FINAL REPORT

Planting Date and Cultivar Effects on Winter Wheat Yield

Steve Orloff
Farm Advisor/ County Director
UCCE Siskiyou County
1655 S. Main St. Yreka, CA
(530) 842-2711 sborloff@ucdavis.edu

Abstract/Summary of Results and Conclusions
There has been an increase in winter wheat plantings in recent years because the yield is typically consistently higher than that achieved with spring wheat. This has been a practice that was discouraged in the past due to concerns over winter kill or frost injury. There is a broad range of planting dates for winter wheat in the Klamath Basin from October to February, and research was needed to determine the most advantageous planting window. Eight high yielding winter wheat varieties (5 soft white winter and 3 hard red winter varieties) were seeded at the Intermountain Research and Extension Center (IREC) in Tulelake at four planting dates (September 26, October 15, November 10 and February 4). Surprisingly, the earliest planting date (September) was the lowest yielding. The November planting date did not perform as well either for some cultivars due to the lack of sufficient rainfall after seeding. October and February planting dates were the overall highest yielding. Which of the two planting dates was superior depended on the cultivar. These results are very interesting and not what would have been predicted. Therefore, it is imperative to continue this study for another year due to year-to-year variability in weather conditions to determine if these conclusions are consistent and can be used to guide planting date decisions.

Introduction and Objectives
Wheat is an important crop in the Klamath Basin and the intermountain area as a whole. The Klamath Basin is the most concentrated area of wheat production in the Intermountain Region. In the rest of California spring wheat varieties are produced, but are grown over the winter season. In contrast to the more temperate zones of California, both spring wheat and true winter wheat varieties are produced in the Intermountain Region. Spring wheat production is more common but winter wheat is gaining in popularity because winter wheat plantings have generally yielded a half to one ton higher than spring wheat. Spring wheat is typically seeded in April and warm/hot temperatures often follow within a couple of months after seeding limiting the potential yield. The actual timing of winter wheat plantings varies tremendously from October through November, ceases in mid-winter due to the severe cold and may also occur in late winter (February). In the past, winter wheat production in the Klamath Basin was often discouraged because of the possibility of winter kill or floret sterility caused by untimely spring frosts. To overcome this risk, winter wheat is sometimes planted in February. However, with this timing yield potential may be reduced because there is less time for tillering, and growers run the risk of there not being sufficient chill hours to satisfy the vernalization requirement of winter wheat.

Research is needed to quantify the yield impacts associated with the wide variation in winter wheat planting dates. Early fall planting (late September) is currently not done, but research is warranted to determine if an early fall planting followed by irrigation could improve root development and help plants get better established before the onset of winter. Some planting dates are more convenient for growers, primarily due to time limitations following rotation crops. Regardless, it is still advantageous to

know the yield penalties associated with some planting dates so that growers can make informed decisions regarding planting date. There are several new winter wheat varieties, both soft white and hard red, which need to be evaluated across a range of planting dates to better understand their potential for the Intermountain area.

Winter wheat variety trials have been conducted for decades in Montague and more recently at IREC by the UC Davis small grains program in cooperation with local Farm Advisors. These variety trials have identified the top yielding winter wheat varieties in the Intermountain Region. The leading varieties from these trials were selected for inclusion in this research. However, the varieties have only been evaluated at a single planting date—typically late October.

The objectives of this research are to:

1. Compare the yield potential of several leading cultivars of soft white winter wheat and hard red winter wheat across a range of planting dates

2. Determine the effect of four different planting dates on the yield of eight different winter wheat cultivars

Materials and Methods

Eight winter wheat varieties were seeded at 120 pounds per acre using a cone seeder at four different planting dates at the Intermountain Research and Extension Center (IREC) in Tulelake, CA. Because soft white winter wheat has been more popular than hard red varieties, we selected 5 soft white varieties and three hard red varieties (Soft white varieties: Bruneau, Mary, Tubbs, Bobtail and SY Ovation. Hard red varieties: Norwest 553, Azimut and Keldin). The planting dates we evaluated were September 25, October 15, November 10 and February 4. Sprinkler irrigation occurred after planting for the September and October planting dates. Because of the dry fall, the September planting was actually irrigated twice in the fall. November and February planting dates were not irrigated after planting and relied on rainfall and soil moisture for germination.

A split-plot experimental design was used with planting date as the main plot and winter wheat cultivar as the sub plot. The planting date main plots were separated from each other so that the September and October planting date plots could be irrigated independently in the fall. All plots were uniformly irrigated during the spring and summer. Heading date was determined for all plots. Plant height was measured before harvest. All plots were harvested for yield with a small plot combine and bushel weight determined.

Budget

The funds were spent on the IREC recharge rate for hourly labor ($13.13 per hour). The total was $1,938. This includes labor used for field preparation, irrigation, harvest and general plot maintenance as well as data collection. Funds were also used for my Field Assistants who helped conduct the trial (total $2787). Approximately $450 was used for transportation costs to IREC.

Results

Winter wheat yields in the Klamath Basin were lower than normal this year in this trial, as well as in commercial fields. However, wheat yield in our trial was higher than the average commercial yield. The reason for low yields this year is not fully understood but is likely due to a combination of extreme cold in December, low rainfall and a lack of deep soil moisture and hot temperatures in early summer. There

was a highly significant difference in yield between cultivars (Table 1). The soft white winter wheats tended to yield higher than the hard red varieties (Table 2). Overall, Tubbs was the highest yielding variety, while Keldin was the highest yielding hard red variety. Planting date was found to have a highly significant effect on yield. As mentioned, the first two planting dates were irrigated after planting. November was not and had a poorer stand as a result because November was abnormally dry. SY Ovation was the most affected, which explains the poor yield at that planting date. Azimut was also affected but to a lesser degree. January was far drier than normal, allowing an early February planting date. Rain occurred shortly after planting.

Table 1. Analysis of variance evaluating the effect of planting date, variety, and the interaction of planting date and variety on plant height, yield, and bushel weight.

	Height	**Yield**	**Bushel Weight**
Planting Date	0.0016	0.0006	0.1199
Variety	<.0001	<.0001	<.0001
Planting Date x Variety	0.0194	0.0002	0.0001

Surprisingly, the September planting had the lowest yield. This was true for nearly every cultivar except for SY Ovation where the November planting date had the lowest yield due to a poor stand. Also, the variety Bobtail did not appear to be as affected by planting date as the other cultivars. For some cultivars the September planting was over half a ton lower yielding. It was also surprising that the February planting performed as well as it did. The yield was slightly lower than the October planting for some varieties yet higher for others, so the overall average yield for October and February plantings across cultivars was very close. This is surprising in that there was almost a 4 month difference between those two planting dates.

Table 2. The effect of planting date and cultivar on the yield of winter wheat in the Klamath Basin. IREC 2014.

	Yield (tons/acre)				
	Sept 25	**Oct 15**	**Nov 10**	**Feb 4**	**Mean**
Bruneau	2.94	3.62	3.642	3.64	3.46
Mary	3.35	3.73	3.383	3.45	3.48
Tubbs	3.41	3.84	3.431	3.77	3.61
Bobtail	3.52	3.50	3.615	3.32	3.49
SY Ovation	3.02	3.46	2.683	3.77	3.23
Norwest 553	2.58	2.83	3.139	2.95	2.87
Azimut	2.48	2.92	2.663	3.12	2.80
Keldin	2.76	3.57	3.641	3.27	3.31
Mean	3.01	3.43	3.27	3.41	

There were significant differences in bushel weight between varieties (Table 3). The varieties Azimut and Bobtail tended to have the lowest bushel weight. The lowest yielding planting date (September) appeared to have the highest bushel weight. There was also a significant planting date x variety interaction effect on bushel weight.

Table 3. The effect of planting date and cultivar on the bushel weight of winter wheat in the Klamath Basin. IREC 2014.

	Bushel Weight (lbs)				
	Sept 25	**Oct 15**	**Nov 10**	**Feb 4**	**Mean**
Bruneau	57.0	56.5	57.2	56.6	56.8
Mary	57.6	57.3	57.4	56.6	57.3
Tubbs	57.0	57.1	56.5	57.1	56.9
Bobtail	54.4	54.9	54.7	55.7	54.9
SY Ovation	57.6	57.4	57.3	57.2	57.4
Norwest 553	58.6	58.9	58.1	59.0	58.7
Azimut	55.4	53.5	51.9	52.1	53.2
Keldin	59.2	59.6	59.5	59.0	59.3
Mean	57.1	56.9	56.6	56.7	

Discussion, Conclusions and Recommendations

These results were unexpected. I would have thought that a September planting would yield the highest. The plants would be larger and more established going into the cold winter months. Planting grain in September would be a sacrifice because it is difficult for growers to plant by this time due to harvest schedules for the preceding crop. Also, it would likely require more irrigation. The thought was that it may be worth the extra effort if yields were higher. As it turned out, plants sown in October were larger going into the winter and appeared more vigorous when growth resumed later in the winter. However, to our surprise, for most cultivars the September planting date was the lowest yielding of the four planting dates. Why the September planting was the lowest yielding is not well understood at this point. It is interesting to note that the September planting date also resulted in the shortest plants (see Table 4), while the other three planting dates were all comparable.

Table 4. The effect of planting date and cultivar on the height of winter wheat in the Klamath Basin. IREC 2014.

	Plant Height (cm)				
	Sept 25	**Oct 15**	**Nov 10**	**Feb 4**	**Mean**
Bruneau	36	40	40	40	39
Mary	32	36	36	35	35
Tubbs	37	39	40	40	39
Bobtail	31	33	35	35	34
SY Ovation	35	37	34	37	36
Norwest 553	32	33	33	34	33
Azimut	29	30	30	30	30
Keldin	33	38	38	37	37
Mean	33	36	36	36	

It is also interesting to note that the average yield for the February planting date was as high as the October planting date nearly four months later. The November planting date would probably yield

higher in most years than it did this year had there been sufficient rainfall soon after planting for uniform emergence. Perhaps the February planting was higher yielding than it would be in other years because January was so dry allowing an earlier February planting than might occur in some years and timely rain occurred immediately after planting. This allowed for earlier emergence and more time for vernalization to occur. It is interesting to note the heading date for the different planting dates. The heading dates for the February planting were nearly identical to the November planting (Table 5), actually slightly earlier in some cases. Perhaps wheat plants grow so little over the cold winter months of late November, December, January and early February that yield isn't reduced much if planting is delayed until February but more research is needed.

While these results are interesting, one should not draw conclusions and make recommendations after just one year. This research must be repeated to have more confidence in the findings. They suggest at this point that early planting may be not warranted and the optimum planting window after that may be quite long.

Table 5. The effect of planting date and cultivar on the heading date of winter wheat in the Klamath Basin. IREC 2014.

	Heading Date			
	Sept 25	**Oct 15**	**Nov 10**	**Feb 4**
Bruneau	21-Jul	27-Jul	4-Aug	31-Jul
Mary	19-Jul	21-Jul	30-Jul	26-Jul
Tubbs	20-Jul	27-Jul	2-Aug	1-Aug
Bobtail	19-Jul	19-Jul	30-Jul	3-Aug
SY Ovation	19-Jul	24-Jul	8-Aug	27-Jul
Norwest 553	21-Jul	27-Jul	3-Aug	28-Jul
Azimut	19-Jul	22-Jul	1-Aug	27-Jul
Keldin	19-Jul	19-Jul	24-Jul	21-Jul