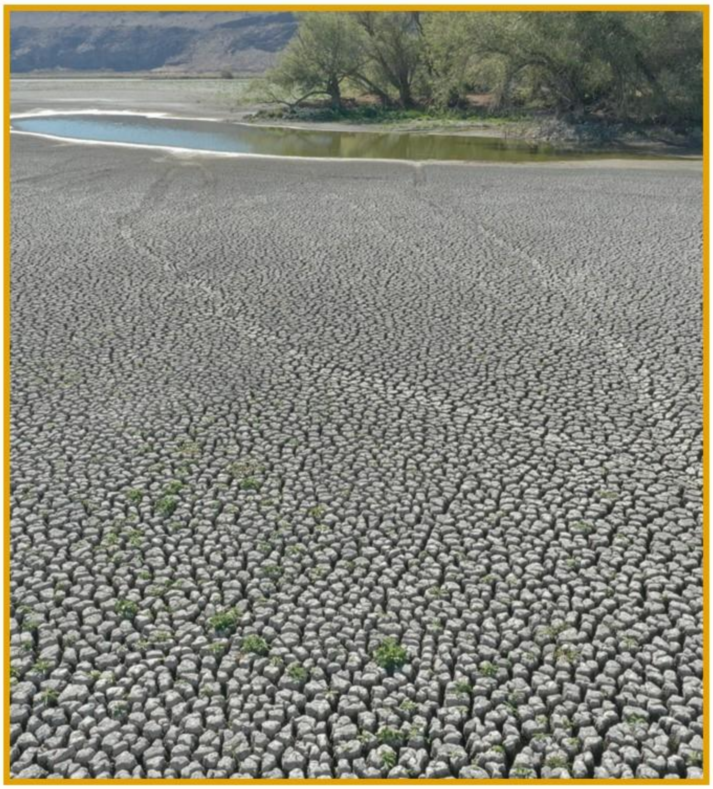
2022 Spring Research Update



Intermountain Research and Extension Center

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Agriculture and Natural Resources

Table of Contents

Importance of Planting Date for Crops Grown in the Klamath Basin

By Rob Wilson

The uncertainty of irrigation water deliveries from year to year make planting decisions difficult especially when water availability and government programs are unknown before April. This uncertainty is troublesome, but growers should strive to hit the correct planting time if possible. Planting crops at the correct time is one of the most critical farming activities for maximizing yield potential, avoiding pests, and having timely harvests. Our region has a very limited growing season of frost-free days and many crops require certain weather conditions to maximize yield potential. Below are recommended planting dates for common crops grown in the Klamath Basin.

Winter grains are best planted in October and early November. Forage plantings can be planted earlier in the fall, but early fall planted wheat and barley are often susceptible to spring frost damage as they head out too early the following year.

Spring grains are best planted from late March through April. May and June plantings have lower yield potential and more weed and insect problems due to hot summer temperatures.

Seedling alfalfa can be planted from mid-May through June or in late August. Late August plantings are preferred in drought years as they require less irrigation water for establishment compared to spring planting. Planting alfalfa after mid-September often results in crop failure due to frost injury to seedling plants.

Onions should be planted in mid-April to early May. Onions planted in late May or early June can reach maturity, but yields are often significantly lower than earlier plantings.

Potato planting date depends on the variety with Mid-May to early June being the most common planting window.

Sudangrass and warm season grass should be planted in early June to avoid spring frosts but still allow time for growth during the hottest months of the year.

Replenishing Soil Moisture Reserves in Established Alfalfa

By Rob Wilson

Many alfalfa fields were deficit irrigated or went without irrigation last year. I'm keeping my fingers crossed for copious amounts of precipitation during March, but winter precipitation up until now is not enough to refill the soil profile in most deficit alfalfa fields. So, what can alfalfa growers do if it remains dry? In a perfect world, growers would have plenty of irrigation water to irrigate all fields, but 2022 will likely come with irrigation water restrictions. As such, I advise alfalfa growers to check soil moisture in their fields and try to accurately refill the soil profile in dry fields and conserve water in fields that do not need deep irrigation.

Alfalfa roots often extend beyond 5ft in the soil; it takes a large amount of water to refill the soil profile.

How do you determine how much irrigation water is needed to refill the soil profile in deficit irrigated alfalfa? The first step is to check soil moisture by digging in the soil. Since alfalfa has a 3-to-6-foot root system this means you need to dig at least 3 feet deep. I find a spiral soil auger works well for checking soil moisture in alfalfa. You can auger 6 inches of soil at a time and check soil moisture as you go down to 3 or 4 feet. Currently, the top 8 inches of soil are wet at IREC, but the remaining 1 to 4 ft are very dry. This means spring irrigation needs to re-wet a 3 ft root zone to refill the soil profile. The amount of irrigation water needed to refill the root zone depends on your soil type. In this example, a sandy loam soil would require 4.5 inches of irrigation water or a 14-hour wheel-line set. In a clay loam soil, 7.0 inches of irrigation water or a 22-hour wheel-line set is needed to refill the soil profile as clay soils hold more water than sandy soils.

Alfalfa Irrigation Strategies for Maximizing Yield with Limited Water It is important to determine what fields will be irrigated fully, what fields will receive partial irrigation, and what fields will not be irrigated. I recommend prioritizing your most productive fields for full irrigation. In fields that can only receive partial irrigation, apply allocated water to refill the soil profile before 1st cutting and remaining water before 2nd cutting. The first two cuttings often make up 70% of total yield in a 3-cut system, and once alfalfa is drought stressed it will go dormant until fall. It makes little sense to deficit irrigate all fields throughout the season especially after fields stop growing due to drought stress. It is also wise to not irrigate alfalfa with poor stands and low yield potential and instead allocate more water to healthy productive fields.

Latest Alfalfa Variety Yield Results

By Chris DeBen, Dan Putnam, 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.

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**. IN 2021, THIS TRIAL RECEIVED ZERO ADDITIONAL IRRIGATION WATER** due to the sudden cutoff of water in the Klamath irrigation project. The site received approximately 6” of rainfall over the winter. Thus, 2021 was basically a dryland trial with the only water coming from residual soil moisture. Two cuttings were taken during the 2021 season with the first cutting taking place on June 17, 2021. Surprisingly, the first two cuttings of 2021 were higher yielding than the first two cuttings under fully irrigated conditions in 2020 (see results on-line at https://alfalfa.ucdavis.edu for previous year’s trials). The trial demonstrated that substantial yields can be achieved with natural rainfall if residual soil moisture is available in soils with high water holding capacity. Single year results for 2021 harvests are provided in a separate table. The average yield across all varieties in 2021 was 6.6 tons/acre.

2017-2021 YIELDS. TULELAKE ALFALFA CULTIVAR TRIAL. TRIAL PLANTED 5/22/17

	FD	2017 Yield		2018 Yield		2019 Yield		2020 Yield		2021 Yield		Average			% of Vernal
						Dry t/a									
Released Varieties															
WL365HQ	5	3.80	(9)	9.64	(9)	9.42	(2)	9.23	(1)	6.74	(13)	7.76	(1)	A	115.3
Integra 8450	4	3.76	(11)	9.72	(7)	9.03	(5)	8.88	(6)	7.03	(5)	7.68	(2)	A B	114.1
HybriForce-4400	4	4.14	(4)	9.74	(6)	8.95	(10)	8.63	(21)	6.76	(10)	7.64	(3)	A B C	113.4
Nexgrow 6422Q	4	3.03	(35)	9.89	(1)	9.27	(3)	8.98	(3)	6.87	(9)	7.61	(5)	A B C D	112.9
SW4107	4	3.04	(29)	9.84	(2)	9.50	(1)	8.84	(8)	6.65	(18)	7.57	(6)	A B C D E	112.4
SW5210	6	3.74	(12)	9.51	(12)	9.05	(4)	8.92	(4)	6.53	(25)	7.55	(7)	A B C D E F	112.1
54Q29	4	3.04	(30)	9.76	(5)	8.95	(9)	8.63	(20)	7.24	(1)	7.52	(8)	B C D E F G	111.7
FG R513W224S	5	3.64	(18)	9.50	(13)	8.92	(12)	8.64	(18)	6.89	(8)	7.52	(9)	B C D E F G	111.6
FG R513W227S	5	3.27	(24)	9.20	(26)	8.96	(8)	9.01	(2)	7.09	(2)	7.51	(10)	B C D E F G	111.4
WL377HQ	5	3.04	(27)	9.66	(8)	8.98	(6)	8.88	(7)	6.95	(6)	7.50	(11)	B C D E F G	111.4
HybriForce-3600	6	4.28	(2)	9.25	(23)	8.32	(36)	8.53	(24)	7.06	(4)	7.49	(12)	B C D E F G	111.1
SW5213	5	3.51	(22)	9.51	(11)	8.82	(16)	8.61	(22)	6.92	(7)	7.47	(13)	B C D E F G	111.0
Genuity-RR	4	3.74	(14)	9.20	(25)	8.81	(17)	8.53	(23)	7.09	(3)	7.47	(14)	B C D E F G	111.0
Nexgrow 6585Q	5	3.74	(13)	9.25	(22)	8.83	(15)	8.89	(5)	6.65	(19)	7.47	(15)	B C D E F G	110.9
WL363HQ	5	3.78	(10)	9.26	(21)	8.94	(11)	8.75	(13)	6.58	(22)	7.46	(16)	B C D E F G	110.8
FG R410W253	4	3.61	(20)	9.20	(24)	8.67	(21)	8.82	(9)	6.75	(11)	7.41	(17)	C D E F G H	110.0
AmeriStand 545NT RR	5	3.41	(23)	9.35	(17)	8.83	(14)	8.66	(16)	6.68	(16)	7.39	(18)	D E F G H I	109.7
Dekalb 43-13	4	3.81	(8)	9.27	(19)	8.71	(19)	8.38	(28)	6.74	(14)	7.38	(19)	D E F G H I	109.6
Xtra-3	4	3.54	(21)	9.41	(15)	8.89	(13)	8.39	(27)	6.59	(21)	7.37	(20)	E F G H I J	109.4
FG R513M225S	5	3.71	(16)	9.19	(27)	8.69	(20)	8.80	(11)	6.38	(31)	7.36	(21)	E F G H I J	109.2
PGI459	4	4.16	(3)	9.01	(31)	8.64	(23)	8.25	(35)	6.67	(17)	7.35	(22)	E F G H I J K	109.1
HybriForce-3430	3	3.98	(6)	9.79	(4)	8.66	(22)	8.37	(29)	5.91	(44)	7.34	(23)	E F G H I J K	109.0
HybriForce-3420/Wet	4	4.09	(5)	9.57	(10)	8.55	(30)	8.25	(36)	6.19	(36)	7.33	(24)	F G H I J K	108.8
Integra 8444R	4	3.72	(15)	9.27	(20)	8.42	(34)	8.67	(15)	6.44	(29)	7.31	(25)	G H I J K L	108.5
Archer III	5	3.03	(38)	9.41	(16)	8.62	(27)	8.32	(32)	6.69	(15)	7.21	(27)	H I J K L M	107.1
Integra 8420	4	3.03	(34)	9.42	(14)	8.44	(33)	8.28	(33)	6.42	(30)	7.12	(30)	K L M N O	105.7
WL 372HQ-RR	5	3.02	(42)	9.19	(28)	8.56	(29)	8.18	(38)	6.45	(28)	7.08	(31)	L M N O	105.1
4R200	4	3.67	(17)	8.72	(37)	8.29	(37)	8.24	(37)	6.38	(32)	7.06	(34)	M N O P	104.8
Hi-Gest 360	3	3.03	(39)	9.30	(18)	8.63	(26)	8.17	(39)	6.10	(41)	7.05	(35)	M N O P Q	104.6
Ameristand 427TQ	4	3.04	(25)	8.95	(32)	8.24	(38)	7.77	(43)	6.12	(40)	6.82	(41)	Q R S T	101.3
Ameristand 445-NT	4	3.04	(26)	8.86	(35)	8.12	(40)	7.82	(42)	6.23	(35)	6.81	(42)	R S T	101.1
Vernal	2	3.03	(32)	8.68	(39)	8.10	(41)	7.69	(44)	6.18	(38)	6.74	(43)	S T	100.0
Experimental Varieties															
msSunstra-143146	3	4.30	(1)	9.83	(3)	8.73	(18)	8.50	(25)	6.75	(12)	7.62	(4)	A B C	113.1
SW4466	4	3.62	(19)	9.13	(29)	8.98	(7)	8.36	(30)	6.03	(42)	7.22	(26)	H I J K L M	107.2
msSunstra-155202	6	3.86	(7)	9.03	(30)	8.04	(42)	8.26	(34)	6.60	(20)	7.16	(28)	I J K L M N	106.3
RRL414M104	4	3.03	(40)	8.69	(38)	8.63	(24)	8.76	(12)	6.57	(23)	7.14	(29)	J K L M N O	106.0
RRL514W209	5	3.03	(31)	8.63	(40)	8.57	(28)	8.70	(14)	6.47	(26)	7.08	(32)	L M N O	105.1
RRL414M377	4	3.04	(28)	8.86	(34)	8.52	(31)	8.82	(10)	6.15	(39)	7.08	(33)	L M N O	105.0
H0415ST202	4	3.03	(37)	8.87	(33)	8.63	(25)	8.36	(31)	6.18	(37)	7.01	(36)	M N O P Q R	104.1
H0515QT102	5	3.02	(41)	8.43	(42)	8.33	(35)	8.65	(17)	6.34	(33)	6.95	(37)	N O P Q R S	103.2
H0415A3144	4	3.03	(36)	8.73	(36)	8.45	(32)	8.44	(26)	6.00	(43)	6.93	(38)	O P Q R S	102.9
H0415QT111	4	3.02	(44)	8.46	(41)	8.00	(44)	8.63	(19)	6.53	(24)	6.93	(39)	O P Q R S	102.8
RRL414W208	4	3.02	(43)	8.42	(43)	8.15	(39)	8.14	(40)	6.46	(27)	6.84	(40)	P Q R S T	101.5
RRL514W201	5	3.03	(33)	8.20	(44)	8.01	(43)	7.90	(41)	6.24	(34)	6.68	(44)	T	99.1
MEAN		3.44		9.20		8.66		8.51		6.55		7.27			
CV		8.16		3.66		3.47		3.97		6.87		2.67			
LSD (0.1)		0.33		0.40		0.36		0.40		0.53		0.23			

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.

*No supplemental irrigation used for 2021 harvests (only natural rainfall and residual soil moisture)

2021 YIELDS, TULELAKE ALFALFA CULTIVAR TRIAL (DROUGHT). 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
		17-Jun	19-Jul	TOTAL		VERNAL
	FD		Dry t/a			
Released Varieties						
54Q29	4	3.95 (1)	3.29 (27)	7.24 (1)	A	117.3
FG R513W227S	5	3.32 (11)	3.77 (1)	7.09 (2)	A B	114.9
Genuity-RR	4	3.59 (2)	3.50 (11)	7.09 (3)	A B	114.7
Hybriforce-3600	6	3.54 (3)	3.52 (8)	7.06 (4)	A B C	114.3
Integra 8450	4	3.38 (10)	3.65 (3)	7.03 (5)	A B C D	113.9
WL377HQ	5	3.20 (22)	3.75 (2)	6.95 (6)	A B C D E	112.6
SW5213	5	3.49 (4)	3.43 (16)	6.92 (7)	A B C D E	112.1
FG R513W224S	5	3.29 (15)	3.60 (4)	6.89 (8)	A B C D E F	111.6
Nexgrow 6422Q	4	3.47 (6)	3.40 (18)	6.87 (9)	A B C D E F G	111.2
Hybriforce-4400	4	3.39 (9)	3.37 (20)	6.76 (10)	A B C D E F G H	109.4
FG R410W253	4	3.31 (13)	3.44 (14)	6.75 (11)	A B C D E F G H	109.3
WL365HQ	5	3.17 (24)	3.57 (5)	6.74 (13)	A B C D E F G H	109.1
Dekalb 43-13	4	3.23 (17)	3.51 (9)	6.74 (14)	A B C D E F G H	109.1
Archer III	5	3.40 (8)	3.29 (28)	6.69 (15)	B C D E F G H I	108.3
AmeriStand 545NT RR	5	3.12 (31)	3.57 (6)	6.68 (16)	B C D E F G H I J	108.2
PGI459	4	3.23 (18)	3.44 (13)	6.67 (17)	B C D E F G H I J	108.0
SW4107	4	3.20 (20)	3.44 (15)	6.65 (18)	B C D E F G H I J K	107.6
Nexgrow 6585Q	5	3.14 (27)	3.50 (10)	6.65 (19)	B C D E F G H I J K	107.6
Xtra-3	4	3.20 (21)	3.39 (19)	6.59 (21)	B C D E F G H I J K L	106.7
WL363HQ	5	3.18 (23)	3.41 (17)	6.58 (22)	B C D E F G H I J K L	106.5
SW5210	6	3.31 (12)	3.21 (32)	6.53 (25)	D E F G H I J K L M N	105.6
WL 372HQ-RR	5	3.00 (38)	3.45 (12)	6.45 (28)	E F G H I J K L M N	104.5
Integra 8444R	4	2.91 (44)	3.53 (7)	6.44 (29)	E F G H I J K L M N O	104.3
Integra 8420	4	3.21 (19)	3.21 (34)	6.42 (30)	E F G H I J K L M N O	104.0
FG R513M225S	5	3.05 (34)	3.34 (21)	6.38 (31)	F G H I J K L M N O	103.4
4R200	4	3.04 (35)	3.33 (22)	6.38 (32)	F G H I J K L M N O	103.2
Ameristand 445-NT	4	3.12 (30)	3.11 (37)	6.23 (35)	H I J K L M N O	100.9
Hybriforce-3420/Wet	4	3.08 (33)	3.11 (38)	6.19 (36)	I J K L M N O	100.2
Vernal	2	3.14 (28)	3.04 (42)	6.18 (38)	I J K L M N O	100.0
Ameristand 427TQ	4	2.97 (41)	3.15 (35)	6.12 (40)	K L M N O	99.1
Hi-Gest 360	3	2.99 (39)	3.11 (36)	6.10 (41)	L M N O	98.7
Hybriforce-3430	3	3.04 (36)	2.88 (44)	5.91 (44)	O	95.8
Experimental Varieties						
msSunstra-143146	3	3.49 (5)	3.26 (31)	6.75 (12)	A B C D E F G H	109.2
msSunstra-155202	6	3.29 (14)	3.31 (25)	6.60 (20)	B C D E F G H I J K L	106.9
RRL414M104	4	3.28 (16)	3.28 (29)	6.57 (23)	B C D E F G H I J K L	106.3
H0415QT111	4	3.45 (7)	3.09 (39)	6.53 (24)	C D E F G H I J K L M	105.8
RRL514W209	5	3.13 (29)	3.33 (23)	6.47 (26)	E F G H I J K L M N	104.7
RRL414W208	4	3.15 (25)	3.31 (26)	6.46 (27)	E F G H I J K L M N	104.5
H0515QT102	5	3.01 (37)	3.33 (24)	6.34 (33)	G H I J K L M N O	102.6
RRL514W201	5	2.97 (42)	3.27 (30)	6.24 (34)	H I J K L M N O	101.1
H0415ST202	4	2.97 (40)	3.21 (33)	6.18 (37)	I J K L M N O	100.1
RRL414M377	4	3.09 (32)	3.05 (41)	6.15 (39)	J K L M N O	99.5
SW4466	4	3.15 (26)	2.88 (43)	6.03 (42)	M N O	97.6
H0415A3144	4	2.93 (43)	3.07 (40)	6.00 (43)	N O	97.1
MEAN		3.22	3.33	6.55		
CV		12.42	7.14	6.87		
LSD (0.1)		NS	0.28	0.53		

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.

*No supplemental irrigation used for 2021 harvests (only natural rainfall and residual soil moisture)

Cutting Strategies for Maximizing Revenue and Alfalfa Health during Drought

By Rob Wilson

The decision on when alfalfa is cut through the season has a large impact on alfalfa yield, alfalfa quality, and farm revenue. It boils down to the classic yield versus forage quality trade-off Dan Putnam has preached about for years. Longer cutting intervals equal higher yield but lower quality. Shorter cutting intervals equal lower yield but higher quality. In Tulelake, 4 cuttings per year is common. In other part of Siskiyou County, 3 cuttings per year is common. Four cuttings per year favor quality with most cuttings testing supreme or premium. Three cuttings favor yield with least one cutting testing below premium. Both cutting strategies have merit, and some growers utilize both strategies in different fields.

All cutting schedules should strive to maximize 1st cutting yield for the desired quality! A mistake I see many producers make is taking first cutting too early. The first of June rolls in and everyone breaks out the swather and cuts away. In some years the alfalfa is ready to harvest the first week of June but in others the alfalfa is quite short (supreme+ quality). Harvesting 1st cutting too early can result in a yield penalty of 0.5 to 0.75 tons/acre without a significant bump in hay price especially in high price years. 1st cutting is the biggest cutting of the year and can make up 35% to 50% of total yield.

Space cutting schedules across the growing season to avoid ending up with 3.5 cuttings per year! Growers should avoid 4-cut schedules that result in 4th cutting regrowth that is too short to harvest but too tall to leave standing going into winter. In this situation, growers do not capture the yield increase from a 3-cut system, and they often do not achieve test hay in every cutting like a 4-cut system. A good planning exercise is at the time of 1st cutting calculate the number of days left until the last date you feel comfortable taking 4th cutting and then divide by 3. For example, if you select September 7th as your last harvest date, cutting 1st cutting on June 1 would equal 33 days between cuttings, cutting on June 8th would equal 30 days between cuttings, and cutting on June 15th would equal 28 days between cuttings.

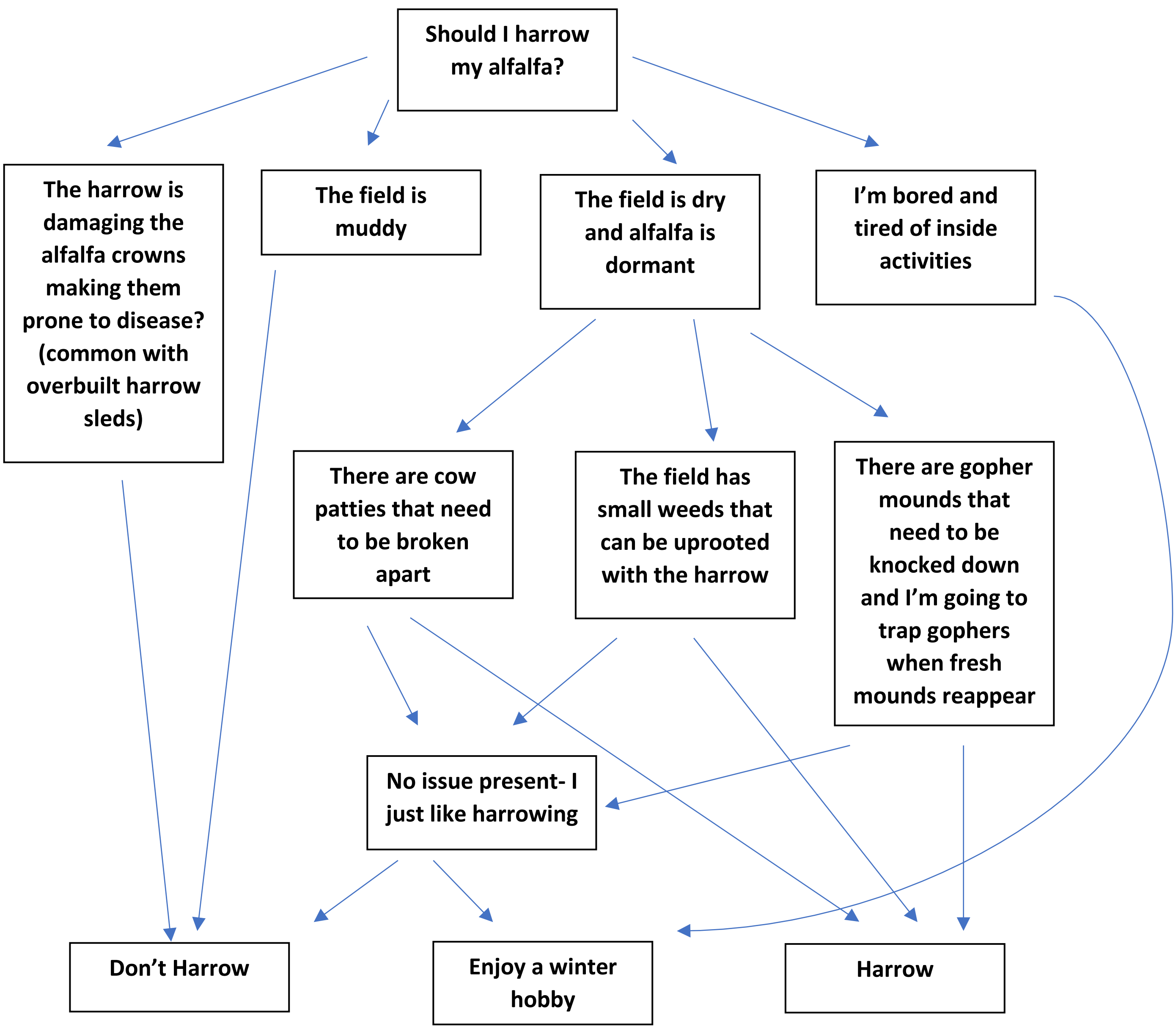
Consider drought and limited water in your cutting schedule. Sometimes it's ok to delay first cutting and apply another irrigation before 1st cutting if your alfalfa needs water and irrigation deliveries are not available soon. Last year, everyone wanted water at the same time after 1st cutting creating a major problem on timely irrigation deliveries. It makes no sense to take first cutting early only to wait two weeks for your next irrigation water delivery.

Longer intervals between cutting (32+ days) or a 3-cut system has several advantages during drought especially in fields that lack irrigation water. In this scenario, growers can maximize first cutting yield by delaying harvest until premium or good quality, go for high yield at 2nd cutting, and then allow alfalfa to go dormant or get a 3rd cutting depending on soil moisture. Longer cutting intervals equal higher alfalfa yields and better health as alfalfa has a chance to rebuild carbohydrate root reserves needed for winter survival and regrowth. Cutting alfalfa frequently in a 4-cut system stresses alfalfa and can negatively affect next year's growth especially when alfalfa is stressed. Several studies conducted by Steve Orloff showed that alfalfa yields and stand longevity diminished over time with a 4-cut system versus a 3-cut system.

Too Harrow or Not to Harrow Alfalfa?

By Rob Wilson

A common start to the field season for alfalfa growers is to break out the tractor and harrow all alfalfa fields. Many people find a sense of satisfaction and optimism when a field is freshly harrowed, but is harrowing all alfalfa fields a good decision? My opinion is no. Harrowing has advantages and disadvantages, but I advise growers to ask yourself why am harrowing and is it worth the time and diesel fuel. Below is a decision chart to consider before harrowing alfalfa this winter.



2021 Small Grain Variety Trial Report

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

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Introduction This report summarizes grain yield and agronomic characteristics for public and private entries in IREC's 2021 small grain variety testing. 2021 IREC grain trials were irrigated using well water thanks to a well on site and TID support. 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 2020-2021 growing season included: winter wheat, winter barley, spring hard wheat, spring soft wheat, and spring barley. 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. Small grain yield and quality for other locations around the Northwest can be found at https://cropandsoil.oregonstate.edu/wheat/osu-wheat-variety-trials. UC small grain variety trial summaries for multi-year and multi-trial data can be found at http://smallgrainselection.plantsciences.ucdavis.edu/.

2021 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:	Winter Trials 100 ft^2
	Spring Trials 66.5 ft^2
Seeding Rate:	100 lbs./Acre
Row Spacing:	6 Inches
Number of Reps:	4

Hard Winter Wheat Trial

Planting Date: 10/15/2020
Previous Crop: Sudan Grass
Spring 2021 Soil Test N: 14.2 ppm (51 lbs. N/Acre)
Fertilizer: Season total Nitrogen was 192 lbs. N/Acre applied through the season. 22 lbs. N/A at planting (10/14/2020), 90 lbs. N/A early through late tillering (4/19/2021), 80lbs. N/A through stem elongation (5/21/2021), 30 lbs. N/A at flowering (6/10/2021).
Irrigation Quantity: Solid-set sprinklers 18.87 Acre inches (final irrigation 6/30/2021)
Harvest Date: 8/18/2021

Variety Highlights: Several varieties performed well in 2021. WB4394 was the highest yielding, however it was prone to lodging. Millie, LWH18-0122 and OR2170052H had similar yields but less lodging compared to WB4394. Three varieties met the quality protein standard of 13%, LCS Evina, LCS Jet and LWH18-0122. All were hard red type. Breck, Snowmass 2.0 and PN13201002-04 plots were almost 100 percent lodged.

2021 IREC Irrigated Winter Hard Red Wheat Agronomic Characteristics.

Entry #	Entry Name	Class	Grain Yield (tons/acre)	Heading Date	Maturity Date	Plant Height (cm)	% Lodged Plants	Bushel wt.	Protein %
11	WB4394	HRW	5.41	14-Jun	26-Jul	120	60	62.4	12.1
14	Millie (OR2130118H)	HWW	5.08	16-Jun	30-Jul	99	0	63.0	11.9
8	LWH18-0122	HRW	5.01	15-Jun	25-Jul	91	0	60.5	13.0
18	OR2170052H	HWW	4.51	20-Jun	31-Jul	105	4	60.2	11.7
9	LWH19-0192	HRW	4.46	17-Jun	28-Jul	104	0	61.7	12.6
7	LCS Rocket	HRW	4.37	18-Jun	29-Jul	89	0	59.4	12.2
10	PN13201002-04	HRW	4.35	15-Jun	26-Jul	113	90	61.2	12.5
5	LCS Jet	HRW	4.34	17-Jun	31-Jul	100	3	51.2	13.1
15	OR2160011R	HRW	4.31	16-Jun	28-Jul	94	3	61.8	12.0
20	Breck	HWW	4.26	11-Jun	26-Jul	108	93	63.0	12.8
13	Irv (OR2110679)	HWW	4.25	16-Jun	29-Jul	101	19	61.2	12.5
4	IDO2006	HWW	4.13	19-Jun	31-Jul	105	25	51.7	11.6
12	Snowmass 2.0	HWW	4.12	5-Jun	26-Jul	99	94	61.0	12.3
6	LCS Evina	HRW	4.12	20-Jun	29-Jul	113	2	51.6	14.1
1	Scorpio	HRW	4.03	20-Jun	1-Aug	88	0	60.9	12.4
17	OR2160065H	HWW	3.88	18-Jun	31-Jul	99	10	61.7	12.8
19	OR2180100R	HRW	3.78	20-Jun	30-Jul	84	0	59.8	11.2
16	OR2150168H	HWW	3.65	16-Jun	30-Jul	100	1	60.7	12.0
2	WA8309	HRW	3.53	17-Jun	2-Aug	75	0	58.9	12.9
3	IDO1906	HWW	3.50	12-Jun	23-Jul	90	5	59.6	12.9
	Average		**4.25**	**16-Jun**	**28-Jul**	**99**	**20**	**59.6**	**12.4**

Soft White Winter Wheat Trial

Planting Date:	10/15/2020
Previous Crop:	Sudan Grass
Spring Soil Test N:	14.2 ppm (51 lbs. N/Acre)
Fertilizer:	Season Total Nitrogen was 142 lbs. N/Acre applied through the season. 22 lbs. N/A at planting (10/14/2020), 90 lbs. N/A early through late tillering (4/19/2021), 80lbs. N/A through stem elongation (5/21/2021)
Irrigation Quantity:	Solid-set sprinklers 18.87 Acre inches (final irrigation 6/30/2021)
Harvest Date:	8/18/2021

Variety Highlights: The awnless variety LCS Blackjack continues to perform well and may be suitable as a forage or seed crop. Other varieties in the 2021 trial with high yields over the three-year period from 2018-2020 include Bobtail (awnletted), LCS Hulk and WB1783. Several varieties were very prone to lodging in the trial. Varieties with high yield and low lodging were LWW-18-5080, LCS Artdeco, LCS Blackjack and SY Assure.

2021 IREC Irrigated Winter Soft White Wheat Agronomic Characteristics.

Entry #	Entry Name	Grain Yield (tons/acre)	Heading Date	Maturity Date	Plant Height	% Lodged	Bushel wt.	Protein %
26	13-046145A	5.50	13-Jun	30-Jul	99	71	60.3	10.7
31	11PN039#20	5.28	14-Jun	27-Jul	97	19	59.9	11.8
24	LWW18-5078	5.16	18-Jun	30-Jul	100	34	60.3	11.1
18	LCS Blackjack	4.99	17-Jun	28-Jul	94	13	59.4	11.4
40	LCS Hulk	4.90	17-Jun	30-Jul	101	55	61.3	11.7
8	OR2160264	4.86	15-Jun	31-Jul	98	45	59.7	12.0
21	LWW18-5080	4.85	18-Jun	28-Jul	96	0	51.4	11.2
7	OR2160243	4.80	15-Jun	1-Aug	97	65	59.8	11.6
32	09PN118-02	4.80	18-Jun	31-Jul	102	68	60.3	11.5
25	LWW18-1171	4.75	19-Jun	1-Aug	101	98	58.4	11.5
2	Bobtail	4.75	17-Jun	31-Jul	98	30	59.3	11.9
13	IDO1708	4.73	14-Jun	28-Jul	103	95	58.1	11.9
17	LCS Shine	4.72	13-Jun	23-Jul	87	21	60.2	11.5
23	LWW17-5877	4.69	14-Jun	31-Jul	99	29	61.1	11.6
34	WB1783	4.58	17-Jun	1-Aug	12	90	50.7	11.8
15	LCS Artdeco	4.57	15-Jun	28-Jul	96	6	58.3	11.6
6	OR2130755	4.47	16-Jun	29-Jul	111	31	60.3	11.3
38	ARSX500-14CBW (clul	4.45	16-Jun	30-Jul	98	89	61.1	12.0
33	WB1529	4.43	14-Jun	27-Jul	95	35	21.3	12.0
27	SY Assure	4.42	13-Jun	25-Jul	91	1	59.6	12.0
28	SY Dayton	4.40	18-Jun	1-Aug	94	55	60.1	11.5
35	M-Press	4.36	19-Jun	29-Jul	100	19	60.7	11.1
1	Rosalyn	4.36	29-Jun	31-Jul	99	60	59.5	10.6
4	Norwest Duet	4.33	18-Jun	30-Jul	112	86	51.3	11.4
29	AP Illiad	4.30	17-Jun	29-Jul	95	6	59.8	12.5
22	LWW18-0587	4.28	20-Jun	1-Aug	103	89	60.4	10.8
30	AP Dynamic	4.28	19-Jun	31-Jul	103	3	60.0	11.8
39	ARSX492-6CBW (club)	4.27	18-Jun	30-Jul	98	98	59.4	12.4
5	Nixon (OR2121086)	4.25	19-Jun	2-Aug	104	81	59.2	11.4
36	M-Idas	4.18	16-Jun	29-Jul	95	14	60.5	11.4
16	LCS Drive	4.18	14-Jun	30-Jul	84	19	56.1	11.6
19	LWW17-8185	4.18	18-Jun	30-Jul	97	81	51.5	11.3
12	WA8336	4.17	16-Jun	30-Jul	94	97	58.5	11.0
14	IDO2008	4.11	17-Jun	30-Jul	98	90	59.2	12.2
11	WA8307	3.99	20-Jun	29-Jul	108	37	59.5	12.7
3	Norwest Tandem	3.91	16-Jun	30-Jul	90	1	29.6	11.0
10	OR5180071 (club)	3.80	21-Jun	1-Aug	100	21	59.0	11.3
9	OR2170559	3.79	19-Jun	29-Jul	90	3	59.5	12.5
20	LWW17-5815	3.70	19-Jun	1-Aug	100	21	51.6	13.3
37	Castella (club)	3.66	17-Jun	28-Jul	105	92	61.0	12.7
	Average	**4.45**	**11-May**	**23-Jun**	**96**	**47**	**56.9**	**11.6**

Winter Barley Trial

Planting Date: 10/15/2020
Previous Crop: Sudan Grass
Spring Soil Test N: 14.2 ppm (51lbs. N/Acre)
Fertilizer: Season total Nitrogen was 67 lbs. N/Acre applied through growing season. 22 lbs. N/A at planting (10/14/2020), 15 lbs. N/A at tillering (4/9/2021) and 30 lbs. N/A during stem elongation through jointing (5/21/2021).
Irrigation Quantity: Solid-set sprinklers 14.67 Acre inches (final irrigation 6/4/2021)
Harvest Date: 8/2/2021

Variety Highlights: All malt varieties achieved protein below the standard 11% in 2021. Thunder and Wintmalt had low protein and high yield. Thunder is a recent release from the Oregon State University Barley Breeding Program. Alba, a feed barley, was the only variety to show significant lodging.

2021 IREC Irrigated Winter Barley Agronomic Characteristics.

Entry #	Entry Name	Class	Grain Yield (tons/acre)	Heading Date	Maturity Date	Plant Height (cm)	% Lodged Plants	Bushel wt.	Protein %
2	Thunder	Malt	4.34	4-Jun	8-Jul	93	13	50.3	9.8
1	Wintmalt	Malt	4.25	5-Jun	11-Jul	100	1	49.3	10.0
6	Alba	Feed	3.89	5-Jun	7-Jul	111	58	47.8	9.9
4	DH141222	Malt	3.86	4-Jun	5-Jul	102	3	51.2	11.1
3	Lightning	Feed	3.74	4-Jun	5-Jul	98	1	50.5	11.2
5	DH141225	Malt	3.71	2-Jun	4-Jul	97	0	50.9	10.7
	Average		**3.97**	**4-Jun**	**6-Jul**	**100**	**13**	**50.0**	**10.4**

Spring Soft Wheat Trial

Planting Date: 4/15/2021
Previous Crop: Sudan grass
Spring Soil Test N: 13.9 ppm (50 lbs. N/Acre)
Fertilizer: Season total nitrogen was 182 lbs. per acre applied through the season. 22 lbs. N/A at planting (4/14/2021), 30 lbs. N/A at tillering (5/21/2021), 130 lbs. N/A through early boot (6/10/2021).
Irrigation Quantity: Solid-set sprinklers 22.11 Acre inches (final irrigation 6/30/2021)
Harvest Date: 8/17/21

Variety Highlights: Lodging was a significant issue for the spring wheat trial in 2021. WB6121 and UI Cookie were the only varieties with 30% or less lodging. Yields may have been lower in 2021 compared to 2020 because of the high amount of lodging. WB6341, Tekoa and UI Cookie (all high yields in 2021) were the highest yielding released spring soft wheat varieties over a three-year period from 2018-2020.

2021 IREC Irrigated Spring Soft Wheat Agronomic Characteristics

Entry #	Entry Name	Class	Grain Yield (tons/acre)	Heading Date	Maturity Date	Plant Height (cm)	% Lodged Plants	Bushel wt. (lbs)	Protein %
3	IDO1802S	SWS	4.99	21-Jun	2-Aug	94	53	62.8	11.6
1	UI CookieIDO1405S	SWS	4.88	22-Jun	2-Aug	98	30	61.8	12.0
2	IDO1702S	SWS	4.71	21-Jun	2-Aug	94	40	63.0	11.6
5	WB6341	SWS	4.69	22-Jun	2-Aug	95	40	62.5	10.8
4	IDO1902s	SWS	4.47	22-Jun	3-Aug	96	86	63.1	11.6
6	WB6121	SWS	4.36	21-Jun	1-Aug	91	15	62.4	12.5
7	WB6211 CLP	SWS	4.29	21-Jun	3-Aug	93	71	60.8	12.2
10	Tekoa	SWS	4.23	23-Jun	3-Aug	99	70	62.3	12.0
9	Ryan	SWS	3.90	22-Jun	2-Aug	93	93	60.0	12.4
15	WA 8325	CLUB	3.81	22-Jun	2-Aug	97	88	61.7	11.1
12	WA 8321	SWS	3.60	23-Jun	3-Aug	97	94	60.7	11.9
13	WA 8323	SWS	3.57	22-Jun	3-Aug	97	89	59.4	12.5
8	Seahawk	SWS	3.52	25-Jun	3-Aug	99	78	61.3	12.1
14	WA 8324	SWS	3.47	22-Jun	3-Aug	97	86	60.0	12.1
11	Louise	SWS	3.43	25-Jun	3-Aug	101	90	60.9	12.2
	Average		**4.13**	**22-Jun**	**2-Aug**	**96**	**68**	**61.5**	**11.9**

Spring Hard Wheat Trial

Planting Date: 4/17/2020
Previous Crop: Sudan grass
Spring Soil Test N: 13.9 ppm (50 lbs. N/Acre)
Fertilizer: Season total nitrogen was 212 lbs. per acre applied through the season. 22 lbs. N/A at planting (4/14/2021), 30 lbs. N/A at tillering (5/21/2021), 130 lbs. N/A through early boot (6/10/2021), and 30 lbs. N/A at flowering (6/25/2021).

Irrigation Quantity: Solid-set sprinklers 22.95 Acre inches (final irrigation 6/30/2021)
Harvest Date: 8/17/2021

Variety Highlights: All varieties in the 2021 Spring Hard Wheat Trial met the protein standard of 13% with the nitrogen fertilizer application applied during flowering. WB9668 and WB7202 CLP had protein over 15% in addition to high yield. UC-Central Red, WB9662 and Patwin 515 had 0% lodging in a year prone to lodging.

2021 IREC Irrigated Spring Hard Wheat Agronomic Characteristics

Entry #	Entry Name	Class	Grain Yield (tons/acre)	Heading Date	Maturity Date	% Lodged Plants	Plant Height (cm)	Bushel wt. (lbs)	Protein %
12	UC 1838	HRS	4.62	22-Jun	2-Aug	35	95	62.6	14.53
8	WB9668	HRS	4.44	22-Jun	2-Aug	30	82	61.7	15.05
5	WB7202 CLP	HWS	4.34	20-Jun	3-Aug	4	80	61.8	15.20
9	UC-Central Red	HRS	4.29	22-Jun	3-Aug	0	84	62.2	13.60
6	WB9303	HRS	4.25	19-Jun	31-Jul	3	94	60.9	14.47
4	IDO2004S	HWS	4.12	23-Jun	6-Aug	28	97	61.3	14.70
3	IDO2002S	HWS	4.03	22-Jun	3-Aug	15	84	62.5	14.88
7	WB9662	HRS	4.03	24-Jun	4-Aug	0	85	62.2	13.77
1	IDO2105S	HRS	3.91	21-Jun	6-Aug	83	94	62.2	14.57
14	Kelse	HRS	3.83	24-Jun	5-Aug	6	97	60.8	14.33
15	Patwin 515	HRS	3.83	25-Jun	6-Aug	0	72	62.2	14.57
11	UC Amarillo	HWS	3.56	22-Jun	28-Jul	1	76	61.8	14.33
2	IDO1804S	HWS	3.46	23-Jun	7-Aug	91	93	62.7	15.45
10	Rojo-515	HRS	3.35	21-Jun	1-Aug	40	71	63.2	14.90
13	Glee	HRS	3.28	21-Jun	4-Aug	83	92	63.1	14.65
18	WA 8314	HRS	3.26	24-Jun	6-Aug	80	93	60.3	14.20
16	Net CL+ (WA 8280 CL +)	HRS	3.24	22-Jun	6-Aug	84	95	61.6	13.83
17	WA 8299 CL+	HRS	3.22	22-Jun	5-Aug	89	93	61.8	15.05
19	Lanning	HRS	2.95	20-Jun	5-Aug	73	91	61.7	15.15
20	MT1716	HRS	2.94	22-Jun	5-Aug	76	93	62.3	14.40
	Average		**3.75**	**22-Jun**	**3-Aug**	**41**	**88**	**61.9**	**14.58**

Spring Barley Trial

Planting Date: 4/15/2021
Previous Crop: Sudan Grass Hay
Spring Soil Test N: 13.9 ppm (50 lbs. N/Acre)
Fertilizer: Season total Nitrogen was 72 lbs. N/Acre applied through growing season. 22 lbs. N/A at planting (4/14/2021), 30 lbs. N/A late tillering (5/21/2021), and 20 lbs. N/A at stem elongation (6/2/2021).
Irrigation Quantity: Solid-set sprinklers 15.39 Acre inches (final irrigation 6/11/2021)
Harvest Date: 8/17/21

Variety Highlights: KWS Jessie, KWS Thalis, KWS Fantex and LCS Opera were some of the highest yielding malt barley entries. KWS Jessie and LCS Opera also met malting standard with protein below 11%. Lodging was a significant issue in the spring barley trial, but KWS Jessie and KWS Fantex showed minimal lodging (below 5%) due to their short height. LCS Opera and Claymore have been some of the best performers over the three-year period from 2018-2020.

2021 IREC Irrigated Spring Barley Wheat Agronomic Characteristics

Entry #	Entry Name	Class	Grain Yield (tons/acre)	Heading Date	Maturity Date	Plant Height (cm)	% Lodged Plants	Bushel wt. (lbs)	Protein %
8	KWS Jessie	Malt	4.89	22-Jun	28-Jul	83	4	51.18	10.4
6	KWS Thalis	Malt	4.64	23-Jun	28-Jul	93	21	50.95	11.0
2	Claymore	Feed	4.56	23-Jun	24-Jul	108	38	51.50	11.5
9	KWS Fantex	Malt	4.50	24-Jun	27-Jul	88	2	52.33	11.0
14	LCS Opera	Malt	4.30	25-Jun	30-Jul	85	63	49.50	10.8
10	KWS Willis	Malt	4.25	23-Jun	30-Jul	96	28	50.03	11.5
7	KWS Amadora	Malt	4.19	23-Jun	28-Jul	89	24	52.08	11.1
4	Oreana	Feed	4.14	25-Jun	30-Jul	88	48	51.55	11.1
3	Altorado	Feed	4.02	21-Jun	26-Jul	103	14	52.10	13.0
12	14WAIM-3620.70	Malt	4.02	22-Jun	23-Jul	109	19	53.53	11.6
11	13WAM-136.1	Malt	3.78	23-Jun	24-Jul	113	36	51.15	12.3
13	14WAIM-3614.1	Malt	3.76	23-Jun	27-Jul	116	20	51.68	12.5
1	Lenetah	Feed	3.74	23-Jun	24-Jul	109	41	52.03	12.9
15	AAC Connect	Malt	3.61	22-Jun	26-Jul	111	29	51.90	12.8
5	Survivor	Feed	3.54	22-Jun	25-Jul	113	31	52.48	13.2
	Average		**4.13**	**22-Jun**	**26-Jul**	**100**	**28**	**51.58**	**11.7**

2021 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 17 entries, a Specialty trial with 10 entries, and a Chipping trial with 12 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.

Table 1: 2021 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)
Clearwater Russet	353.1	7.2	59.0	265.2	4.0	6.7	4.9
Ranger Russet	440.4	71.1	65.0	294.8	3.0	5.7	7.5
Russet Burbank	353.1	17.0	61.0	260.1	4.0	5.8	5.6
Russet Norkotah	486.2	20.9	69.0	328.7	4.0	5.6	8.0
AOR08540-1	428.2	5.8	73.0	359.4	3.5	6.4	6.3
AOR10204-3	436.4	116.2	63.0	257.4	3.5	5.5	7.7
CO10085-1RU	382.5	21.9	65.0	293.7	3.0	6.2	5.7
CO11009-3RU	418.8	11.5	69.0	331.9	4.0	6.1	6.3
CO12378-1RU	376.7	40.7	61.0	262.9	4.0	6.0	5.8
COA11013-2	427.0	25.9	68.0	335.8	2.5	7.1	5.8
OR12133-10	402.3	12.1	73.0	334.6	2.5	6.4	6.0
POR12NCK50-1	372.5	18.8	66.0	287.0	3.5	5.8	6.0
TX13590-9Ru (Sunset)	455.2	12.8	65.0	352.0	2.0	7.1	6.0
AC12080-4RU	394.7	17.3	61.0	287.5	3.0	6.2	5.8
AC12090-3RU	438.1	50.2	64.0	305.1	2.5	6.7	6.4
CO13003-1RU	359.1	59.1	63.0	241.9	3.5	5.2	6.4
COTX08063-2Ru	345.2	18.3	67.0	261.2	2.0	5.0	6.4
Mean	**404.1**	**31.0**	**65.0**	**297.6**	**3.2**	**6.1**	**6.3**

Table 2: 2021 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	522.7	63.3	3.5	6.2	8.4
Red LaSoda	Red	White	522.0	194.7	2.5	5.5	8.9
Modoc	Red	White	509.1	3.1	3.5	12.3	4.0
A08122-12Rsto	Red	Yellow	468.6	10.4	3.0	13.9	3.1
Yukon Gold	Yellow	Yellow	398.5	22.9	3.0	3.7	10.2
A08120-4Y	Yellow	Yellow	364.0	6.6	1.0	14.7	2.4
AORTX09037-1W/Y	Yellow	Yellow	436.9	19.7	3.0	10.5	3.8
CO11250-1W/Y	Yellow	Yellow	463.5	7.2	2.5	14.4	3.0
CO11266-1W/Y	Yellow	Yellow	409.9	8.3	1.0	11.1	3.5
COTX10118-4Wpe/Y	Yellow	Yellow	579.1	24.8	2.0	11.8	4.6
Mean			**467.4**	**36.1**	**2.5**	**10.4**	**5.2**

Table 3: 2021 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	424.6	11.6	3.3	7.4	6.7	1.102
Snowden	447.4	10.4	3.6	7.6	5.5	1.095
AC11494-6W	301.5	5.2	3.3	7.9	6.5	1.095
AOR12197-4	392.4	60.3	3.0	9.9	5.0	1.087
CO11023-2W	361.4	6.9	3.1	9.1	5.5	1.082
CO11037-5W	392.2	11.5	3.5	7.8	6.1	1.094
CO12235-3W	277.8	16.6	4.0	7.5	5.5	1.082
CO12293-1W	243.3	42.5	3.3	8.5	5.6	1.096
COOR13270-2	379.2	6.4	3.1	6.5	7.5	1.085
NYOR14Q9-5	383.6	4.8	3.8	8.5	4.3	1.100
CO13232-5W	372.3	7.1	3.4	10.4	4.3	1.091
CO13232-25W	436.7	11.3	3.1	10.1	5.1	1.091
Mean	**367.7**	**16.2**	**3.4**	**8.2**	**5.9**	**1.091**

University of California
Agriculture and Natural Resources
Intermountain Research & Extension Center
RESEARCH REPORT
Number 202, 2022

Influence of Potato Vine Kill Timing and Skin-set duration on Black Dot (*Colletotrichum coccodes*) and Potato Quality

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Introduction

Black dot fungal structures (sclerotia) on harvested tubers are a consistent problem for fresh market potato producers throughout California. Tubers infected with black dot have a rash like appearance that is especially evident on red and yellow skin potatoes making them unmarketable. Black dot infection on below ground stems and stolons occurs within weeks of sprouting. Fungicides are effective at suppressing the black dot during the growing season, but fungicides have failed to reduce severity of black dot sclerotia on daughter tubers. Cultural management and harvest timing can influence black dot on daughter tubers. Studies suggest the duration between haulm (stem) senescence and harvest increases severity of black dot; high soil moisture increases black dot, and plant stress can increase severity of black dot. These findings served as a guide for setting up the experiment. The primary study objective was to document the effect of vine kill timing and skin set duration on yield and black dot under California conditions.

2021 Site Information

- **Soil type-** mucky silty clay loam-6% OM
- **Planting Date-** May 18, 2021
- **Irrigation –** solid-set sprinklers
- **Potato Spacing-** 36-inch rows with 10 inch seed spacing
- **Design-** Split Block with 4 blocks (reps)

2021 Study Methods

The study was conducted in field at the Intermountain REC with a long history of natural black dot infection. The study was set up in a split-plot design with four replications. Dark Red Norland, an early maturing red skinned variety was grown under normal conventional management conditions. Vines were killed at three timings: 95% green on 8/5/21 (77 days after planting DAP), 50% green on 8/18/21 (92 DAP), and 10% green on 9/1/21 (106 DAP) (figure 1).

Figure 1. Drone photo of different vine kill timing plots shortly after the 50% vine kill timing.

Vines were killed using Reglone and rolling and soil moisture was kept around 60% ASM from vine kill to harvest to minimize bruising. For each vine kill timing, potatoes were harvested 2 weeks after vine kill or 4 weeks after vine kill. Data included tuber yield, tuber size, tuber skinning, tuber bruise, and the incidence and severity of black dot on daughter tubers. Tuber yield and size was determined by running all potatoes from each plot across an automated grade-line. Black dot incidence and severity was determined by evaluating percent coverage of black dot infection on a 20 tuber sub-sample from each plot. Skinning severity was evaluated by placing 20 tubers from each plot in a cement mixer without paddles for 1 minute at harvest (figure 2.)

Figure 2. Cement mixer setup for evaluating tuber skinning.

Results

2021 weather was unusually hot and dry in spring and early summer (CA CIMIS Station # 91). Potato yields differed significantly between treatments with the last vine kill timing having the highest yield in most categories (Table 1). The early 95% green vine kill timing had the lowest yield, tubers per plant, and tuber size. The 50% green vine kill timing had lower total yield compared to the 10% vine kill timing, but average tuber size, tubers per plant, and 4-to-10-ounce tuber yield were similar between timings. Not surprisingly there were few yield differences between 2-week and 4-week skin set periods for each vine kill timing (Table 1).

Vine kill timing and skin set duration had a significant affect on black dot coverage with the 95% vine kill timing having the least amount of black dot (Table 2). The 50% green vine kill timing harvested 2-week after vine kill had less black dot compared to the 10% vine kill timing. On the flip side, the 95% green and 50% green vine kill timings harvested 2 weeks after vine kill had more tuber skinning compared to other treatments (Table 2). Tuber shape uniformity and tuber quality were similar across treatments except for the 95% green treatment having slightly less growth cracks compared to the 10% green vine kill timing (Table 2).

In summary, harvesting Dark Red Norland early in the season while vines were still green and shorting the skin set duration reduced the severity of black dot tuber blemish. As a trade-off, the 95% green vine kill timing had lower yield and smaller tubers. Tuber skinning increased for the 95% green vine kill timing if the skin set duration was 2 weeks compared to 4 weeks. These results agree with previous published research, and they serve as a guide for growers trying to weigh the trade-off of maximizing yield versus minimizing black dot tuber blemish as the reduction in black dot from early vine kill may outweigh the reduction in yield.

Table 1. Potato stand, yield, and size for vine kill and skin set treatments at IREC in 2021.

Trt #	Treatment	Potato Stand %	Tubers/plant #	Avg tuber size oz	Total yield CWT/A	>14 oz	10-14 oz	6-10 oz	4-6 oz	<4 oz	culls
						Tuber size class percentages					
1	10% green vine kill (106 DAP) & 2 week skin set before harvest	94% a[1]	5.84 a	7.87 a	443 a	7% a	15% a	36% a	19% c	19% b	6% ab
2	10% green vine kill (106 DAP) & 4 week skin set before harvest	97% a	5.81 a	7.63 ab	436 a	6% a	15% a	32% a	22% bc	19% b	6% ab
3	50% green vine kill (92 DAP) & 2 week skin set before harvest	98% a	5.16 ab	7.04 ab	363 b	3% ab	11% ab	35% a	24% abc	21% b	7% a
4	50% green vine kill (92 DAP) & 4 week skin set before harvest	92% a	5.62 a	6.86 b	360 b	4% ab	9% b	33% a	24% abc	23% b	7% a
5	95% green vine kill (77 DAP) & 2 week skin set before harvest	96% a	4.27 b	4.58 c	191 c	0% b	1% c	18% b	35% a	43% a	4% b
6	95% green vine kill (77 DAP) & 4 week skin set before harvest	94% a	4.37 b	4.31 c	181 c	0% b	1% c	14% b	31% ab	49% a	5% ab

[1] Means with the same letter within columns are not statistically different using the Tukey HSD mean comparison test.

Table 2. Black dot Coverage and Potato Quality for vine kill and skin set treatments at IREC in 2021.

Trt #	Treatment	Tuber black dot coverage %	Tuber skinning rating	Tuber skin appearance rating	Tuber shape uniformity	Knobs	Growth cracks	Green	Black spot bruise	Vascular discolor-ation	Hollow Heart
			1-5 rating; 5 = best			Total Tuber percentages					
1	10% green vine kill (106 DAP) & 2 week skin set before harvest	28% ab	4.21 a	3.42 b	3.3 a	2.7% ab	8.2% abc	0.5% a	0.0% a	0.3% a	0.2% a
2	10% green vine kill (106 DAP) & 4 week skin set before harvest	30% a	4.25 a	3.42 b	3.3 a	2.2% ab	9.3% a	0.7% a	0.2% a	0.5% a	0.2% a
3	50% green vine kill (92 DAP) & 2 week skin set before harvest	20% bc	3.58 bc	3.67 ab	3.5 a	6.2% a	5.8% abc	0.3% a	0.0% a	1.0% a	0.0% a
4	50% green vine kill (92 DAP) & 4 week skin set before harvest	28% a	4.00 ab	3.58 ab	3.5 a	3.3% ab	8.8% ab	0.2% a	0.2% a	0.7% a	0.0% a
5	95% green vine kill (77 DAP) & 2 week skin set before harvest	14% c	3.17 c	3.83 a	3.8 a	1.5% b	4.0% bc	0.0% a	0.0% a	0.8% a	0.2% a
6	95% green vine kill (77 DAP) & 4 week skin set before harvest	20% bc	4.00 ab	3.92 a	3.8 a	3.8% ab	3.0% c	0.0% a	0.0% a	0.7% a	0.2% a

[1] Means with the same letter within columns are not statistically different using the Tukey HSD mean comparison test.

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2021 Fungicide Screening for In-Season Strategies for Suppressing White Rot in Onions

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Introduction

Management of white rot disease in onions and garlic is focused on prevention, containment, reduction of inoculum before planting, and suppression with fungicides. Application of penthiopyrad (Fontelis) and/or tebuconazole (Tebustar) in-furrow at planting is the standard fungicide treatment for suppressing white rot in California. Numerous studies have shown these fungicides applied in a concentrated band at planting significantly reduce white rot severity in onions and garlic. Fungicide application in-furrow can prevent economic loss in years with low disease severity or in fields with low inoculum. Unfortunately, fungicides fall short of preventing economic loss in years when weather favors disease development or in fields with high inoculum levels. The reason fungicides fail to suppress white rot is thought to be related to decreasing fungicide concentration over time. Fungicide residue in-furrow decreases in the soil throughout the growing season for a variety of reasons including absorption to the soil, degradation by soil microbes, and leaching.

The objective of this study was to investigate methods for increasing fungicide levels in the soil during summer and early fall. The project investigated in-season banded fungicide application and the use of soil surfactants/penetrants with fungicides. In season banded applications were directed at the base of plants in each seed row at the time of cultivation 2 months after planting.

2021 Site Information

- **Soil type-** mucky silty clay loam-6.5% OM
- **Growing season-** May 6, 2021 to October 5, 2021
- **Irrigation –** solid-set sprinklers
- **Onions-** 36 inch beds with 4 seed-lines spaced 6 inches apart; 2-inch seed spacing; Senscient processing variety
- **Design-** RCB with 5 blocks (reps)

2021 Study Methods
In early May 2021, the field was rototilled and beds were shaped before onion planting. Fungicide treatments were applied in-furrow at planting time. In-furrow fungicides were 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. In-season fungicide application occurred when onions were in the 5-6 leaf stage on 6-30-2021. Fungicides were applied with CO2 powered backpack sprayer using 80015 EVS drop nozzles placed 1 ft above the onion leaves at 50 GPA. Onion stand density was measured in each plot by counting the number of green onions in all seed lines for the entire plot length. Onion vigor (color, height, and leaf cover) was visually estimated in each plot using a 0 to 10 scale, with 10 = highest vigor. Late season visual leaf dieback ratings were taken starting 8-30-2021. The number of plants with leaf dieback per plot and a visual estimate of the percentage of total leaves with leaf dieback per plot was recorded. Onion yield was measured by harvesting all onions in each plot on 10-5-2021. Onions were run across a grade-line to remove loose soil and green tops. Onion bulbs were hand-sorted based on the presence of white-rot. A total weight was recorded for disease-free onions and onions with white-rot symptoms (decay through 1st scale, mycelium, or sclerotia).

Results
Spring and early summer weather was unusually hot and dry in 2021 (data not shown) which likely hampered early season white rot development. Fungicide treatments did not have an influence on spring onion stand or early season vigor (Table). This result suggests the fungicide treatments were safe on onions. The first sign of white rot mycelium growth and leaf dieback was in the last week of August. Leaf dieback in August and September was highest in the untreated control (Table). All fungicides had lower leaf dieback compared to the untreated control, but leaf dieback did not differ

Figure. Drone photo of plot area late season at the start of onion lodging.

between fungicide treatments. This same trend occurred at harvest with all fungicide treatments having high disease-free yield and lower diseased yield compared to the untreated control. Total onion yield was similar across all treatments. Treatments with Tebustar applied in-furrow and Fontelis banded at the time of cultivation had the lowest diseased yield numerically, but this treatment trend was not statistically significant. All treatments including the untreated control had relatively low disease loss which was surprising as the field site had high sclerotia counts before planting. Additional evaluation of in-season fungicides in a year with high disease severity is recommended as disease pressure was relatively low in 2021.

Table. Influence of Fungicides on Onions and White Rot Symptoms in Tulelake, CA 2021.

Treatment		Product Rate	Application time	Onion stand	Onion vigor 4-leaf stage	Onion vigor 7-leaf stage	Leaf dieback 8/30	Leaf dieback 9/13	% leaf dieback 9/13	Disease-free bulb yield	Diseased bulb yield	Total bulb yield
				plants/ bed ft	1-10 scale; 10=best		% of plants		% total leaves	ton/acre		
1	Untreated	n/a	n/a	22.44a	7a	8a	1.13a	4.64a	15.8a	21.86b	3.71a	25.58a
2	Tebustar	20.5 fl oz	in Furrow	24.65a	7.2a	8a	0.14b	0.84b	6b	26.15a	0.77b	26.92a
3	Fontelis	24 fl oz	in Furrow	23.67a	7.2a	8a	0.1b	1.63b	7b	26.55a	1.03b	27.58a
4	Pyraziflumid 20sc	6.2 fl oz	in Furrow	22.81a	7.2a	8a	0.18b	1.42b	6.7b	25.31ab	1.4b	26.71a
5 5	Tebustar Fontelis	20.5 fl oz 24 fl oz	in Furrow banded spray at cultvation	23.2a	7a	8a	0.15b	0.62b	7.2b	26.35a	0.39b	26.74a
6 6	Fontelis Fontelis	24 fl oz 24 fl oz	in Furrow banded spray at cultvation	23.46a	7.6a	8a	0.15b	1.05b	5b	26.29a	0.9b	27.18a
7 7 7	Tebustar Fontelis WE Advantage	20.5 fl oz 24 fl oz 16 fl oz	in Furrow banded spray at cultvation banded spray at cultvation	23.53a	7a	8a	0.04b	0.37b	5.2b	26.84a	0.35b	27.19a
8 8 8 8	Tebustar WE AquateMax Fontelis WE Advantage	20.5 fl oz 32 fl oz 24 fl oz 16 fl oz	in Furrow in Furrow banded spray at cultvation banded spray at cultvation	22.5a	7.2a	8a	0.02b	0.75b	4b	26.6a	0.34b	26.94a

Treatment means with the same letters within columns are not statistically different using Tukey HSD mean comparison test.

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Plant Growth Regulator Testing to Prevent Spring Barley Lodging in Tulelake

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Introduction: Tulelake's climate and soils are favorable for irrigated barley production, and growers consistently obtain some of the highest barley yields reported in California. The downside to these high yields is several barley varieties tend to lodge, the bending over of the stems near the ground level, in Tulelake. One solution to lodging is to apply a plant growth regulator (PGR) that shortens the internodes and strengthens the stem through inhibition of cell elongation. This study tested the effectiveness of PGRs applied at different timings and rates for reducing spring barley lodging. A similar study was conducted in 2018 and 2019 with winter wheat and 2020 with spring barley; report summaries are cited in IREC Research Reports #187, #192, and #196.

Methods: The 2021 study was established in April using the spring 2-row malt barley variety 'Copeland'. The broadcast study was set up as a RCB design with four replications using 9 ft by 21 ft plots. Treatments included an Eastman PGR (Test PGR) with the active ingredient, chlormequat chloride, and a Syngenta PGR (Palisade) with the active ingredient, trinexapac-ethyl, broadcast applied at 20 gallons per acre alone and/or in combination with the fungicide Quilt Xcel for suppression of stripe rust. PGR treatments were applied at three application times: tillering (23), early stem elongation (31-32), and flag leaf emergence (38). The trial included a standard nitrogen fertilizer control (70# N/A) and high nitrogen fertilizer control (110# N/A). Data collected includes crop injury, stem thickness, plant height, stripe rust incidence, lodging, grain yield, and grain quality.

Results: PGR treatments did not cause phytotoxicity after all application times (data not shown). PGR treatments influence on plant height and lodging was variable in 2021, unlike 2020 where PGR's applied at stem elongation or split applied at stem elongation and flag leaf emergence reduced plant height at anthesis compared to the high fertility control (Table 1). Barley stem thickness, seedhead production, and the incidence of stripe rust were similar across treatments (Table 1). PGR treatments increased barley grain yield compared to the controls even though plant height and lodging were variable (Table 2). Barley bushel weight and kernels per 10 seedheads were similar across treatments. PGR treatments where the test PGR was applied at tillering had lower seed weight (g) per 1000 barley seeds compared to PGR treatments with later application dates and the controls.

Figure 1. Aerial view of barley plots at flowering.

Figure 2. Picture of barley roots for select treatments at flowering.

Table 1. Influence of Plant Growth Regulator (PGR) Treatments on Barley Growth, Lodging, and susceptibility to stripe rust in 2021.

Trt #	Treatment Name[1]	Application Timing[2]	Product Rate per acre		Stem thickness (mm) at anthesis	Stem thickness (mm) at harvest	Plant Height (cm) at anthesis	Plant Height (cm) at harvest	Lodging at anthesis 1-9 scale	Lodging at harvest 1-9 scale	# of seedhead per 3ft of row	Stripe rust % incidence
1	*Control Standard N Fertility*	--										
1	Quilt Xcel	D	28	fl oz	3.74a[3]	3.39a	117.6a	110.9a	5.75b	3.50a	102.5a	0
2	*Control High N Fertility*	--										
2	Quilt Xcel	D	28	fl oz	3.79a	3.35a	110.5b	105ab	3.75b	4.25a	93a	0
3	Test PGR	C	31	fl oz								
3	Quilt Xcel	D	28	fl oz	3.47a	3.38a	113.1ab	103.2ab	8.75a	4.88a	119.5a	0
4	Test PGR	D	31	fl oz								
4	Quilt Xcel	D	28	fl oz	3.74a	3.5a	111b	106.9ab	6b	4.50a	115.3a	0
5	Palisade	C	14.4	fl oz								
5	Quilt Xcel	D	28	fl oz	3.63a	3.3a	110.2b	101b	9a	4.88a	112.3a	0
6	Test PGR	C	15.5	fl oz								
6	Test PGR	D	15.5	fl oz								
6	Quilt Xcel	D	28	fl oz	3.82a	3.33a	109.4b	104.7ab	9a	3.5a	111.3a	0
7	Test PGR	B	15.5	fl oz								
7	Test PGR	C	15.5	fl oz								
7	Quilt Xcel	D	28	fl oz	3.71a	3.52a	113.7ab	109.3a	9a	3.63a	120.5a	0
8	Test PGR	B	15.5	fl oz								
8	Test PGR	D	15.5	fl oz								
8	Quilt Xcel	D	28	fl oz	3.64a	3.37a	111.2ab	106.6ab	9a	4.00a	118.3a	0

[1] All treatments with Quilt Xcel included nonionic surfactant added at 0.25% v/v; All PGR treatments were grown with high fertility (110# nitrogen fertilizer split-applied per acre); the standard

[2] Application timings A= 3 leaf unfolded (growth stage 13); B=tillering (23); C=stem elongation (31-32); D=flag leaf emergence (38).

[3] Treatment means with the same letter within columns are not statistically different using the Tukey HSD mean comparsion test.

Table 2. Influence of Plant Growth Regulator (PGR) Treatments on Barley Yield & Quality in Tulelake, CA 2021.

Trt #	Treatment Name[1]	Application Timing[2]	Product Rate per acre		Grain yield (tons/acre)	Bushel weight (lbs)	Kernels per 10 seedheads	grams per 1000 seeds
1	*Control Standard N Fertility*	--						
1	Quilt Xcel	D	28	fl oz	2.66cd[3]	52.4a	26.9a	46.68ab
2	*Control High N Fertility*	--						
2	Quilt Xcel	D	28	fl oz	2.28d	53a	27a	48.95a
3	Test PGR	C	31	fl oz				
3	Quilt Xcel	D	28	fl oz	2.79bc	51.6a	27.5a	45.58abc
4	Test PGR	D	31	fl oz				
4	Quilt Xcel	D	28	fl oz	2.87abc	52.4a	26.2a	47.08a
5	Palisade	C	14.4	fl oz				
5	Quilt Xcel	D	28	fl oz	3.29a	52a	27.9a	49.08a
6	Test PGR	C	15.5	fl oz				
6	Test PGR	D	15.5	fl oz				
6	Quilt Xcel	D	28	fl oz	3.02abc	51.6a	26.9a	45.47abc
7	Test PGR	B	15.5	fl oz				
7	Test PGR	C	15.5	fl oz				
7	Quilt Xcel	D	28	fl oz	3.18ab	52.9a	27.2a	41.49c
8	Test PGR	B	15.5	fl oz				
8	Test PGR	D	15.5	fl oz				
8	Quilt Xcel	D	28	fl oz	3.07abc	51.7a	26.7a	42.67bc

[1] All treatments with Quilt Xcel included nonionic surfactant added at 0.25% v/v; All PGR treatments were grown with high fertility (110# nitrogen

[2] Application timings A= 3 leaf unfolded (growth stage 13); B=tillering (23); C=stem elongation (31-32); D=flag leaf emergence (38).

[3] Treatment means with the same letter within columns are not statistically different using the Tukey HSD mean comparsion test.

Brewers Association Nitrogen Trial (BANT)

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The Brewers Association Nitrogen Trial (BANT) was comprised of fall-planted malting barley lines (two named varieties, and three experimental lines) grown at three locations per year (Corvallis, and Pendleton, OR; Tulelake, CA; and Aberdeen ID) to characterize: Agronomic performance; Response to nitrogen fertilization at flowering; And malting and beer quality and the effects of environment ("terroir") on beer flavor. The experiment was grown for two years (2020 and 2021 harvest). The focus of this report is on data from Tulelake for three of the BANT barleys: Thunder, Lightning, and DH142010, a potential variety of interest to Admiral Malting (CA). We present agronomic data from 2020 and 2021 and beer data from 2020. A detailed report on the full experiment is in preparation and will soon be submitted for publication.

General information for both years
Location: Intermountain Research and Extension Center, Tulelake, CA
Soil type: Tulebasin mucky silty clay loam
Weed control: Rhomene MCPA @ 1 pint/Acre and Detonate @ 2 fl. oz/Acre
Plot size: 100 ft^2
Seeding rate: 86 lbs/Acre
Row spacing: 6 inches
Number of reps: 4

Trial information
Table 1. Management details for Brewers Association Nitrogen Trial (BANT) barley grown at the Intermountain Research and Extension Center (IREC) in the 2020 and 2021 harvest seasons.

	2020 harvest	*2021 harvest*
Planting date	10/22/2019	10/15/2020
Previous crop	Sudangrass	Sudangrass
Fertilizer at planting	22 lb/ac N (11-52-0)	22 lb/ac N as (11-52-0)
Spring soil test N	9.5 ppm N	15.7 ppm N
Fertilizer treatments	• 40 lb/ac N for all plots (green-up) • Additional 20 lb/ac N as urea for high-nitrogen treatment (early heading)	• 15 lb/ac N for all plots (green-up) • Additional 20 lb/ac N as urea for high-nitrogen treatment (early heading)
Irrigation	13.02 acre inches	14.67 acre inches
Average heading date	05/28/2020	06/03/2021
Harvest date	07/29/2020	07/29/2021

Variety highlights

Thunder (released by Oregon State University in 2019) had the highest yields and the lowest percent grain protein of the three varieties in both the 2020 and 2021 growing seasons. Thunder is recommended by the American Malting Barley Association (AMBA) and may be available for contracting in the Klamath Basin with Great Western Malting.

Lightning (released by Oregon State University in 2020) has facultative growth habit and excellent disease resistance but is not on the AMBA recommended list. It may be of interest to craft maltsters and brewers; growers are urged to secure a contract before growing the variety. DH142010 is a potential variety of particular interest to Admiral Malting, due having the British variety “Maris Otter” in its pedigree.

Nitrogen fertilization at flowering did increase grain protein, but values were still within AMBA guidelines. The additional fertilization may allow growers to fine-tune production to meet all-malt or adjunct malting specifications.

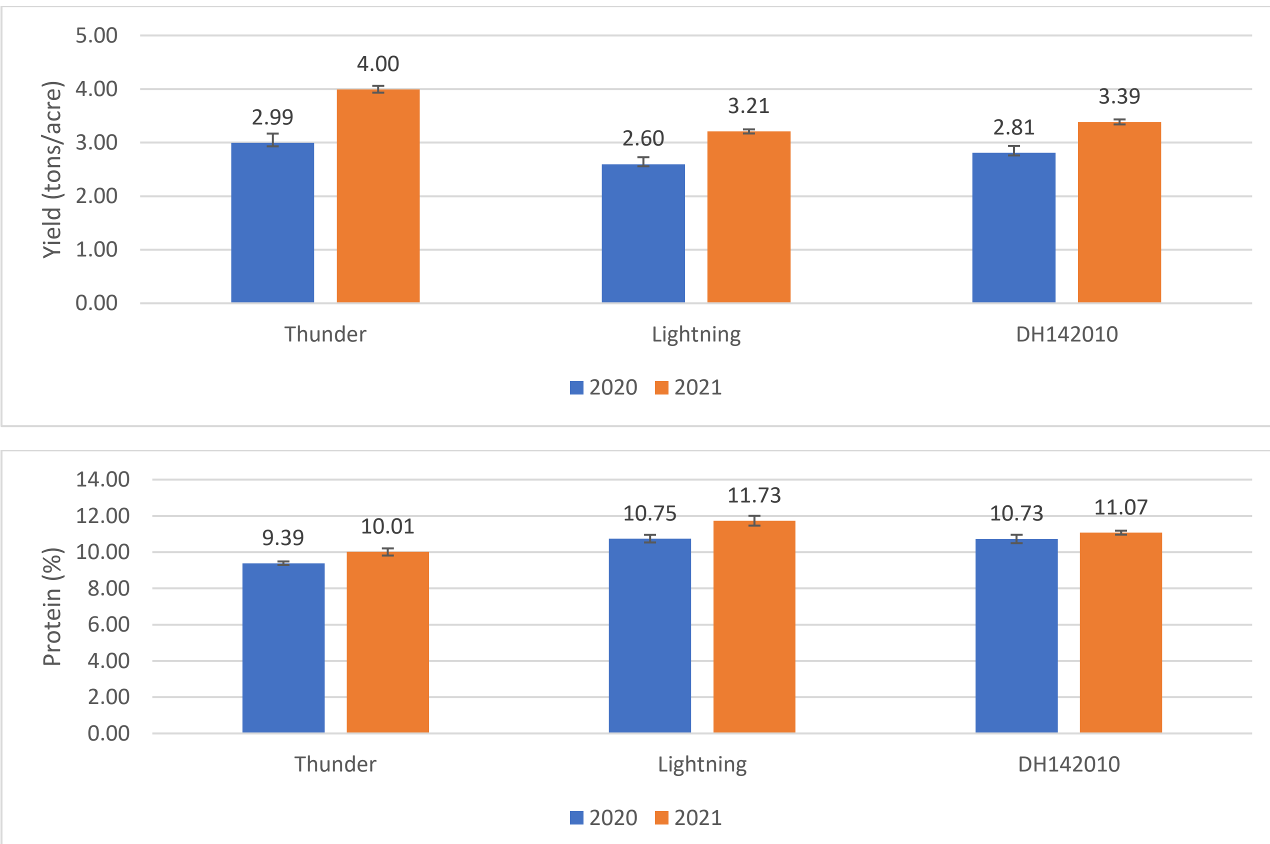


Fig 1. Yield (top) and percent grain protein (bottom) for 2020 and 2021 growing seasons for three selected barley lines from the Brewers Association Nitrogen Trial (BANT).

Malting and brewing highlights

Thunder, Lightning, and DH140963 (a discontinued experimental variety) were malted at the OSU Barley Project malt house and used to brew experimental beers in collaboration with Deschutes Brewing. These beers were compared to beers made from the same barley lines grown at other locations (Corvallis, OR and Pendleton, OR). Figure 2 shows the distinct flavor profile of beer brewed from barley grown at Tulelake in comparison with the other two locations.

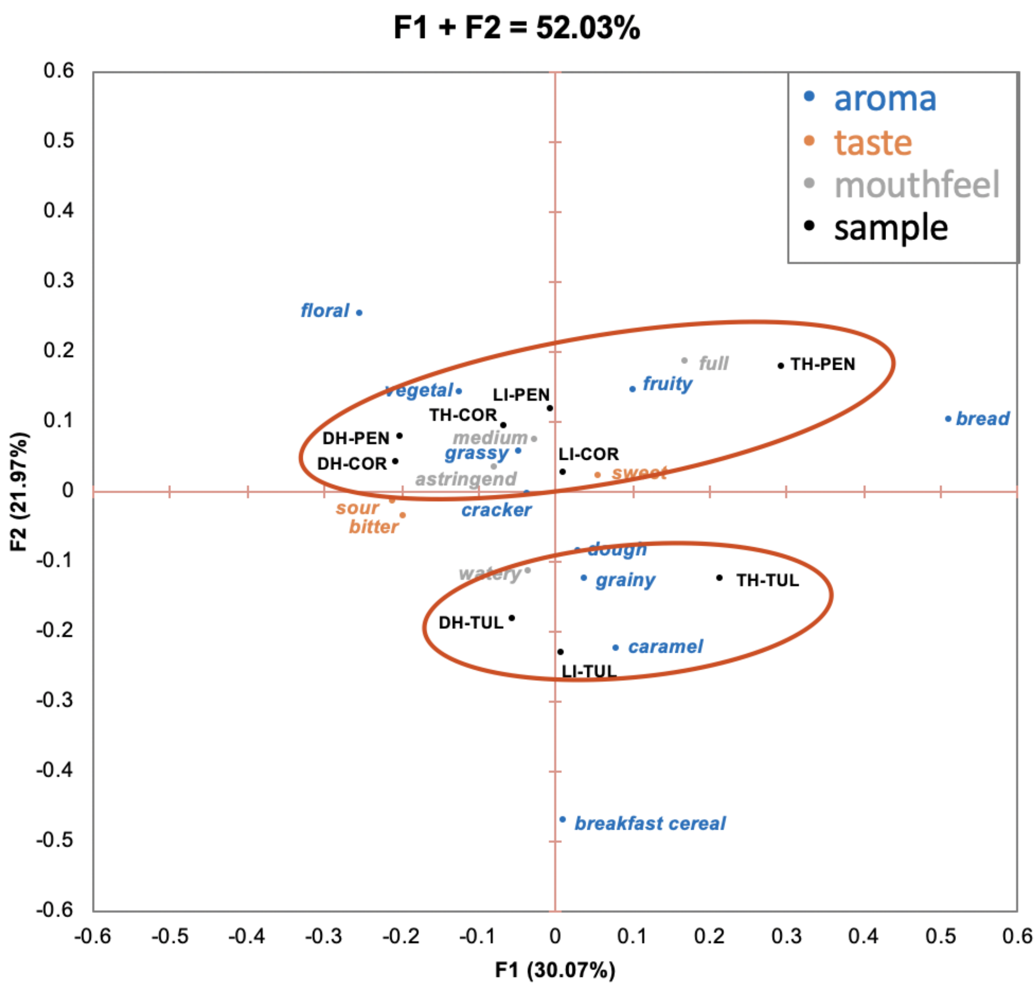
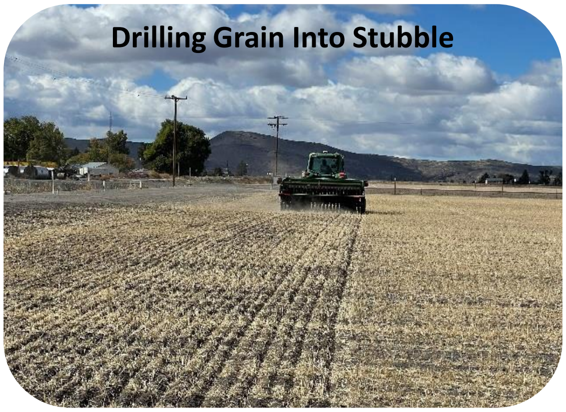


Fig 2. Sensory evaluation of beers brewed with three different barley lines (Thunder [TH], Lightning [LI], and DH140963 [DH]) at three locations (Corvallis [COR], Pendleton [PEN], and Tulelake [TUL]). The Tulelake grown lines formed a distinct grouping and plotted with dough, grainy, and caramel aromas.

Beer brewed from DH142010 grown at Tulelake in 2021 was evaluated for flavor characteristics in a separate study, which is in review for publication. Despite similarities between the malting quality of DH142010 and the control (Copeland), beer brewed with the DH142010 malt produced unique flavors: it was higher in butter, cracker, grainy, and vegetal flavors and lower in fruity and sweet aromatic than Copeland. DH142010 is under consideration for release and, with sufficient industry interest, could be a promising niche variety for the Klamath Basin. A seed increase of DH142010 is currently underway at IREC.

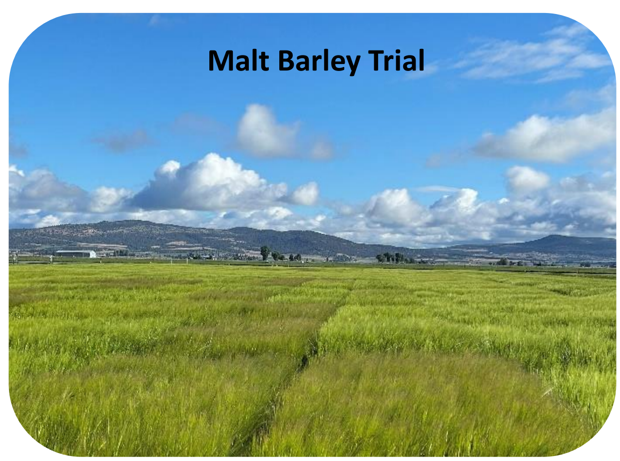

Drilling Grain Into Stubble


Onion Drip Irrigation Trial

Compost Pile Screen


Grain Harvest During Fire


Mint Variety Trial


Malt Barley Trial

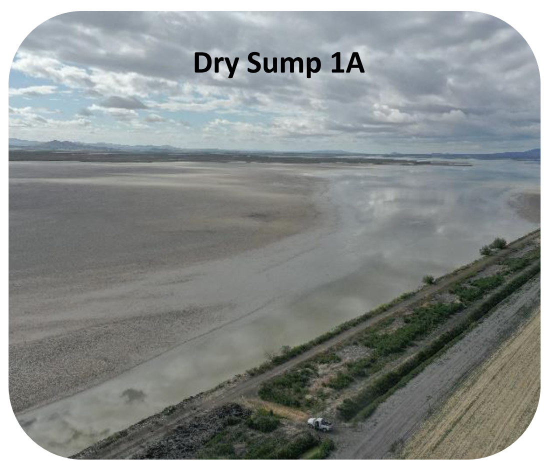

Pulling the IREC Pump


Triticale Harvest


Creating a Resevoir


Potato Vine Kill Timing Study


Memory from previous studies in dryland cover crop planting


Dry Sump 1A