open to any certified alfalfa cultivar, which is sold or is likely to be sold in California. Blends or brands (unless they are certified blends) are not included in these trials. Experimental cultivars with a high likelihood of release within the next few years are tested as space permits. Two new trials were established in 2017: a variety trial was planted in Tulelake, and a subsurface drip-irrigated salinity trial at Westside Field Station in Five Points.

The plantings were at approximately 25 lbs/acre live seed. Plots were 3' to 4' wide and 13 to 20 feet long, depending upon location and specific layout. Four to six replicates of each cultivar were planted at each location, depending upon the expected variation at that site. Experimental design was a randomized complete block design. Harvests for yield estimation were obtained from approximately a 3' x 18' area per plot using a flail-type or cutter-bar type forage harvester, and dry matter yield determined by oven-drying subsamples to a constant weight. A representative group of 5-6 varieties were taken at each harvest, and the average dry matter used for yield determination. Cutting schedules were determined by the most common practice in that region and are the same for all varieties within a trial. The data is obtained from each of the locations and analyzed and summarized at the UC Davis campus.

2017 Planted Tulelake Yield Trial: This trial was planted with 44 entries on May 22, 2017. Four cuttings were taken during the 2018 and 2019 seasons. The first cuttings took place on June 6th in 2018, June 12th in 2019 and June 11, 2020 season. **Tulelake results from 2020 and combined results of 2017-2020 are listed.**

2017-2020 YIELDS, TULELAKE ALFALFA CULTIVAR TRIAL. TRIAL PLANTED 5/22/17

		2017 Yield	2018 Yield	2019 Yield	2020 Yield	Average		% of Vernal
	FD			Dry t/a				
Released Varieties								
WL365HQ	5	3.80 (9)	9.64 (9)	9.42 (2)	9.23 (1)	8.02 (1)	A	116.7
HybriForce-4400	4	4.14 (4)	9.74 (6)	8.95 (10)	8.63 (21)	7.86 (2)	A B	114.4
Integra 8450	4	3.76 (11)	9.72 (7)	9.03 (5)	8.88 (6)	7.85 (3)	A B C	114.1
SW5210	6	3.74 (12)	9.51 (12)	9.05 (4)	8.92 (4)	7.81 (5)	A B C D	113.6
SW4107	4	3.04 (29)	9.84 (2)	9.50 (1)	8.84 (8)	7.81 (6)	A B C D	113.5
Nexgrow 6422Q	4	3.03 (35)	9.89 (1)	9.27 (3)	8.98 (3)	7.79 (7)	A B C D E	113.3
HybriForce-3430	3	3.98 (6)	9.79 (4)	8.66 (22)	8.37 (29)	7.70 (8)	B C D E F	112.0
WL363HQ	5	3.78 (10)	9.26 (21)	8.94 (11)	8.75 (13)	7.68 (9)	B C D E F	111.7
Nexgrow 6585Q	5	3.74 (13)	9.25 (22)	8.83 (15)	8.89 (5)	7.68 (10)	B C D E F	111.7
FG R513W224S	5	3.64 (18)	9.50 (13)	8.92 (12)	8.64 (18)	7.68 (11)	B C D E F	111.6
WL377HQ	5	3.04 (27)	9.66 (8)	8.98 (6)	8.88 (7)	7.64 (12)	B C D E F	111.1
HybriForce-3420/Wet	4	4.09 (5)	9.57 (10)	8.55 (30)	8.25 (36)	7.61 (13)	C D E F	110.7
SW5213	5	3.51 (22)	9.51 (11)	8.82 (16)	8.61 (22)	7.61 (14)	C D E F	110.7
FG R513W227S	5	3.27 (24)	9.20 (26)	8.96 (8)	9.01 (2)	7.61 (15)	C D E F	110.7
FG R513M225S	5	3.71 (16)	9.19 (27)	8.69 (20)	8.80 (11)	7.60 (16)	D E F	110.5
54Q29	4	3.04 (30)	9.76 (5)	8.95 (9)	8.63 (20)	7.59 (17)	D E F	110.5
HybriForce-3600	6	4.28 (2)	9.25 (23)	8.32 (36)	8.53 (24)	7.59 (18)	D E F	110.4
FG R410W253	4	3.61 (20)	9.20 (24)	8.67 (21)	8.82 (9)	7.58 (19)	D E F G	110.2
Genuity-RR	4	3.74 (14)	9.20 (25)	8.81 (17)	8.53 (23)	7.57 (20)	D E F G	110.1
AmeriStand 545NT RI	5	3.41 (23)	9.35 (17)	8.83 (14)	8.66 (16)	7.56 (21)	E F G	110.0
Xtra-3	4	3.54 (21)	9.41 (15)	8.89 (13)	8.39 (27)	7.56 (22)	E F G	110.0
Dekalb 43-13	4	3.81 (8)	9.27 (19)	8.71 (19)	8.38 (28)	7.54 (23)	F G H	109.7
Integra 8444R	4	3.72 (15)	9.27 (20)	8.42 (34)	8.67 (15)	7.52 (25)	F G H I	109.4
PGI459	4	4.16 (3)	9.01 (31)	8.64 (23)	8.25 (35)	7.52 (26)	F G H I J	109.3
Archer III	5	3.03 (38)	9.41 (16)	8.62 (27)	8.32 (32)	7.34 (27)	G H I J K	106.8
Integra 8420	4	3.03 (34)	9.42 (14)	8.44 (33)	8.28 (33)	7.29 (30)	I J K	106.1
Hi-Gest 360	3	3.03 (39)	9.30 (18)	8.63 (26)	8.17 (39)	7.28 (31)	J K	105.9
WL 372HQ-RR	5	3.02 (42)	9.19 (28)	8.56 (29)	8.18 (38)	7.24 (33)	K L	105.3
4R200	4	3.67 (17)	8.72 (37)	8.29 (37)	8.24 (37)	7.23 (35)	K L M	105.1
Ameristand 427TQ	4	3.04 (25)	8.95 (32)	8.24 (38)	7.77 (43)	7.00 (40)	M N O P	101.8
Ameristand 445-NT	4	3.04 (26)	8.86 (35)	8.12 (40)	7.82 (42)	6.96 (41)	N O P	101.2
Vernal	2	3.03 (32)	8.68 (39)	8.10 (41)	7.69 (44)	6.88 (43)	O P	100.0
Experimental Varieties								
msSunstra-143146	3	4.30 (1)	9.83 (3)	8.73 (18)	8.50 (25)	7.84 (4)	A B C	114.0
SW4466	4	3.62 (19)	9.13 (29)	8.98 (7)	8.36 (30)	7.52 (24)	F G H I	109.4
RRL414M377	4	3.04 (28)	8.86 (34)	8.52 (31)	8.82 (10)	7.31 (28)	H I J K	106.3
msSunstra-155202	6	3.86 (7)	9.03 (30)	8.04 (42)	8.26 (34)	7.30 (29)	I J K	106.2
RRL414M104	4	3.03 (40)	8.69 (38)	8.63 (24)	8.76 (12)	7.28 (32)	J K	105.9
RRL514W209	5	3.03 (31)	8.63 (40)	8.57 (28)	8.70 (14)	7.23 (34)	K L M	105.2
H0415ST202	4	3.03 (37)	8.87 (33)	8.63 (25)	8.36 (31)	7.22 (36)	K L M	105.0
H0415A3144	4	3.03 (36)	8.73 (36)	8.45 (32)	8.44 (26)	7.16 (37)	K L M N	104.1
H0515QT102	5	3.02 (41)	8.43 (42)	8.33 (35)	8.65 (17)	7.11 (38)	K L M N O	103.3
H0415QT111	4	3.02 (44)	8.46 (41)	8.00 (44)	8.63 (19)	7.03 (39)	L M N O	102.2
RRL414W208	4	3.02 (43)	8.42 (43)	8.15 (39)	8.14 (40)	6.93 (42)	N O P	100.8
RRL514W201	5	3.03 (33)	8.20 (44)	8.01 (43)	7.90 (41)	6.79 (44)	P	98.7
MEAN		3.44	9.20	8.66	8.51	7.45		
CV		8.16	3.66	3.47	3.97	2.69		
LSD (0.1)		0.33	0.40	0.36	0.40	0.24		

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.

2020 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		Cut 3		Cut 4		YEAR			% of
		11-Jun		16-Jul		11-Aug		23-Sep		TOTAL			VERNAL
	FD	Dry t/a											
Released Varieties													
WL365HQ	5	2.97	(4)	2.67	(1)	1.76	(1)	1.84	(4)	9.23	(1)	A	120.0
FG R513W227S	5	2.73	(24)	2.62	(7)	1.72	(2)	1.94	(1)	9.01	(2)	A B	117.2
Nexgrow 6422Q	4	2.90	(8)	2.64	(4)	1.67	(7)	1.78	(8)	8.98	(3)	A B C	116.8
SW5210	6	3.08	(1)	2.62	(6)	1.54	(27)	1.68	(27)	8.92	(4)	A B C D	116.0
Nexgrow 6585Q	5	2.81	(16)	2.61	(8)	1.65	(10)	1.82	(7)	8.89	(5)	A B C D E	115.6
Integra 8450	4	2.92	(5)	2.62	(5)	1.56	(23)	1.77	(11)	8.88	(6)	A B C D E	115.5
WL377HQ	5	2.74	(23)	2.60	(10)	1.70	(4)	1.84	(3)	8.88	(7)	A B C D E	115.5
SW4107	4	2.81	(14)	2.64	(3)	1.64	(12)	1.75	(15)	8.84	(8)	A B C D E	114.9
FG R410W253	4	2.76	(21)	2.59	(12)	1.65	(11)	1.83	(6)	8.82	(9)	B C D E F	114.7
FG R513M225S	5	2.69	(30)	2.52	(21)	1.72	(3)	1.87	(2)	8.80	(11)	B C D E F	114.5
WL363HQ	5	2.71	(29)	2.66	(2)	1.61	(14)	1.77	(12)	8.75	(13)	B C D E F G H	113.8
Integra 8444R	4	2.67	(31)	2.57	(16)	1.66	(8)	1.78	(9)	8.67	(15)	B C D E F G H I J	112.8
AmeriStand 545NT RI	5	2.63	(36)	2.58	(14)	1.69	(5)	1.77	(10)	8.66	(16)	B C D E F G H I J	112.6
FG R513W224S	5	2.71	(28)	2.50	(23)	1.66	(9)	1.77	(14)	8.64	(18)	B C D E F G H I J K L	112.3
54Q29	4	2.89	(9)	2.57	(17)	1.52	(30)	1.64	(34)	8.63	(20)	B C D E F G H I J K L	112.2
Hybriforce-4400	4	3.01	(2)	2.52	(20)	1.43	(35)	1.66	(33)	8.63	(21)	B C D E F G H I J K L	112.2
SW5213	5	2.73	(25)	2.61	(9)	1.60	(18)	1.67	(28)	8.61	(22)	C D E F G H I J K L	112.0
Genuity-RR	4	2.65	(33)	2.56	(19)	1.60	(17)	1.73	(18)	8.53	(23)	D E F G H I J K L M	111.0
Hybriforce-3600	6	2.55	(41)	2.56	(18)	1.59	(19)	1.84	(5)	8.53	(24)	D E F G H I J K L M	110.9
Xtra-3	4	2.48	(43)	2.58	(13)	1.61	(15)	1.73	(17)	8.39	(27)	G H I J K L M	109.1
Dekalb 43-13	4	2.60	(37)	2.47	(29)	1.54	(28)	1.77	(13)	8.38	(28)	G H I J K L M	108.9
Hybriforce-3430	3	2.88	(11)	2.42	(37)	1.34	(42)	1.72	(20)	8.37	(29)	G H I J K L M	108.8
Archer III	5	2.78	(17)	2.50	(24)	1.42	(36)	1.62	(38)	8.32	(32)	I J K L M	108.1
Integra 8420	4	2.66	(32)	2.44	(33)	1.49	(33)	1.69	(26)	8.28	(33)	J K L M N	107.6
PGI459	4	2.77	(19)	2.48	(27)	1.37	(40)	1.62	(37)	8.25	(35)	K L M N	107.2
Hybriforce-3420/Wet	4	2.76	(20)	2.47	(30)	1.41	(37)	1.61	(40)	8.25	(36)	K L M N	107.2
4R200	4	2.58	(39)	2.43	(35)	1.50	(32)	1.72	(19)	8.24	(37)	L M N	107.1
WL 372HQ-RR	5	2.55	(40)	2.42	(38)	1.58	(20)	1.63	(35)	8.18	(38)	M N O	106.4
Hi-Gest 360	3	2.78	(18)	2.46	(31)	1.35	(41)	1.58	(41)	8.17	(39)	M N O	106.2
Ameristand 445-NT	4	2.65	(34)	2.34	(41)	1.31	(43)	1.51	(43)	7.82	(42)	O P Q	101.6
Ameristand 427TQ	4	2.54	(42)	2.30	(43)	1.38	(39)	1.55	(42)	7.77	(43)	P Q	101.0
Vernal	2	2.72	(27)	2.30	(42)	1.22	(44)	1.44	(44)	7.69	(44)	Q	100.0
Experimental Varieties													
RRL414M377	4	2.99	(3)	2.59	(11)	1.57	(21)	1.66	(30)	8.82	(10)	B C D E F	114.6
RRL414M104	4	2.81	(15)	2.57	(15)	1.68	(6)	1.70	(23)	8.76	(12)	B C D E F G	114.0
RRL514W209	5	2.91	(6)	2.49	(26)	1.60	(16)	1.70	(24)	8.70	(14)	B C D E F G H I	113.1
H0515QT102	5	2.84	(13)	2.48	(28)	1.63	(13)	1.70	(25)	8.65	(17)	B C D E F G H I J K	112.4
H0415QT111	4	2.87	(12)	2.45	(32)	1.57	(22)	1.74	(16)	8.63	(19)	B C D E F G H I J K L	112.2
msSunstra-143146	3	2.89	(10)	2.49	(25)	1.45	(34)	1.67	(29)	8.50	(25)	E F G H I J K L M	110.5
H0415A3144	4	2.76	(22)	2.51	(22)	1.56	(24)	1.62	(39)	8.44	(26)	F G H I J K L M	109.7
SW4466	4	2.91	(7)	2.44	(34)	1.39	(38)	1.63	(36)	8.36	(30)	G H I J K L M	108.8
H0415ST202	4	2.73	(26)	2.39	(39)	1.52	(31)	1.71	(21)	8.36	(31)	H I J K L M	108.6
msSunstra-155202	6	2.59	(38)	2.43	(36)	1.54	(26)	1.71	(22)	8.26	(34)	K L M N	107.4
RRL414W208	4	2.65	(35)	2.28	(44)	1.55	(25)	1.66	(31)	8.14	(40)	M N O P	105.8
RRL514W201	5	2.34	(44)	2.38	(40)	1.52	(29)	1.66	(32)	7.90	(41)	N O P Q	102.8
MEAN		2.75		2.51		1.55		1.71		8.51			
CV		6.27		4.30		6.18		5.75		3.97			
LSD (0.1)		0.20		0.13		0.11		0.12		0.40			

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

Entries follow ed 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.

2020 Small Grain Variety Testing Research at IREC

University of California
Agriculture and Natural Resources
Research and Extension Center System

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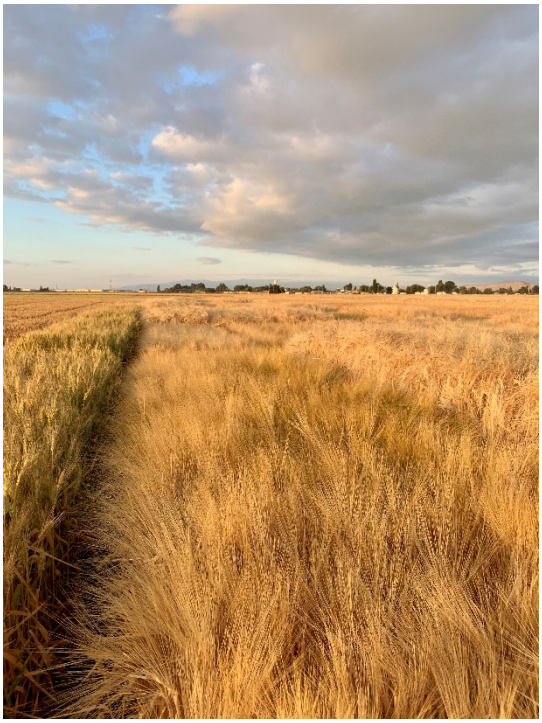
Introduction



This report summarizes grain yield, agronomic characteristics and baking quality characteristics for public and private entries in IREC's 2020 small grain variety testing. This project is a cooperative effort with Oregon State University's Cereal Variety Testing organized by Ryan Graebner and University of California Small Grain Breeding Programs. Research received funding support from the California Wheat Commission, private seed companies, and UC ANR. Trials conducted during the 2019-2020 growing season included: winter wheat, winter barley, spring hard wheat, spring soft wheat, and spring barley. Tulelake's soil and climate support some of the highest yields of irrigated wheat and barley grain in the nation. Entries included released and experimental varieties adapted to Tulelake's high desert climate.

Grain yield and agronomic data was collected by IREC staff. Grain protein and test weights were generated in collaboration with Ryan Graebner, Oregon State University. Baking quality characteristics summaries and pictures were provided by the California Wheat Commission California Wheat – California Wheat Commission. Summaries of Oregon State sites from multi-locations in the Northwest can be found at https://cropandsoil.oregonstate.edu/wheat/osu-wheat-variety-trials. UC Statewide small Grain Variety Trial summaries for multi-year and multi-trial data for all UC Statewide Small Grain Variety Trials can be found at http://smallgrainselection.plantsciences.ucdavis.edu/.

2020 General Trial Information for all trials

Location:	Intermountain Research and Extension Center, Tulelake, CA
Soil Type:	Tulebasin mucky silty clay loam
Weed Control:	Rhomene MCPA @ 1 pt. /Acre; Detonate @ 2 fl oz./Acre
Plot size:	100 ft^2
Seeding Rate:	100 lbs./Acre
Row Spacing:	6 Inches
Number of Reps:	4

Soft White Winter Wheat Trial

Planting Date: 10/23/2019
Previous Crop: Max field pea cover crop
Fall Soil N nitrate: 31 ppm (112 lbs. N/Acre)
Spring Soil Test N: 20 ppm (72 lbs. N/Acre)
Fertilizer: 40 lbs. N/Acre applied April 15/2020 (tillering)
Irrigation Quantity: Solid-set sprinklers 16.8 Acre inches (final irrigation 6/19/2020)
Harvest Date: 8/25/2020
Variety Highlights: Varieties with high yields in 2020 and over a three-year period from 2018—2020 include LCS Blackjack, Bobtail, LCS Ghost, WB1783 and Mary. Bobtail is awnletted (awns with minimal extension), making it suitable for hay and grain production. From an agronomic perspective, WB1793 appears to be prone to lodging with 75% plants lodged in 2020. Mary is susceptible to stripe rust.

2020 IREC Irrigated Winter Wheat Grain Yield Summary, Tulelake, CA.

Entry #	Entry Name	Grain Yield (tons/acre)	
18	LWW16-71088	6.17	A
17	LCS Blackjack (LWW15-71945)	6.02	A B
4	Bobtail	5.69	A B C
15	LCS Ghost (LWW14-74143)	5.64	A B C
11	WB 1783	5.63	A B C
2	Mary	5.62	A B C
3	Rosalyn	5.50	A B C D
14	LCS Hulk	5.50	A B C D
6	Nixon (OR2121086)	5.35	A B C D E
23	OR2150346	5.34	A B C D E F
5	Norwest Duet	5.32	B C D E F
24	OR2150141	5.32	B C D E F
20	Stingray CL+	5.30	B C D E F G
9	SY Ovation	5.23	B C D E F G
13	WB 1532	5.17	C D E F G
22	OR2140401	5.16	C D E F G
1	Stephens	5.13	C D E F G
16	LCS Shine (LWW14-72916)	5.12	C D E F G
21	Magic CL+	5.07	C D E F G
7	VI Bulldog (IDN 07-28017B)	5.03	C D E F G
19	M-Press	4.75	D E F G H
10	SY Dayton	4.65	E F G H
12	WB 1604	4.50	F G H
25	OR5170022	4.47	G H
8	Pritchett	4.02	H
	Average	5.23	

2020 IREC Irrigated Winter Wheat Agronomic Characteristics.

Entry #	Entry Name	Heading Date	Maturity Date	Plant Height (cm)	% Lodged Plants	% Stripe Rust	Bushel wt.	Protein %
1	Stephens	17-Jun	8-Aug	109	86	0	59.3	11.6
2	Mary	16-Jun	6-Aug	105	1	30	59.9	11.6
3	Rosalyn	19-Jun	6-Aug	109	0	0	58.8	10.6
4	Bobtail	17-Jun	7-Aug	106	0	0	59.6	11.4
5	Norwest Duet	19-Jun	5-Aug	115	56	0	60.5	11.6
6	Nixon (OR2121086)	18-Jun	9-Aug	112	0	0	58.8	11.5
7	VI Bulldog (IDN 07-28017B)	17-Jun	7-Aug	105	1	0	60.1	11.8
8	Pritchett	21-Jun	7-Aug	108	51	0	58.6	11.6
9	SY Ovation	19-Jun	5-Aug	104	10	0	59.9	11.7
10	SY Dayton	20-Jun	7-Aug	101	0	0	60.0	12.0
11	WB 1783	18-Jun	9-Aug	109	75	0	61.2	11.3
12	WB 1604	15-Jun	2-Aug	108	23	0	60.7	12.7
13	WB 1532	19-Jun	8-Aug	112	93	0	59.0	13.1
14	LCS Hulk	18-Jun	7-Aug	108	0	0	61.5	11.4
15	LCS Ghost (LWW14-74143)	17-Jun	6-Aug	109	1	0	58.3	10.5
16	LCS Shine (LWW14-72916)	13-Jun	2-Aug	91	0	0	60.2	11.9
17	LCS Blackjack (LWW15-71945)	17-Jun	5-Aug	105	1	0	58.6	11.3
18	LWW16-71088	19-Jun	9-Aug	106	86	0	59.7	11.0
19	M-Press	20-Jun	8-Aug	107	0	0	59.7	11.9
20	Stingray CL+	18-Jun	8-Aug	109	4	0	58.9	11.7
21	Magic CL+	15-Jun	8-Aug	99	5	0	60.0	12.5
22	OR2140401	19-Jun	7-Aug	106	0	0	59.1	11.1
23	OR2150346	19-Jun	9-Aug	104	0	0	57.5	11.7
24	OR2150141	19-Jun	8-Aug	113	1	0	59.3	12.4
25	OR5170022	19-Jun	8-Aug	106	0	0	59.6	13.7
	Average	17-Jun	6-Aug	107	19.8	1.2	59.5	11.7

Winter Barley Trial

Planting Date: 10/23/2019
Previous Crop: Max field pea cover crop
Fall Soil N nitrate: 31 ppm (112 lbs. N/Acre)
Spring Soil Test N: 20 ppm (72 lbs. N/Acre)
Fertilizer: None
Irrigation Quantity: Solid-set sprinklers 11.76 Acre inches (final irrigation 5/29/2020)
Harvest Date: 8/13/2020
Variety Highlights: Thunder, a recent release from the Oregon State University barley breeding program, was the highest yielding winter malting barley type. All winter malt barley varieties had higher than desirable protein for malt quality. This may have been due to the abundance of nitrogen available from the previous field pea cover crop. The top yielding entry in the trial was Strider. It is a 6-row feed barley with good resistance to strip rust.

2020 IREC Irrigated Winter Barley Yield and Agronomic Characteristics

Entry #	Entry Name	Barley Type	Grain Yield tons/A	Heading Date	Maturity Date	Plant Height (cm)	% Lodged Plants	% Stripe Rust	Bushel wt.	Protein %
1	Alba	Feed	3.56	5-Jun	22-Jul	120	10	5	50.0	13.5
2	Strider	Feed	3.94	2-Jun	20-Jul	120	0	0	49.4	13.0
3	Wintmalt	Malt	2.91	6-Jun	24-Jul	105	55	55	49.0	15.4
4	Thunder	Malt	3.29	5-Jun	23-Jul	109	14	23	50.9	15.5
5	DH130910	Malt	3.02	5-Jun	18-Jul	112	5	8	51.4	14.7
	Average		3.34	4-Jun	21-Jul	113	17	18	50.1	14.4

Spring Soft Wheat Trial

Planting Date: 4/17/2020

Previous Crop: Max field pea cover crop

Spring Soil Test N: 38 ppm (138 lbs. N/Acre)

Fertilizer: 40 lbs. N/Acre applied 4/15/2020 (tillering); 20 lbs. N/Acre applied 6/10/2020 (joint)

Irrigation Quantity: Solid-set sprinklers 19.32 Acre inches (final irrigation 7/1/2020)

Harvest Date: 9/3/2020

Variety Highlights: WB6341 and Tekoa were the highest yielding released spring soft wheats in 2020 and over a three-year average from 2018-2020. Both varieties have acceptable protein levels and test weights for soft wheats. Other varieties of local interest, which were not in the trial for 2020 but have produced well in previous years, are UI Stone and WB6430.

2020 IREC Irrigated Spring Soft Wheat Yields

Entry #	Entry Name	Grain Yield (tons/acre)				
3	IDO01405S	5.14	A			
1	WB6341	5.09	A			
10	IDO1401S	4.95	A	B		
5	Tekoa	4.94	A	B		
9	IDO1404S	4.78	A	B	C	
12	10PN2013-02	4.74	A	B	C	
2	WB6121	4.56		B	C	
7	IDO01702S	4.54		B	C	
4	Ryan	4.45			C	D
8	Alpowa	4.37			C	D
6	Melba	4.03				D
11	AP Coachman	3.40				E
	Average	4.58				

2020 IREC Irrigated Spring Soft Wheat Agronomic Characteristics

Entry #	Entry Name	Heading Date	Maturity Date	Plant Height (cm)	% Lodged Plants	% Stripe Rust	Bushel wt. (lbs)	Protein %
1	WB6341	25-Jun	14-Aug	105	0	0	61.1	11.0
2	WB6121	24-Jun	13-Aug	91	0	0	61.6	12.6
3	IDO01405S	25-Jun	14-Aug	98	0	0	61.5	11.8
4	Ryan	24-Jun	14-Aug	97	44	0	58.8	12.4
5	Tekoa	27-Jun	16-Aug	112	23	0	62.5	11.9
6	Melba	28-Jun	19-Aug	96	78	0	61.0	12.0
7	IDO01702S	25-Jun	14-Aug	11	0	0	61.6	11.0
8	Alpowa	29-Jun	14-Aug	113	21	50	61.5	11.9
9	IDO1404S	27-Jun	18-Aug	100	0	0	61.9	11.1
10	IDO1401S	24-Jun	14-Aug	105	19	0	60.9	11.6
11	AP Coachman	29-Jun	17-Aug	109	91	0	56.6	11.3
12	10PN2013-02	26-Jun	14-Aug	108	0	0	60.9	11.8
	Average	26-Jun	15-Aug	95	23	4	60.8	11.7

Spring Hard Wheat Trial

Planting Date: 4/17/2020

Previous Crop: Max field pea cover crop

Spring Soil Test N: 38 ppm (138 lbs. N/Acre)

Fertilizer: 40 lbs. N/Acre applied 4/15/2020 (tillering); 20 lbs. N/Acre applied 6/10/2020 (joint); 40 lbs. N/Acre applied 7/2/2020 (flowering)

Irrigation Quantity: Solid-set sprinklers 19.32 Acre inches (final irrigation 7/1/2020)

Harvest Date: 9/3/2020

Variety Highlights: Varieties tested in the 2020 spring hard wheat trial were fertilized to maximize protein by applying 40 additional units of nitrogen at flowering. SY Teton was the highest yielding released hard white wheat, but it had lower test weights and lower protein compared to many other entries. The highest yielding released hard red wheat varieties from 2018-2020 were WB9699, AP Renegade, WB9668, WB9518, WBPatron, and WB9904. Of these highest yielding varieties, WB9668 and WB9518 had favorable grain protein above 15% similar to the standard high protein variety Yecora Rojo, which was at 15.7%. WBPatron is an awnless variety that could potentially be used for grain hay production.

2020 IREC Irrigated Spring Hard Red Wheat Grain Yields

Entry #	Entry Name	Grain Yield (tons/acre)	
15	SY Teton	4.90	A
19	WB9699	4.75	A B
18	Softsvevo	4.68	A B C
16	IDO1203S-A	4.63	A B C
4	AP Renegade (SY3017-9)	4.51	A B C D
10	WB9668	4.49	A B C D
14	LNR16-1485	4.47	A B C D
7	WBPatron	4.44	A B C D
3	WA 8315	4.41	A B C D E
11	WB9904	4.39	A B C D E F
5	AP Venom	4.38	A B C D E F
9	WB9518	4.36	A B C D E F
17	IDO1804S	4.27	B C D E F
20	WB9990	4.19	C D E F
8	WB9303	4.08	D E F G
2	Alum	4.05	D E F G
6	AP Octane	4.01	D E F G
13	LNR16-1223	3.86	E F G
1	Yecora Rojo	3.85	F G
12	IDO1805S	3.56	G
	Average	4.31	

2020 IREC Irrigated Spring Hard Red Wheat Agronomic Characteristics

Entry #	Entry Name	Heading Date	Maturity Date	Plant Height (cm)	% Lodged Plants	% Stripe Rust	Bushel wt. (lbs)	Protein %
1	Yecora Rojo	25-Jun	12-Aug	81	0	10	60.7	15.9
2	Alum	27-Jun	15-Aug	109	18	0	61.1	14.8
3	WA 8315	26-Jun	14-Aug	110	43	0	61.5	14.6
4	AP Renegade (SY3017-9)	27-Jun	17-Aug	104	0	0	60.6	13.9
5	AP Venom	2-Jul	14-Aug	106	0	0	60.5	14.6
6	AP Octane	27-Jun	14-Aug	86	0	0	59.0	14.9
7	WBPatron	25-Jun	12-Aug	88	0	0	59.9	14.0
8	WB9303	24-Jun	14-Aug	97	0	0	62.4	14.9
9	WB9518	27-Jun	13-Aug	94	0	0	60.9	15.2
10	WB9668	26-Jun	14-Aug	89	0	0	62.6	15.2
11	WB9904	28-Jun	14-Aug	94	0	0	60.6	13.3
12	IDO1805S	27-Jun	15-Aug	96	14	0	58.8	14.9
13	LNR16-1223	2-Jul	14-Aug	108	81	5	59.8	13.6
14	LNR16-1485	29-Jun	13-Aug	118	0	5	61.1	13.9
15	SY Teton	25-Jun	15-Aug	95	0	0	58.6	13.5
16	IDO1203S-A	25-Jun	14-Aug	95	0	0	61.7	14.6
17	IDO1804S	27-Jun	15-Aug	102	59	20	59.4	14.4
18	Softsvevo	26-Jun	14-Aug	102	3	10	60.3	14.6
19	WB9699	27-Jun	14-Aug	87	0	0	61.2	13.7
20	WB9990	30-Jun	13-Aug	89	0	0	59.7	13.3
	Average	27-Jun	14-Aug	98	11	2.5	60.5	14.4

Spring Barley Trial

Planting Date: 4/17/2020

Previous Crop: Sudan Grass Hay

Spring Soil Test N: 2.9 ppm (10 lbs. N/Acre)

Fertilizer: 40 lbs. N/Acre applied 5/22/2020 (tillering); 30 lbs. N/Acre applied 5/29/2020 (late tillering-stem elongation)

Irrigation Quantity: Solid-set sprinklers 15.54 Acre inches (final irrigation 6/26/2020)

Harvest Date: 8/24/2020

Variety Highlights: Barley lines tested in 2020 were fertilized sparingly to maintain low grain protein desirable for malting. Low nitrogen also helps minimize lodging, which can occur frequently on Tulelake's fertile soil. IREC had a moderate incidence of stripe rust disease in 2020. LCS Opera was a high yielding malt type with shorter plant height (less likely to lodge), low protein, and resistance to stripe rust. Claymore, a 2-row barley, has been the highest yielding feed type the past three seasons (2018-2020).

2020 IREC Irrigated Spring Barley Grain Yields

Entry #	Entry Name	Type	Grain Yield (tons/acre)		
5	Oreana	Feed	4.26	A	
2	LCS Opera	Malt	4.22	A	
8	Charger	Feed	4.04	A	B
10	KWS Chrissie	Malt	4.02	A	B
9	KWS Jessie	Malt	4.00	A	B
1	Claymore	Feed	3.92	A	B
7	LCS Diablo	Malt	3.92	A	B
3	CDC Copeland	Malt	3.88	A	B
4	Altorado	Feed	3.60	A	B
13	Francin	Malt	3.51	A	B C
11	AAC Connect	Malt	3.21		B C
12	Meg's Song	Food	3.08		B C
6	DH130910	Malt	2.60		C
			3.71		

2020 IREC Irrigated Spring Barley Agronomic Characteristics

Entry #	Entry Name	Type	Heading Date	Maturity Date	Plant Height (cm)	% Lodged Plants	% Stripe Rust	Bushel wt. (lbs)	Protein %
1	Claymore	Feed	28-Jun	31-Jul	113	0	8	52.1	9.6
2	LCS Opera	Malt	30-Jun	5-Aug	87	0	0	50.6	9.3
3	CDC Copeland	Malt	28-Jun	27-Jul	124	0	20	52.0	9.6
4	Altorado	Feed	28-Jun	29-Jul	102	0	0	53.8	9.9
5	Oreana	Feed	29-Jun	2-Aug	85	0	11	52.5	9.6
6	DH130910	Malt	29-Jun	29-Jul	103	0	4	50.8	12.9
7	LCS Diablo	Malt	30-Jun	5-Aug	86	0	3	48.7	9.8
8	Charger	Feed	25-Jun	29-Jul	109	0	11	53.8	9.2
9	KWS Jessie	Malt	30-Jun	1-Aug	83	0	6	50.3	9.5
10	KWS Chrissie	Malt	30-Jun	31-Jul	85	0	33	51.9	9.4
11	AAC Connect	Malt	27-Jun	25-Jul	110	0	10	52.2	10.8
12	Meg's Song	Food	26-Jun	31-Jul	115	0	6	61.7	12.0
13	Francin	Malt	29-Jun	1-Aug	87	0	4	51.8	10.5
			28-Jun	30-Jul	99	0	9	52.5	10.1

California Wheat Commission Baking Quality Test Results

An aspect of wheat production farmers rarely look at is how their crop performs in baking and cooking tests. The California wheat commission ran quality tests on selected hard red wheat and soft white wheat varieties produced at IREC in 2020. The following tables and pictures show results from these quality and baking tests.

Hard red wheat is widely used to make flour for bread. Yecora Rojo is widely known to have good red wheat quality and it serves as a standard to compare with other varieties. Bread baking quality targets for hard red wheat are: ≥63.5% bake absorption, 3 -5 minute bake mix time, ≥870cc bread loaf volume, & ≤5 bread crumb grain.

Soft white wheat is commonly used in cakes, cookies, pastries, and crackers. SY Ovation is widely known to have good soft white wheat quality and serves as a standard to compare with other soft white varieties. Quality soft white wheats produce larger diameter cookies and sponge cakes with large volumes and tender, fine crumb grain. The quality target for sugar-snap cookie diameter is 9.3 cm or 186mm for two cookies.

Another wheat quality parameter making headlines recently is falling number. Falling number is a test for increased alpha amylase activity, an enzyme that is produced during preharvest sprouting or large temperature fluctuations during grain maturation. A falling number score below 300 seconds is a danger in grain because the digested starch compromises the ability to produce good quality baking products. The quality standard for falling number in all wheat classes is ≥300.

2020 IREC Irrigated Hard Spring Red Wheat Milling and Bread Quality

	MILLING		REGULAR BREAD TEST				
Entry Name	Wheat FALL NO. (SEC)	Milling Score	DOUGH HANDLING (1-10)	CRUMB COLOR (1-10)	CRUMB GRAIN (1-10)	CRUMB TEXTURE (1-10)	BREAD SYMMETRY (1-10)
Yecora Rojo	368	107.17	6	6	5	5.0	5.0
Alum	348	104.10	6	6	5	5.0	5.0
AP Renegade	430	104.00	7	8	7	7.0	7.0
AP Venom	309	105.36	7	8	6	7.0	7.0
AP Octane	365	102.64	6	8	7	8.0	7.0
WB Patron	383	105.87	3	4	1	1.0	2.0
WB 9518	354	101.77	4	4	3	3.0	4.0
WB 9668	380	102.84	6	6	5	5.0	7.0
SY Teton	290	103.57	6	9	7	8.0	7.0
WB 9699	411	102.34	7	8	7	7.0	7.0
WB 9990	337	105.16	4	8	4	3.0	4.0

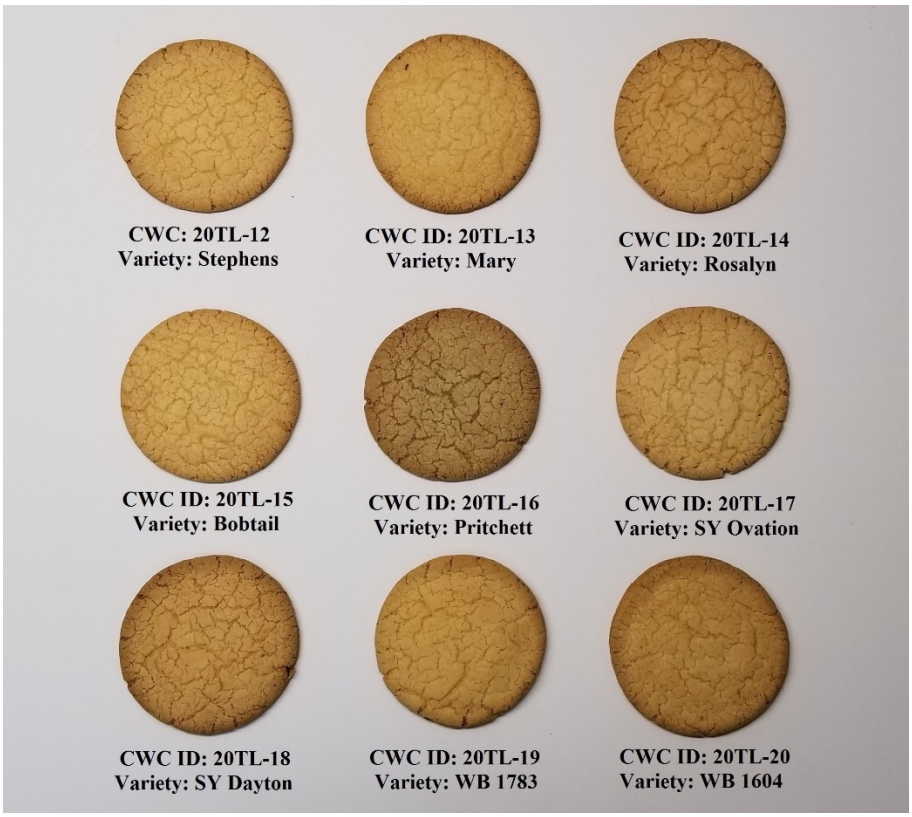
2020 IREC Irrigated Soft Spring and Soft Winter Wheat Milling and Cookie Quality

	MILLING		Cookie Test		
Entry Name	Wheat FALL NO. (SEC)	Milling Score	Diameter for 2 cookies (mm)	Thickness for 2 cookies (mm)	Width/Thickness W/T
Stephens	307	84.46	176.25	15.08	11.69
Mary	339	78.87	177.25	14.73	12.03
Rosalyn	303	76.80	173.75	15.73	11.05
Bobtail	309	86.73	176.75	14.62	12.09
Pritchett	106	46.88	178.50	13.94	12.80
SY Ovation	293	82.03	174.50	16.12	10.83
SY Dayton	289	84.12	176.25	15.26	11.55
WB 1783	359	79.61	166.75	14.44	11.55
WB 1604	321	77.70	175.00	15.19	11.52
WB 1532	334	80.96	175.00	14.96	11.70
LCS Hulk	291	80.24	176.00	14.81	11.88
WB 6341	239	81.81	176.00	14.15	12.44
WB 6121	295	80.96	171.25	15.64	10.95
Ryan	253	80.44	171.50	15.56	11.02
Tekoa	306	82.57	175.75	13.36	13.15
Melba	275	79.97	180.75	13.33	13.56
Alpowa	338	80.06	174.50	15.28	11.42
AP Coachman	290	75.74	173.25	16.21	10.69


CWC ID: 20TL-1
Variety: Yecora Rojo
CWC ID: 20TL-2
Variety: Alum
CWC ID: 20TL-3
Variety: AP Renegade
CWC ID: 20TL-4
Variety: AP Venom


CWC ID: 20TL-5
Variety: AP Octane
CWC ID: 20TL-6
Variety: WB Patron
CWC ID: 20TL-7
Variety: WB 9518
CWC ID: 20TL-8
Variety: WB 9668


CWC ID: 20TL-9
Variety: SY Teton
CWC ID: 20TL-10
Variety: WB 9699
CWC ID: 20TL-11
Variety: WB 9990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Variety: Bobtail
CWC ID: 20TL-16
Variety: Pritchett
CWC ID: 20TL-17
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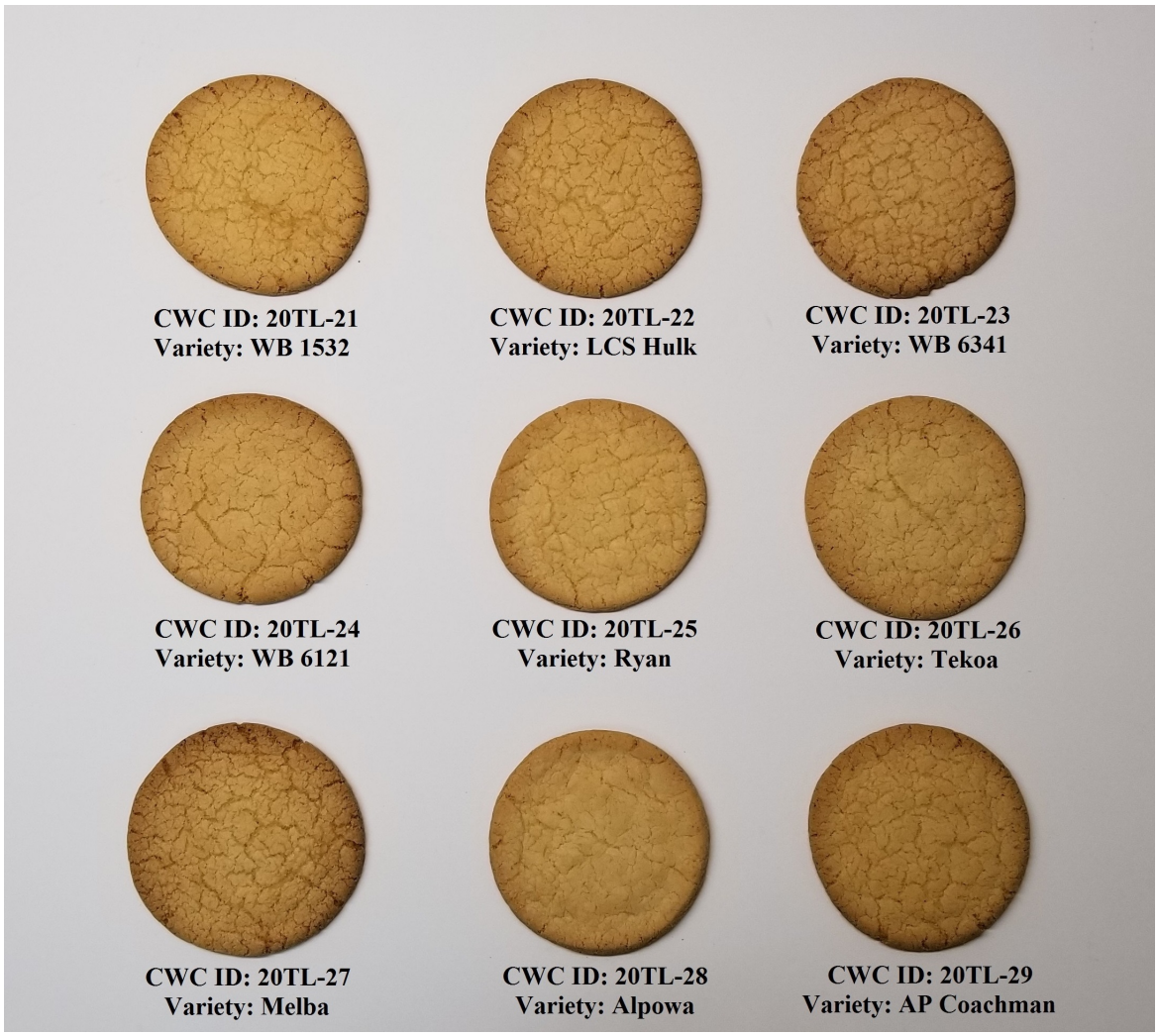
Variety: WB 1783
CWC ID: 20TL-20
Variety: WB 1604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Variety: WB 6121
CWC ID: 20TL-25
Variety: Ryan
CWC ID: 20TL-26
Variety: Tekoa
CWC ID: 20TL-27
Variety: Melba
CWC ID: 20TL-28
Variety: Alpowa
CWC ID: 20TL-29
Variety: AP Coachman

Influence of Cover Crops and Compost on Soil Health and Soil Fertility

University of California
Agriculture and Natural Resources
Research and Extension Center System

By Rob Wilson, UC ANR IREC Director

A three-year study was conducted at the University of California Intermountain Research and Extension Center in Northeast California to evaluate the influence of compost and cover crops on soil health, soil nutrients, crop yield, and crop quality. The study was funded by the California Department of Food and Agriculture Healthy Soils Grant Program. Barley, potatoes, and winter wheat were grown under two management regimes. An organic regime used organic fertilizers and no pesticides. The other regime followed conventional practices and used synthetic fertilizer and pesticides. Fertilizer for both management regimes was applied based on soil nutrient content following University of California recommendations. Measurement of soil properties in the third year of the study showed multiple applications of compost totaling 10 tons per acre increased soil organic matter and soil carbon (Table 1). Soil organic matter and total carbon were numerically higher in the cover crop treatment compared to the untreated control, but compost had a much more pronounced effect on soil carbon compared to cover crops.

Table 1. Soil properties for soil treatments in year 3 (2020) averaged across conventional and organic production systems.

Treatment	Water holding capacity ($g\ g^{-1}$)	Microbial biomass C[2] ($mg\ kg^{-1}$)	Soil Organic Matter (%)	Total C[3] ($g\ kg^{-1}$)	Total N[3] ($g\ kg^{-1}$)	C:N ratio #	POXC[4] ($mg\ kg^{-1}$)
Untreated	.93a[1]	291a	6.23b	36.15b	3.3a	10.97a	1132a
Compost (10 tons/A total)	.92a	286a	6.61a	38.31a	3.42a	11.21a	1104a
Legume/mustard cover crops	.95a	271a	6.31b	36.59b	3.32a	11.01a	1003a

[1] treatment means within columns with the same letter are not statistically different using Tukey's HSD test.

[2] by chloroform fumigation extraction method, [3] by dry combustion, [4] Permanganate oxidizable carbon

Why is soil carbon important? Soil carbon is the main component of soil organic matter and helps with water-retention capacity, soil structure, and soil's capacity to support microbial and plant growth. Sequestering soil carbon is also a hot topic being considered as a farming practice to help fight climate change by reducing CO_2 in the atmosphere. In our study, 10 tons of compost per acre did not increase soil water holding capacity, soil microbial biomass, and crop yields in Tulelake soil over a 3-year period (Table 1).

Figure. IREC staff spreading compost

A significant benefit of growing a field pea or vetch cover crop compared to compost was an increase in plant-available nitrogen from incorporating legume cover crop residues. Field

peas and vetch fixed a substantial amount of atmospheric nitrogen that benefited crop growth for two years. The cover crop allowed successful production of conventional and organic potatoes without the need for supplemental nitrogen fertilizer. Elevated mineralized nitrogen in the cover crop soil two years after legume incorporation also reduced nitrogen fertilizer need by 40% when growing winter wheat. Compost required similar nitrogen fertilizer input compared to the untreated control in all years.

Differences between organic and conventional management regimes were minimal regarding changes in soil properties and crop yields. The organic production regime had more potato disease and weeds compared to conventional production. The untreated control had higher net revenue compared to compost and cover crops. Compost had the lowest net revenue since the cost of compost was not offset by increases in crop yield or soil nutrient availability.

An aspect of organic crop production we continue to learn about is nitrogen release from organic amendments.

Table 2. Amendments nitrogen content, C:N ratio, and nitrogen release after 12 weeks incorporated in soil. (Data courtesy of Dr. Geisseler Lab at UC Davis)

Material	nitrogen (N) content (%)	Typical carbon:nitrogen (C:N) ratio	% nitrogen available to plants after 12 weeks
Lawn trimming & wood based composts	0.5 - 2.0	13 - 20	-3% (loss) to 4%
Poultry manure composts	2.0 - 5.0	6 - 8	30% to 35%
Bloodmeal and feathermeal	13 - 15	3 - 4	65% to 70%
Guano	12 - 13	3 - 4	80% to 90%

The amount of nitrogen in plant available form 12 weeks after incorporation into warm and moist soil differs greatly between amendments (Table 1). 70% or more of the nitrogen in bloodmeal, feathermeal, and guano is available by 12 weeks of application, while 35% or less of nitrogen in poultry manure and composts is available by 12 weeks of application. Many yard waste and wood-based composts tie up nitrogen reducing nitrogen availability 12 weeks after application.

Dr. Daniel Geisseler, nutrient management specialist at UC Davis, compiled data from the literature on nitrogen mineralization for several organic fertilizer amendments. The dataset he compiled showed quite clearly that the carbon to nitrogen ration (C:N ratio) of the amendment and soil temperature are two driving forces that can be used to estimate nitrogen availability from amendments. The general rules of thumb are the smaller the C:N ratio and the warmer the soil temperature the quicker nitrogen in the amendment will be mineralized into plant available form. On the flip side, nitrogen available to plants in amendments with a C:N ratio over 15 and amendments in cold soil temperatures below 50 degrees Fahrenheit is very low.

2020 Potato Variety Development

University of California
Agriculture and Natural Resources
Research and Extension Center System

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Three potato variety trials were conducted at the Intermountain Research and Extension Center in Tulelake, CA. Trials were categorized by market type and included a Russet trial with 19 entries, a Specialty trial with 13 entries, and a Chipping trial with 15 entries. Entries included selections from the Western Regional (WR) variety development program, Southwest Regional (SWR) variety development program, and varieties of local interest. The tables below highlight some of the results from these trials. To see the complete report including all results and pictures of the entries, go to the link shown below.

http://irec.ucanr.edu/Research/Past_Research/Potato_Projects_313/

Table 1: 2020 Intermountain Research & Extension Center Russet Variety Trial

	Total CWT/Acre	Culls + 2's CWT/Acre	%1's	U.S. 1's CWT/Acre	Merit Score (1-5, 5=best)	Tubers per Plant	Average Tuber Size (oz)
Ranger Russet	440.8	63.2	65	285.9	3.3	5.1	8.1
Russet Burbank	436.2	107.0	63	274.8	3.3	6.0	6.7
Russet Norkotah	389.3	13.5	80	310.6	4.0	5.3	6.8
Clearwater Russet	425.0	18.2	78	331.3	4.0	7.5	5.4
TX13590-9Ru	486.4	29.0	73	356.8	2.9	7.7	6.0
A071012-4BF	569.8	126.6	44	251.8	3.0	4.9	10.7
A07769-4	402.8	50.9	62	247.7	3.4	4.6	8.6
A10021-5TE	466.9	29.3	69	323.7	3.4	5.9	7.4
AOR08540-1	477.2	36.0	76	364.1	3.4	6.1	7.4
AOR10204-3	491.8	59.6	69	339.2	3.1	5.4	8.6
CO10085-1RU	396.4	9.1	77	304.2	3.4	6.4	5.8
CO10087-4RU	333.4	15.1	74	245.8	3.0	5.2	6.1
CO10091-1RU	397.2	3.0	74	293.1	3.0	7.8	4.8
CO11009-3RU	448.5	22.7	73	324.9	3.9	6.1	6.9
OR12133-10	538.5	32.4	78	420.6	2.5	6.5	7.8
POR12NCK50-1	426.9	8.8	77	330.3	3.5	5.4	7.4
CO12152-1RU	360.3	25.3	68	244.8	2.9	7.0	4.8
CO12378-1RU	361.6	11.2	67	239.7	3.0	7.8	4.5
COTX08063-2Ru	337.0	28.7	68	227.9	1.9	6.0	5.5
Mean	**430.8**	**36.3**	**70**	**300.8**	**3.2**	**6.1**	**6.8**

Table 2: 2020 Intermountain Research & Extension Center Specialty Variety Trial							
Clone / Variety	Skin Color	Flesh Color	Total Yield CWT/Acre	Culls CWT/Acre	Merit Score (1-5, 5=best)	Tubers/ Plant	Average Size (oz)
Chieftain	Red	White	657.7	42.3	3.5	7.9	12.2
Red LaSoda	Red	White	642.2	140.2	2.5	6.9	14.2
Modoc	Red	White	426.1	29.6	3.5	9.8	7.5
A08112-7R	Red	Red	412.8	6.0	3.9	14.6	4.3
ATX06264s-4R/Y	Red	Yellow	519.8	21.8	3.0	11.9	7.5
Yukon Gold	Yellow	Yellow	528.1	34.7	3.4	6.3	12.6
CO10064-1W/Y	White	Yellow	448.5	19.0	3.3	11.2	5.9
CO10098-5W/Y	White	Yellow	393.5	19.3	2.6	11.2	5.2
CO11250-1W/Y	White	Yellow	522.3	28.1	2.3	11.9	6.4
CO11266-1W/Y	White	Yellow	470.7	10.7	2.1	14.9	4.8
POR14PG22-3	White	White	586.1	17.9	2.8	19.5	4.3
La Ratte	Yellow	White	280.1	20.8	4.0	12.5	3.2
PORTX03PG25-R/R	Red/Purple	Red	403.7	18.1	2.5	11.2	5.3
Mean			**483.9**	**32.3**	**3.0**	**11.5**	**7.2**

Table 3: 2020 Intermountain Research & Extension Center Chip Variety Trial						
Clone / Variety	Total Yield CWT/Acre	Culls CWT/Acre	Merit Score (1-5, 5=best)	Tubers/ Plant	Average Tuber Size (oz)	Specific Gravity
Atlantic	538.7	16.2	3.3	7.4	6.7	1.102
Snowden	449.0	12.5	3.6	7.6	5.5	1.095
AOR12197-4	524.8	38.7	3.3	7.9	6.5	1.095
CO10073-7W	522.1	15.9	3.0	9.9	5.0	1.087
CO10076-4W	530.5	9.3	3.1	9.1	5.5	1.082
CO11023-2W	516.5	14.5	3.5	7.8	6.1	1.094
CO11023-9W	450.6	8.9	4.0	7.5	5.5	1.082
CO11037-5W	504.6	16.7	3.3	8.5	5.6	1.096
TX09403-15W	499.7	13.9	3.1	6.5	7.5	1.085
AC11494-6W	381.3	7.4	3.8	8.5	4.3	1.100
AORTX09037-1W/Y	486.7	9.6	3.4	10.4	4.3	1.091
ATTX07042-3W	554.5	17.7	3.1	10.1	5.1	1.091
CO12235-3W	459.1	21.1	3.4	6.7	6.5	1.092
CO12293-1W	551.6	25.8	3.9	7.0	7.4	1.087
TX09403-21W	528.3	9.4	3.4	7.5	7.0	1.082
Mean	**499.9**	**15.8**	**3.4**	**8.2**	**5.9**	**1.091**

2020 Multi-State Weed Research in Mint

University of California
Agriculture and Natural Resources
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The California trial was in an established peppermint (Black Mitcham) field at IREC and a commercial field near Tulelake. Both fields were irrigated with solid-set sprinklers and managed for one cutting per season. The soil types were silty clay loam with 5 to 7% organic matter.

Plots were 9 by 21 feet. Herbicide treatments were applied in February 2020 when peppermint was dormant. Winter annual weeds were green at the time of application. Treatments were replicated four times in a randomized complete block design. Herbicides were applied using a small plot CO_2 sprayer at 20 gpa. Crop injury weed burn-down, and weed density were measured multiple times during the growing season at both sites. Mint hay yield was determined by harvesting a 5 X 10 ft quadrat in each plot at the IREC site. Hay was weighed, dried and steam distilled to determine oil yield. Peppermint was not harvested at the grower site due to a sporadic mint stand from winter kill. Data was analyzed using ANOVA and treatment means were separated using Tukey's HSD test.

Table 1. Dormant Herbicide Treatment List for 2020 Mint Trial in Tulelake

Trt	Product Name	Active Ingredient	Product per acre
1	Nontreated		n/a
2	Gramoxone 2L+	paraquat	32 fl oz
	Zeus	sulfentrazone	9 fl oz
	(standard)	NIS	.25% v/v
3	Zidua	pyroxasulfone	1.69 oz
	Rainier	NIS	.25% v/v
4	Zidua	pyroxasulfone	3.38 oz
	Rainier	NIS	.25% v/v
5	Sharpen	saflufenacil	2 fl. oz
	Renegade	MSO	1%
	Spray grade AMS	AMS	1%
6	Sharpen	saflufenacil	4 fl. oz
	Renegade	MSO	1%
	Spray grade AMS	AMS	1%
7	Sharpen	saflufenacil	6 fl oz
	Renegade	MSO	1%
	Spray grade AMS	AMS	1%
8	Sharpen	saflufenacil	2 fl. oz
	Zidua	pyroxasulfone	1.69
	Renegade	MSO	1%
	Spray grade AMS	AMS	1%
9	Anthem Flex	carfentrazone + pyroxasulfone	4.5 fl oz
	Rainier	NIS	.25% v/v
	Chateau	flumioxazin	2.95 oz
10	Zidua	pyroxasulfone	2.25 oz
	Rainier	NIS	.25% v/v
11	DCC-3825	tiafenacil	1.98 fl oz
	Renegade	MSO	1%
12	DCC-3825	tiafenacil	2.96 fl oz
	Renegade	MSO	1%
13	Goal 2XL	oxyfluorfen	40 fl. oz
	Chateau	flumioxazin	4 oz
14	Gramoxone 2L+	paraquat	32
	Rainier	NIS	.25% v/v
	Sharpen	saflufenacil	2 fl. oz
15	Chateau	flumioxazin	4 oz
	Renegade	MSO	1%
	Spray grade AMS	AMS	1%

California Results

Herbicide treatments did not cause significant crop injury in 2020 (Tables 2 & 3). Peppermint green-up at the grower site was sporadic with most plots showing signs of winterkill; crop injury did not correspond to herbicide treatments. Peppermint bloom, biomass, and oil yield were similar across treatments at IREC. Oil yield averaged 81 lbs/acre (Table 4). These results confirm previous year results that Sharpen, Zidua, and tiafenacil are safe to peppermint on Tulelake soils even at high rates.

Weed density and burn-down ratings are shown in Tables 5 & 6. Treatments with Sharpen, tiafenacil, and Gramoxone provided excellent control of prickly lettuce at both sites. These treatments also provided 100% control of tansy mustard. Zidua alone provided poor control of prickly lettuce and tansy mustard. Zidua alone and in tank-mixes reduced kochia density compared to Goal 2XL (treatment with highest kochia density).

Table 2. Crop Injury in Tulelake, CA 2020 (IREC)		**4/22 | 3"**	**5/26 | 6"**	**6/26 | 30"**
		peppermint injury		
Trt #	**Herbicide Treatment**	**% injury; 100%=dead mint**		
1	Untreated Control	1.25	0	0
2	Gramoxone + Zeus 9 fl oz- dormant mint (standard)	2.5	0	0
3	Zidua 1.7 oz- dormant mint	0	0	0
4	Zidua 3.4 oz- dormant mint	1.25	0	0
5	Sharpen 2 fl oz- dormant mint	0	0	0
6	Sharpen 4 fl oz- dormant mint	2.5	0	0
7	Sharpen 6 fl oz- dormant mint	1.25	0	0
8	Sharpen 2 fl oz + Zidua 1.7 oz- dormant mint	1.25	0	0
9	Anthem Flex 4.5 fl oz- dormant mint	0	0	0
10	Chateau 3 oz + Zidua 2.25 oz- dormant mint	2.5	0	0
11	DCC-3825 (tiafenacil) 1.98 fl oz- dormant mint	1.25	0	0
12	DCC-3825 (tiafenacil) 2.96 fl oz- dormant mint	1.25	0	0
13	Goal 2xl 40 fl oz- dormant mint	2.5	0	0
14	Gramoxone + Chateau 4 oz- dormant mint	3.75	0	0
15	Sharpen 2 fl oz + Chateau 4 oz- dormant mint	0	0	0
No significant differences between treatments and untreated control using Tukey HSD test.				

Table 3. Crop Injury in Tulelake, CA (Grower)		6/8 | 6"	6/26 | 12"	7/29 | 30"
		peppermint injury		
Trt #	Herbicide Treatment	% injury; 100%=dead mint		
1	Untreated Control	10	15	3
2	Gramoxone + Zeus 9 fl oz- dormant mint (standard)	11	11	1
3	Zidua 1.7 oz- dormant mint	16	20	9
4	Zidua 3.4 oz- dormant mint	15	20	8
5	Sharpen 2 fl oz- dormant mint	13	14	4
6	Sharpen 4 fl oz- dormant mint	18	22	10
7	Sharpen 6 fl oz- dormant mint	18	22	0
8	Sharpen 2 fl oz + Zidua 1.7 oz- dormant mint	18	28	2
9	Anthem Flex 4.5 fl oz- dormant mint	14	21	13
10	Chateau 3 oz + Zidua 2.25 oz- dormant mint	13	13	0
11	DCC-3825 (tiafenacil) 1.98 fl oz- dormant mint	6	6	0
12	DCC-3825 (tiafenacil) 2.96 fl oz- dormant mint	10	13	8
13	Goal 2xl 40 fl oz- dormant mint	10	11	0
14	Gramoxone + Chateau 4 oz- dormant mint	8	9	0
15	Sharpen 2 fl oz + Chateau 4 oz- dormant mint	13	13	4

No significant differences between treatments and untreated control using Tukey HSD test.

Table 4. Mint Harvest Results in Tulelake, CA 2020		Mint Bloom	Mint Biomass	Mint Oil Yield
Trt #	Herbicide Treatment	%	tons/acre	lbs/acre
1	Untreated Control	3.0	12.4	76.5
2	Gramoxone + Zeus 9 fl oz- dormant mint (standard)	3.5	11.9	78.9
3	Zidua 1.7 oz- dormant mint	5.3	11.8	74.6
4	Zidua 3.4 oz- dormant mint	3.0	12.8	80.5
5	Sharpen 2 fl oz- dormant mint	5.3	13.4	90.7
6	Sharpen 4 fl oz- dormant mint	4.0	13.2	84.3
7	Sharpen 6 fl oz- dormant mint	2.5	13.0	84.7
8	Sharpen 2 fl oz + Zidua 1.7 oz- dormant mint	3.5	12.9	80.0
9	Anthem Flex 4.5 fl oz- dormant mint	3.5	12.5	83.5
10	Chateau 3 oz + Zidua 2.25 oz- dormant mint	4.0	12.7	75.9
11	DCC-3825 (tiafenacil) 1.98 fl oz- dormant mint	4.0	13.2	83.8
12	DCC-3825 (tiafenacil) 2.96 fl oz- dormant mint	3.5	14.6	86.4
13	Goal 2xl 40 fl oz- dormant mint	6.5	11.7	69.5
14	Gramoxone + Chateau 4 oz- dormant mint	3.0	12.6	82.8
15	Sharpen 2 fl oz + Chateau 4 oz- dormant mint	5.8	13.0	76.1

No significant differences between treatments and untreated control using Tukey HSD test.

Table 5. Weed Control in Tulelake, CA 2020 (IREC)		3/5/2020	4/22/2020	
		Weed burn-down rating	prickly lettuce	total weeds
Trt #	Herbicide Treatment	%	# of weeds per plot	
1	Untreated Control	0b	43a	44a
2	Gramoxone + Zeus 9 fl oz- dormant mint (standard)	98a	1c	2c
3	Zidua 1.7 oz- dormant mint	15b	42a	43a
4	Zidua 3.4 oz- dormant mint	33b	34a	37a
5	Sharpen 2 fl oz- dormant mint	100a	0c	1c
6	Sharpen 4 fl oz- dormant mint	100a	0c	1c
7	Sharpen 6 fl oz- dormant mint	100a	0c	0c
8	Sharpen 2 fl oz + Zidua 1.7 oz- dormant mint	100a	1c	1c
9	Anthem Flex 4.5 fl oz- dormant mint	86a	16.5b	17b
10	Chateau 3 oz + Zidua 2.25 oz- dormant mint	84a	10bc	12bc
11	DCC-3825 (tiafenacil) 1.98 fl oz- dormant mint	96a	2c	2c
12	DCC-3825 (tiafenacil) 2.96 fl oz- dormant mint	100a	1c	1c
13	Goal 2xl 40 fl oz- dormant mint	91a	5bc	6bc
14	Gramoxone + Chateau 4 oz- dormant mint	100a	1c	1c
15	Sharpen 2 fl oz + Chateau 4 oz- dormant mint	100a	1c	2c

Treatment means with the same letter within columns are not different usingTukey HSD test.

Table 6. Weed Control in Tulelake, CA 2020 (Grower)		3/5/2020	4/24/2020			
		Weed burn-down rating	prickly lettuce	tansy mustard	kochia	total weeds
Trt #	Herbicide Treatment	%	# of weeds per plot			
1	Untreated Control	13c	73a	3a	9ab	79a
2	Gramoxone + Zeus 9 fl oz- dormant mint (standard)	95a	4d	0b	0b	4e
3	Zidua 1.7 oz- dormant mint	25bc	47b	5a	4b	56ab
4	Zidua 3.4 oz- dormant mint	40bc	47b	4a	4b	52abc
5	Sharpen 2 fl oz- dormant mint	100a	1d	0	9ab	3e
6	Sharpen 4 fl oz- dormant mint	100a	0d	0	7ab	5e
7	Sharpen 6 fl oz- dormant mint	98a	0d	0	11ab	2e
8	Sharpen 2 fl oz + Zidua 1.7 oz- dormant mint	100a	1d	0	3b	2e
9	Anthem Flex 4.5 fl oz- dormant mint	100a	38bc	0	3b	39bcd
10	Chateau 3 oz + Zidua 2.25 oz- dormant mint	68ab	14cd	5a	1b	21de
11	DCC-3825 (tiafenacil) 1.98 fl oz- dormant mint	98a	14cd	0	12ab	14de
12	DCC-3825 (tiafenacil) 2.96 fl oz- dormant mint	100a	6d	0	12ab	7e
13	Goal 2xl 40 fl oz- dormant mint	100a	20cd	0	20a	23cde
14	Gramoxone + Chateau 4 oz- dormant mint	100a	4d	0	2b	4e
15	Sharpen 2 fl oz + Chateau 4 oz- dormant mint	99a	0d	0	1b	1e

Treatment means with the same letter within columns are not different usingTukey HSD test.

Composting Cow Shelter

Onion Drip Irrigation Trial

Double Bird Scare

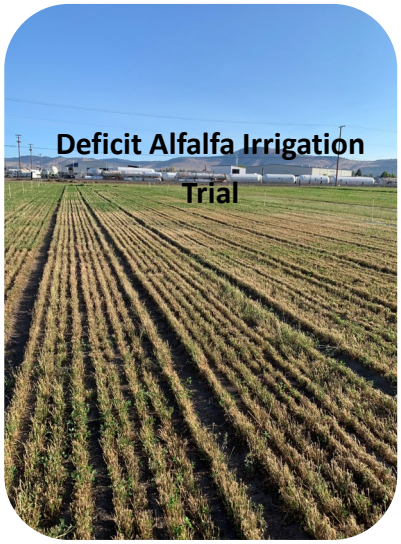
New Mint Varieties

Another Tile Drain Attempt

Mint Plot Harvest


Robbie "The Carter" Carver


Jake "The Snake" Velvet Mint


Deficit Alfalfa Irrigation Trial


Mint Transplanting


Trap Crop White Rot Trial


Skyview