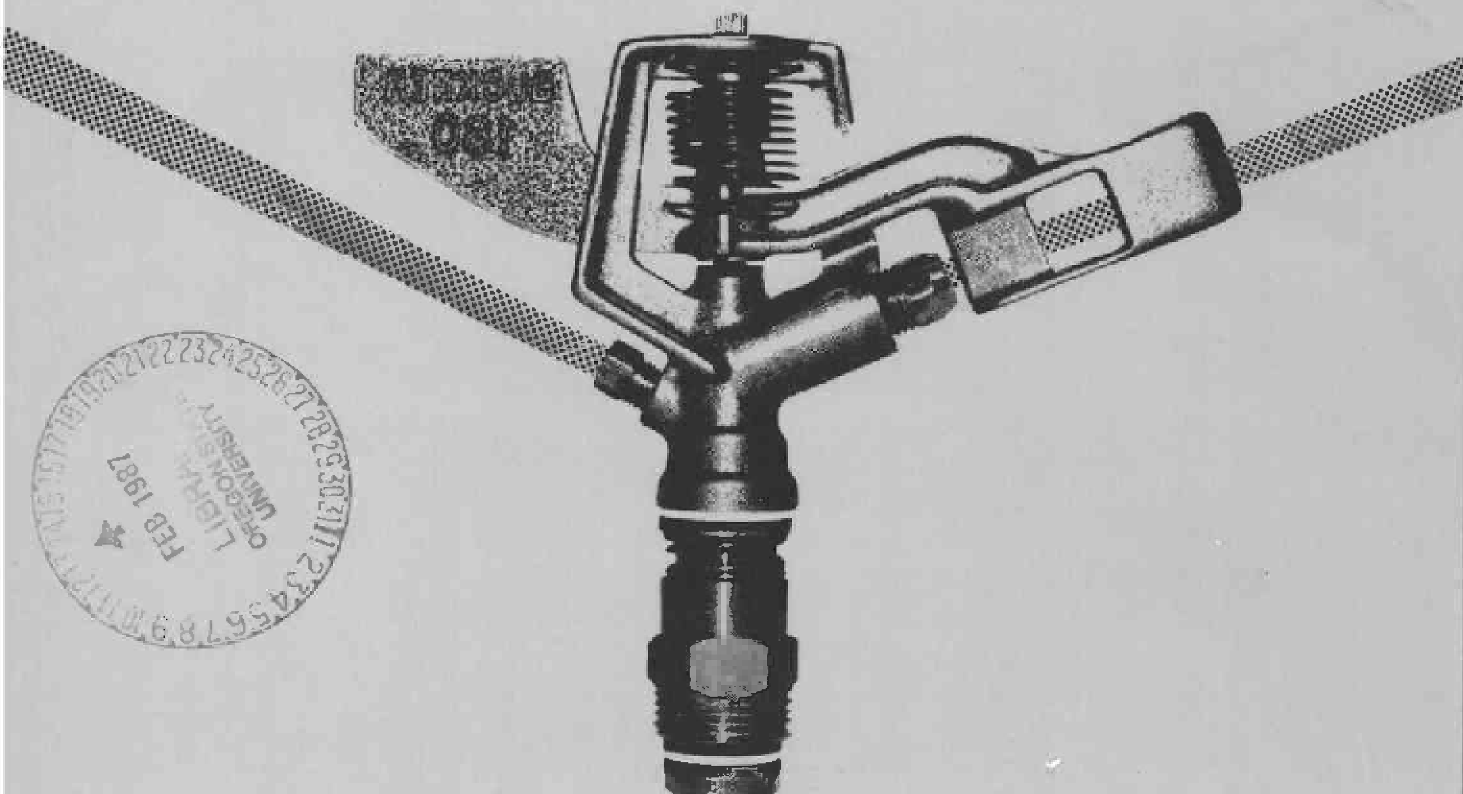
Irrigated Crop Research in Oregon's Columbia Basin



1985 Research Report

OREGON STATE UNIVERSITY
AGRICULTURAL RESEARCH
AND
EXTENSION CENTER
HERMISTON STATION

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Oregon State University, Corvallis

HERMISTON AGRICULTURAL RESEARCH AND EXTENSION CENTER

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HERMISTON AGRICULTURAL RESEARCH AND EXTENSION CENTER

G. L. Reed[1]

Oregon State University's Agricultural Experiment Station has maintained a station in Umatilla County since initiation of the Umatilla Reclamation Project. Originally, the Umatilla Experiment Farm was 2 miles north of Hermiston and was a cooperative effort of OSU-AES, United States Department of Agriculture - Bureau of Plant Industry, and the United States Reclamation Service. Construction on the original site began in 1909 with research beginning in 1912. The purpose of the station was to support the needs of farmers settling on the light soils of the Umatilla Reclamation Project. Research during that era concentrated on irrigation, water use, suitability of crops, selection of crop varieties, and production of livestock. Considerable effort was placed on the development of orchard, forage, agronomic, and vegetable crops. This early work led the way to the development of many of our present cropping systems. During the first few years of research, the station staff recognized and demonstrated the value of producing the Russett Burbank potato, alfalfa, melons, and sweet potato in the region.

Limited acreage, with areas that were unsuitable for irrigation, led to relocating the station on its present site, with construction beginning in 1931. Expansion of the station resulted in increased animal research with emphasis in various periods on cattle, swine, sheep, and poultry.

The farm has 180 acres developed for research and about 120 unimproved acres for expansion. Over the years, federal budget restraints reduced USDA and US Reclamation Service support to the station. The station is now operated independently by Oregon State University. During the mid-1970s, the station became the first off campus site to consolidate Agricultural Experiment Station and Extension Service efforts in a single location. The consolidation of research and extension is proving very effective, it has improved the awareness of researchers of farming problems and reduced the time needed for new knowledge to be passed on to the farmer. For a time, from the 1970s through mid-1985, the station operated under consolidated management with the OSU's Columbia Basin Agricultural Research Center at Pendleton. When it became obvious to area growers that research was needed to develop diversified crops for the area, the growers were encouraged by Oregon State University to form an Agricultural Advisory Committee for the station to provide recommendations to the AES and to station personnel.

Efforts of the Agricultural Advisory Committee have had a significant impact upon the station. Because of their efforts, management of the station has once again become independent, a program in vegetable production and breeding has been initiated, a project aimed at the registration of pesticides for horticultural crops has been started, and a program in horticultural irrigation will be initiated next year. When completed, these changes will have increased the professional staff of the station from four

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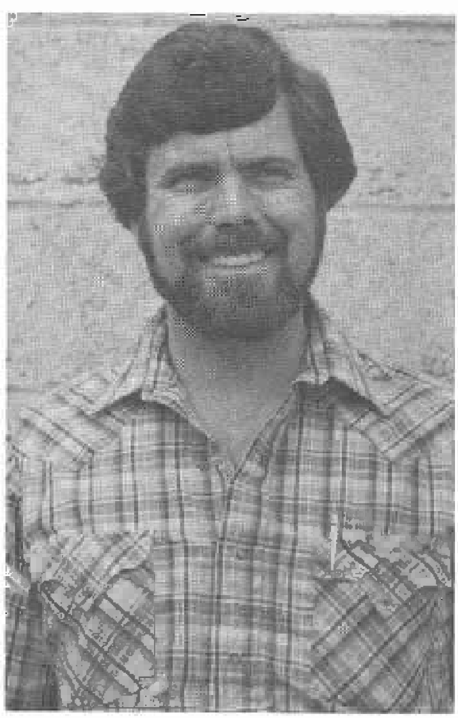
and one-half to seven and one-half. The response of Oregon State University has demonstrated that today, as in the past, the Agricultural Experiment Station remains responsive to needs of the state's growers.

The combined efforts of staff of the Agricultural Experiment Station, Extension Service, and members of the Agricultural Advisory Committee provide an excellent basis for support of the irrigated agricultural regions of the Columbia Basin. The excellent cereal (feed grain) and potato breeding efforts of the station and the new horticultural efforts should provide continuing knowledge to assist the area in surviving the rigors of today's economic climate and in preparing for a better tomorrow.

PRESENTATION OF AWARD TO MARTIN PITNEY

During the 1986 Station Field Day, the staff of the Hermiston Agricultural Research and Extension Center and members of the Agricultural Advisory Committee recognized Martin Pitney for his leadership in developing the advisory committee and support of the station. The many hours which he devoted to development of the committee, the many trips to the Corvallis campus, phone calls to the administration and personal contacts within the Hermiston farm community are much appreciated. In recognition of this, a plaque bearing the following inscription was presented to Martin during his tour of the station during the Field Day.



Martin L. Pitney

Chairman HAREC Advisory Committee 1984-1986

In Recognition of Efforts to

Establish the Hermiston

Agricultural Research & Extension

Center Avisory Committee

and for the

Excellent Support Provided

to the

Continuation and Expansion

of the Center

CONTENTS

1984 NORTH CENTRAL POTATO EVALUATION TRIALS

D. C. Hane and A. R. Mosley[z]

New potato (<u>Solanum tuberosum</u> L.) lines are evaluated in annual yield trials for desirable processing and/or fresh market characteristics. Yield, quality, disease resistance, storability, and fry characteristics are obtained for each line.

The statewide trial at Hermiston is one of four such trials conducted in Oregon. New lines exhibiting good yield potential, having blocky to oblong russetted tubers with a high grade-out of U.S. No. 1 tubers, good internal qualities, and acceptable fry qualities are entered in this program. Lines come from early selection trials in Oregon and from programs in other Western States.

A more diverse group of cultivars is evaluated in the Western Regional trials. Participating locations throughout six western states and Canada are limited to three entries each. The statewide trial is Oregon's source of lines for inclusion in these trials.

A potential response of new cultivars to commercial management in the Hermiston area is evaluated through tests conducted at grower sites. These tests give added insight to a new line's adaptability to North Central Oregon conditions.

PROCEDURES

Trials are planted from late March through mid-April in a randomized block design with four replications (three in off-station trials). The soil type at the Research Center is an Adkins loamy fine sand. Soil types in commercial fields vary from loamy sand to sandy. All seed is hand cut, treated with a fungicide and bagged for individual plots. 'Russet Burbank', 'Lemhi' and 'Norgold Russet' are the check varieties. Each plot consists of one 25-foot row. Rows are on 34-inch centers and plants are spaced nine inches apart in the row. A five-foot border is maintained between replications.

Management practices suitable to the Hermiston area are used for the trials. Pesticides are applied as needed. A per acre fertilizer mix of approximately 100 pounds of nitrogen, 150 pounds of phosphorous, 150 pounds of potash, 60 pounds of sulfur and needed minor elements is banded at planting. During the growing season 200 to 275 pounds of nitrogen per acre is applied through the irrigation system. Generally, three sprinkler irrigations per week are required to supply water.

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Results and Discussion

The three off-station trials conducted in 1984 provided different management schemes for evaluating entries (Table 1).

Location 1 was in an early harvested field of Norgold-M potatoes with a cropping history of potatoes every other year for several cycles. The standard check variety, Norgold, was the lowest yielding line and had the lowest percent of No. 1 tubers. ND534-4 looked promising, but yields and grade-out didn't compare with Norgold-M or with 78LC-1 78LC-1 is a new entry being considered for fresh market and early processing.

Location 2 was in a field of Russet Burbank (RB) potatoes where the soil was fumigated the previous fall. This field was harvested relatively late. All RB entries had exceptional quality and yield. However, internal physiological problems were quite high. The early-maturing line ND534-4 yielded poorly under these conditions. ND388-1 had a high percent of U.S. No. 1 tubers,and although the specific gravity was lower than RB, its fry color was acceptable. This line is being released by North Dakota. The performance of 78LC-1 was below that of RB.

The third off-station testing site was in a new field with no previous irrigated cropping history. The check entry, RB, yielded more than 50 tons per acre with a grade-out of 83% U.S. No. 1 tubers. Hollow heart was above acceptable standards. Though line A74114-4, yielded and graded well, it had 24% internal brown spot (IBS) and likely will be dropped. Whole seed (78LC-1S) and cut seed (78LC-1C) of 78LC-1 produced similar yields and grade-out. The whole seed produced smaller tubers with slightly more tubers per plant. The 15% IBS observed in ND388-1 indicates a potential problem.

Table 2 summarizes evaluations about entries in the statewide trial. Overall, yields were lower than expected, but grade-out of U.S. No. 1 tubers was exceptionally good. Internal problems were minimal except for black spot bruise.

Four lines (A74212-1, A7869-5, A079492-2, and NDA1309-6) were selected from the statewide trial for testing in 1985. A74212-1 exhibits good fresh market characteristics in Central Oregon and the Klamath Basin. In the Columbia Basin, it is late maturing, has low specific gravity, and fries dark. A7869-5 yielded 27% more total production and 50% more U.S. No. 1's than R.B. in this trial. Specific gravity for this line was marginal. Selection A079492-2 exhibited good yield and quality, but its white skin and scab susceptibility limit its potential in the Columbia Basin. NDA1309-6 has excellent specific gravity, good internal quality, and a high percent of U.S. No. 2 tubers, but it was low in total yield and showed a tendency to shatter bruise.

Overall, the early harvested Western Regional trial was low in total production and tubers were small (Table 3). Three lines were kept for testing in the 1985 early trials. Colorado line, TC582-1, yielded 28% less total production and had 33% fewer U.S. No. 1 tubers than Norgold. Tubers were small, but specific gravity was excellent. North Dakota line ND534-4 had 10% less total production than Norgold, but grade-out of U.S. No. 1's was equivalent. This line was promising in 1983 in the Columbia Basin, therefore, Oregon elected to keep it in the early Western Regional trial for 1985. An interesting new line, 78LC-1, which has small, compact plants and produces a medium yield of smooth, oblong, medium russetted tubers will also be included in the early 1985 test. This line has 23% more U.S. No. 1 tubers than Norgold, but often has pear shaped tubers.

Results of the late harvested Western Regional trial are shown in Table 4. Average production for the 1984 trial was low. Two lines were selected for testing in 1985. Line A7411-2 is a long, medium russet that yielded 15% more total production and graded 23% more U.S. No. 1's than RB. It has good specific gravity and fries very light. Line A74114-4 exhibits fresh market characteristics, having low specific gravity and dark fries. The eye-appealing tubers are oblong to blocky, and medium russetted.

Table 1. Total yield, percent U.S.No.1 and 2 tubers, specific gravity, tuber size, and internal defects for entries grown at three grower locations near Hermiston, Oregon, 1984.

ENTRY	TOTAL YIELD	U.S. NO.1	U.S. NO.2	SPECIFIC GRAVITY	WEIGHT PER TUBER	HOLLOW HEART	BROWN CENTER	INTERNAL BROWN SPOT	BLACK SPOT	VASCULAR DISCOLOR
	cwt/ acre	---percent---			oz.	---------------- percent ----------------				
SITE 1										
NORGOLD	318	69.2	0.9	1.076	3.5	(Test results not tabulated - internals were minimal)				
NORGOLD-M	405	76.7	0.3	1.074	5.7					
ND534-4	324	72.6	0.6	1.073	5.3					
78LC-1	430	81.4	0.0	1.082	7.3					
SITE 2										
RB	954	81.3	7.5	1.081	11.1	10.7	6.7	6.7	8.0	0.0
78LC-1	611	73.9	8.2	1.074	6.2	1.3	0.0	5.3	1.3	0.0
ND388-1	638	91.0	0.0	1.073	7.7	0.0	1.3	0.0	4.0	0.0
ND534-4	486	87.1	0.2	1.065	7.0	2.7	0.0	0.0	4.0	0.0
RB 1	1130	71.3	16.1	1.086	9.0	4.0	12.0	10.7	4.0	0.0
RB 2	949	83.9	6.4	1.087	8.7	4.0	6.7	4.0	2.7	0.0
SITE 3										
RB	1052	83.5	9.0	1.086	11.1	18.7	1.3	0.0	6.7	0.0
A74114-4	775	94.1	2.1	1.085	11.1	0.0	1.3	24.0	0.0	0.0
78LC-1S*	673	94.7	0.0	1.075	8.9	1.3	1.3	0.0	2.7	1.3
78LC-1C*	657	93.4	0.2	1.073	10.4	1.3	0.0	1.3	5.3	0.0
ND388-1	651	91.7	2.2	1.078	9.4	4.0	0.0	14.7	8.0	0.0

* S = Single drop
* C = Cut seed

Note: Internal information taken on tubers weighing more than 10 ounces with percent defects being additive.

Table 2. Total yield, yield of U.S. No. 1 and 2 tubers, specific gravity, tuber weight, percent internal defects, and fry color for entries grown in the 1984 statewide variety trial at the Hermiston Agricultural Research and Extension Center, Hermiston, Oregon.

ENTRY	TOTAL YIELD	U.S. NO. 1	U.S. NO. 2	SPECIFIC GRAVITY	WEIGHT PER TUBER	HOLLOW HEART	BROWN CENTER	INTERNAL BROWN SPOT	BLACK SPOT	VASCULAR DISCOLOR	FRY[z] COLOR
	--------CWT/ACRE-------				OZ.	----------------PERCENT---------------					
RB	614	499	58	1.085	8.3	0	0	3	24	2	1.0
Lemhi	634	616	0	1.096	10.0	0	0	1	60	0	1.0
Norgold	294	217	0	1.069	4.8	4	0	0	3	0	
Nooksack	506	491	6	1.092	11.9	0	4	0	4	21	1.9
A68678-2	399	365	5	1.084	9.5	0	0	3	42	0	1.2
A69870-10	533	517	0	1.082	8.2	0	0	1	34	0	0.2
A71997-8	524	460	6	1.084	6.4	1	1	0	7	0	2.3
A7242-3	604	576	10	1.082	8.1	0	0	0	18	0	4.0
A7279-12	589	520	15	1.088	8.3	2	4	0	15	7	1.8
A72685-2	693	649	4	1.090	9.1	0	8	0	19	3	2.2
A74212-1	723	674	17	1.077	0.9	0	0	2	14	5	3.5
A7532-1	601	523	7	1.086	7.3	1	1	1	20	11	0.0
A77153-3	608	58	11	1.090	11.1	0	0	2	17	1	1.8
A7811-16	451	414	8	1.078	7.9	0	0	57	39	0	
A7814-6	380	310	7	1.075	6.2	0	0	0	5	4	
A7836-28	483	414	4	1.090	7.1	1	1	0	28	2	0.2
A7869-5	781	746	11	1.079	12.1	6	2	8	29	1	2.6
A079492-2	702	658	9	1.082	7.1	1	0	9	11	1	1.2
C007908-1	554	517	4	1.084	7.5	0	1	1	6	1	2.5
C007921-1	477	429	10	1.071	6.0	1	0	2	20	0	
ND388-1	434	401	4	1.079	6.9	2	0	0	16	0	
ND681-3	473	417	5	1.082	8.0	0	0	0	21	10	
ND678-8	249	174	0	1.059	5.0	0	0	0	4	0	
NDA815-1	283	217	1	1.069	5.3	0	0	0	3	0	
NDA1238-2	354	286	8	1.073	6.0	1	13	0	3	0	
NDA1242-1	114	83	4	1.068	6.8	0	0	2	0		
NDA1242-3	291	239	1	1.076	4.9	0	1	0	5	0	
NDA1246-4	430	373	6	1.063	6.9	1	1	13	4	0	
NDA1276-3	75	58	2	1.063	7.1	2	14	0	1	0	
NDA1309-6	528	499	0	1.098	8.6	0	0	13	44	0	0.4
5%LSD	109.6	108.7		0.005							
CV(%)	16.17	17.85		0.34							

[z]Fry color index 0 to 4 where 0 = very light and 4 = very dark.

Table 3. Total yield, yield of U.S. No. 1 and 2 tubers, specific gravity, tuber weight, and percent internal defects for entries grown in the early Western Regional Variety Trial at the Hermiston Agricultural Research and Extension Center, Hermiston, Oregon.

ENTRY	TOTAL YIELD	U.S. NO. 1	U.S. NO. 2	SPECIFIC GRAVITY	WEIGHT PER TUBER	HOLLOW HEART	BROWN CENTER	INTERNAL BROWN SPOT	BLACK SPOT	VASCULAR DISCOLOR
	--------CWT/ACRE--------				OZ.	----------------PERCENT----------------				
A7411-2	413	353	21.4	1.072	6.3	0	0	0	22	3
A74114-4	298	247	0.9	1.077	5.7	0	0	0	5	5
A74132-7	330	268	1.4	1.067	6.0	0	0	0	12	2
A74133-1	435	353	4.1	1.072	6.3	0	0	0	2	0
A74212-1	412	365	15.0	1.066	6.8	0	0	0	4	0
AC77652-1	364	318	5.1	1.067	5.4	0	0	0	8	0
ND534-4R	287	234	5.6	1.072	5.9	0	0	0	5	1
NDD47-1	159	138	0.0	1.061	8.3	0	0	12	9	4
NDD277-2	305	283	0.5	1.065	5.9	0	0	0	1	3
TL582-1	228	157	1.0	1.086	3.4	0	0	0	5	25
78LC-1	364	290	4.4	1.076	5.2	0	0	0	2	1
NORGOLD	318	236	0.0	1.068	5.1	0	0	0	4	0
5%LSD	114	104		0.005						
CV(%)	24.8	27.4		0.39						

Table 4. Total yield of U.S. No. 1 and 2 tubers, specific gravity, tuber weight, percent internal defects, and fry color for entries in the late harvested 1984 Western Regional Variety Trial at the Hermiston Agricultural Research and Extension Center, Hermiston, Oregon.

ENTRY	TOTAL YIELD	U.S. NO. 1	U.S. NO. 2	SPECIFIC GRAVITY	WEIGHT PER TUBER	HOLLOW HEART	BROWN CENTER	INTERNAL BROWN SPOT	BLACK SPOT	VASCULAR DISCOLOR	FRY[3] COLOR
	-------CWT/ACRE-------				OZ.	---------------PERCENT-----------------					
A69870-10	492	467	3.5	1.078	8.2	0	0	1	30	0	0.0
A7411-2	646	585	32.1	1.087	9.6	0	0	2	23	3	1.1
A74114-4	351	309	0.0	1.076	7.3	0	0	2	3	2	3.2
A74132-7	534	497	12.9	1.077	7.4	0	0	0	22	2	1.3
A74133-1	531	505	0.0	1.081	9.1	0	0	0	10	0	4.0
A74212-1	733	685	20.4	1.071	15.2	0	0	0	2	15	3.1
AC77652-1	456	424	6.8	1.068	7.7	4	0	0	7	0	3.0
ND534-4	270	203	0.0	1.068	5.3	0	0	0	6	0	1.6
NDD47-1	346	296	5.1	1.067	6.6	0	0	2	1	16	2.8
NDD277-2	377	352	8.9	1.070	7.5	0	0	0	2	0	2.4
TC582-1	405	354	2.8	1.096	7.5	0	0	0	9	0	2.0
78LC-1	355	304	0.0	1.071	6.0	0	0	0	3	0	3.3
RB	562	475	46.0	1.082	8.1	0	3	3	18	3	1.5
LEMHI	599	570	12.0	1.092	9.9	0	0	0	58	0	0.1
5%LSD	132	127	0.005								
CV(%)		19.6	20.9	0.34							

[3]Fry color index 0 to 4, where 0 = very light and 4 = very dark.

ASSOCIATED EFFECTS OF PLANTING DATES ON YIELD AND QUALITY OF IRRIGATED WINTER BARLEY AND WHEAT GROWN NEAR HERMISTON, OREGON.

Mathias F. Kolding[3]

Adequate stand establishment is requisite to optimum crop yields. The timing of establishment, however, may have a profound effect on stand performance.

Cereal growers in North Central Oregon may elect to sow fall planted cereals after a rain in late August, or early September, or when soil moisture is disappearing at reasonable seeding depths. Other growers may choose an early seeding date to establish a protective soil cover, or to spread their work loads.

Before the extensive irrigation development in the 1970s, early planted fall cereal seedlings in North Central Oregon were geographically isolated from cereal disease hosts. The vegetative pattern, however, has changed from a "dry dead" summer, to one of large green irrigated crop areas bordered by plants harboring debilitating cereal diseases. Barley Yellow Dwarf Virus (BYDV) is one of those diseases.

Pike (5) reports that aphids such as the bird cherry oat aphid Rhopalosiphon padi L. develop large populations in Columbia Basin corn fields during the growing season. Winged aphids then migrate from maturing corn and grasses to feed on fall-planted cereal seedlings. Aphid feeding can cause severe damage, but when BYDV is transmitted to the seedlings, damage can range from no visible effect to severely stunted or dead plants. Panayatou (4) inoculated wheat (Triticum aestivum L. em Thell.) and barley (Hordeum vulgare L.) at one week and five weeks after germination. Those plants inoculated at one week after germination exhibited more BYDV symptoms than those inoculated at five weeks. In a comparison of 1200 early and 1200 late fall-seeded wheat lines exposed to naturally occurring infected bird cherry oat aphids, Carrigan (2) found that most early seeded lines yielded 15 to 37 percent less than when seeded later. Bruehl and Damstegt (1) grew 14 Ethiopian BYDV infected and non-infected barley lines. They measured a 25 to 59 percent yield reduction in the infected versus the non-infected. Grafton (3) reported that BYDV enhances winter injury to winter barley. BYDV infected plots had shorter plants, fewer fertile tillers and total dry weight, smaller seed size, and less yield. He also noted that increased tolerance to BYDV is possible by utilizing resistance found in winter barley populations.

METHOD

This study was initiated to measure the effects of BYDV on winter barley and wheat planted on three dates near Hermiston, Oregon. Eight winter cereal varieties (Table 1) were planted September 2, 26, and October

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[3]Cereal Breeding Specialist, Oregon State University, Hermiston Agricultural Research & Extension Center, Hermiston, Oregon 97838.

8, 1981, on the Hermiston Agricultural Research Center near Hermiston, Oregon. The experiment was arranged as a factorial with dates as main plots. Individual plots were 15 feet long with four rows spaced at 12 inches. More than 200 aphids per foot of row were counted during a random count at the three-to five-leaf stage. Aphids were well distributed throughout the center on other cereal seedlings. Daytime temperatures were warm (70 to 85 degrees Fahrenheit) and sunny. BYDV symptoms (yellowing) were observed in the fall, but were not recorded until April 8, 1982, at or prior to the early boot stage. A scale of 1 = tolerant (no symptoms) to 9 = dead, was used for disease evaluation. Heading date, grain yield, bushel weight, and percent plump grain were recorded.

RESULTS

Excellent, uniform stands were achieved from each seeding date, as well as uniform aphid populations at the research center during September and October. The bird cherry oat aphid was predominant.

Plants yellowed in the fall in typical BYDV leaf patterns. The amount of yellowing appeared nearly equivalent to yellowing observed in the eight lines in previous years (Table 1). BYDV presence was not verified by laboratory tests.

The mean value of BYDV readings (Table 2) differed between dates and entries, but date X entry interaction was not significant. Symptom ratings were generally smaller for the barleys as planting date was delayed. In the wheats, the ratings increased.

Grain yields differed significantly between dates (Table 3), however, the difference for the first and second date (1,784 pounds per acre) was twice the 812 pounds per acre between the second and third date. Yield increases for the individual entries from the first to the third date ranged from 91 pounds for FB77818-109 to 4,103 pounds for FW73830CP04.

Tests weights given in Table 4 increased as the seeding date was delayed. Barley weights increased from a range of 39 to 43 pounds per bushel when seeded September 2 to a range of 49.6 to 53.9 when seeded October 8. The highest wheat test weight was a low 56.5 pounds per bushel.

Percent barley kernel plumpness (Table 5) increased with later seeding dates, while plumpness decreased for the wheats.

Heading date mean values from January 1 were 142, 140, and 144 respectively for delayed seeding dates (Table 6).

DISCUSSION

Simple interactions between variety and seeding dates rarely occur. Day length, temperature, moisture, and disease complex changes as the season progresses may have a profound effect on grain yield. When choosing a time to plant, a balance between the value of stand establishment versus damage to stands is important. If water is available, however, a delayed fall seeding date may avoid profound disease effects and could give a more successful crop.

In this experiment the earlier seeding dates had significantly lower grain yields, test weights, and fewer plump kernels. The winter barleys were severely affected by BYDV. The more tolerant lines had stable yields, but their grain quality was still adversely affected when planted early. Grain quality of the two wheats did not improve. BYDV may not have affected the wheats greatly at any date, but some dwarfing and sterile tillers occurred in the early planting date.

Wheat test weight remained low across all seeding dates. BYDV index ratings were still at the moderately tolerant level (Table 2) after the late seeding date. Leaf yellowing and purpling are part of the symptomatology used to give visible ratings for BYDV in the feed grain breeding program. Yellowing and purpling are also symptoms of sharp eyespot caused by Rhizoctonia solani L. and takeall, caused by Gaumanomycetes sp.. Either sharp eyespot and/or takeall infection probably contributed to low test weight, since they were identified in the plot area.

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TABLE 1. Winter barleys and wheats planted in date of planting trial grown near Hermiston, Oregon, 1982.

Entry	Name or pedigree	Crop	Previous reaction to BYDV infections
1. CI15817	Mal	barley	susceptible
2. CI11887	Schuyler	barley	moderately tolerant
3. FB77817-013	OR7107/Hpr	barley	moderately tolerant
4. FB77818-109	OR7107/Hpr	barley	tolerant
5. FB77818-135	OR7107/Hpr	barley	tolerant
6. FB235-185	Luther	barley	moderately susceptible
7. CI17596	Stephens	wheat	moderately tolerant
8. FW73830CP04	1523-Dc/Rb	wheat	tolerant

Table 2. Barley yellow dwarf virus ratings[1] for winter 1981.

Entry	Virus Ratings Planting Date			
	Sept. 2	Sept. 21	Oct 8	Average
1 Mal	4.3	4.3	1.7	3.4
2 Schuyler	3.0	3.7	1.0	2.6
3 FB 77818-013	1.7	1.7	1.7	1.7
4 FB 77818-109	1.3	1.7	1.0	1.3
5 FB 77818-135	1.6	1.3	1.0	1.3
6 FB 235-185	5.3	3.7	1.3	3.4
7 Stephens	4.7	5.0	3.3	2.8
8 FW 73830CP04	2.0	4.0	3.3	3.1
Average	3.0	3.2	1.8	2.5

[1]Barley yellow dwarf virus ratings are on a scale of 1-9 where 1 = tolerance and 9 = plant death. These ratings are each the average of three plots.

Date significant at .1%, standard error = .213.
Entry significant at 1%, standard error = .348.
Date x entry interaction not significant, standard error = .603.

Table 3. Pounds per acre of winter barley and wheat planted at the Hermiston Agricultural Research & Extension Center near Hermiston, Oregon, 1981.

Entry	Planting Date				
	Sept. 2	Sept. 21	Oct. 8	Increase	Average[1]
1 Mal	3,608	6,051	6,772	3,164	5,477
2 Schuyler	5,089	6,394	6,301	1,212	5,928
3 FB 77818-013	5,189	6,728	7,084	1,895	6,334
4 FB 77818-109	5,408	5,105	5,499	91	5,337
5 FB 77818-135	3,940	5,834	6,429	2,489	5,401
6 FB 235-185	2,183	5,294	6,255	4,072	4,577
7 Stephens	4,571	6,528	8,315	3,744	6,471
8 FW 73830CP04	3,997	6,320	8,100	4,103	6,139
Average	4,248	6,032	6,844	2,596	5,708

[1]Standard error = .995.
Dates and entry significant to .1% and 1% respectfully.
Date X entry interaction not significant.

Table 4. Test weights[1] of winter barley and wheat planted at the Hermiston Agricultural Research & Extension Center, Hermiston, Oregon, 1981.

Entry	Planting Date			
	Sept. 2	Sept. 21	Oct. 8	Average
1 Mal	42.7	46.3	51.2	46.7
2 Schuyler	43.6	49.6	52.6	48.6
3 FB 77818-013	39.7	47.2	50.3	45.7
4 FB 77818-109	39.2	45.8	49.6	44.9
5 FB 77818-135	39.9	47.2	49.7	45.6
6 FR 235-185	40.9	49.1	50.9	47.0
7 Stephens	53.3	56.5	53.9	54.6
8 FW 73830CP04	54.7	56.5	56.1	55.8
Average	44.2	49.8	51.8	48.6

[1]Pounds per bushel.
Date significant at .1%, standard error = .49.
Entry significant at .1%, standard error = .80.
Date x entry interaction significant at .1%, standard error = 1.386.

Table 5. Percent kernel plumpness[1] of winter barley and wheat at planted at the Hermiston Agricultural Research Center, Hermiston, Oregon, 1981.

Entry	Planting Date Sept. 2	Sept. 21	Oct. 8	Average
1 Mal	52	60	85	66
2 Schuyler	59	61	76	65
3 FB 77818-013	71	91	91	84
4 FB 77818-109	64	71	74	70
5 FB 77818-138	67	72	84	74
6 FB 235-185	45	64	78	62
7 Stephens	88	71	72	77
8 FW 7380CP04	69	59	58	62
Average	64	69	77	70

[1]Percent kernels remaining on a 5.5 x .5 inch slotted screen.
LSD at 1% = 24%, LSD at 5% = 17 %.

Table 6. Heading date of winter barley and wheat planted at the Hermiston Agricultural Research Center, Hermiston, Oregon, 1981.

Entry	Planting Date[1] Sept. 2	Sept, 21	Oct. 8	Average
1 Mal	136	133	135	135
2 Schuyler	136	133	134	135
3 FB 77818-013	138	139	146	141
4 FB 77818-109	147	147	148	147
5 FB 77818-138	138	139	147	142
6 FB 235-185	148	138	144	142
7 Stephens	138	138	146	141
8 FW 7380CP04	152	154	154	154
Average	142	140	144	142

[1]Heading date from January 1.
LSD at 1% = 7 days, LSD at 5% = 5 days.

EFFECTS OF PHOSPHORUS AND COMMERCIAL LIQUID CONCENTRATES CONTAINING PHOSPHORUS IN ALFALFA WHEN GROWN ON A SANDY LOAM SITE IN THE COLUMBIA BASIN

Gary L. Prothero*

The high cost of non-forage protein has prompted alfalfa feeders to buy high protein and TDN forage resulting in higher hay prices and quicker sales. To meet the demand for high quality alfalfa hay that has 20 percent or more protein and 29 percent or less Acid Detergent Fiber, the alfalfa grower must know the factors that lead to this kind of alfalfa quality. Factors affecting quality include stage of maturity at time of harvest, cutting date, weeds, condition at time of baling, rain, insect damage, health of the plant, and varieties.

Alfalfa growers in the Columbia Basin have been associating higher protein levels with regular phosphorus fertilizer applications. As a result, this experiment was funded by local growers and fertilizer dealers to study quality responses to phosphorus fertilizer application.

METHODS

An alfalfa field at the Hermiston Research and Extension Center was selected which had no phosphorus fertilizer applied since seeding in 1980. The field was entering its fourth cutting season in 1984. Protein in recent quality hay samples from this field was in the range of 16 to 18 percent.

A soil sample taken in January 31, 1984, showed the following analysis:

pH	P ppm	K ppm	Ca meg/100	Mg gm	S ppm	B ppm	Zn ppm	Cu ppm
6.9	11	105	4.8	1.8	2.0	0.2	1.4	0.8

Fertilizer recommendations, based on this analysis, from the OSU Fertilizer Guide FG20 for Alfalfa in Eastern Oregon, were as follows:

40 to 80 lbs/acre P205
50 to 100 lbs/acre K20
25 to 40 lbs/acre of sulfur
2 lbs/acre of boron

The main experiment included 6 treatments and 5 replications of each treatment. The plots were 20 by 100 feet so the fertilizer could be applied by commercial spray equipment. The fertilizer was applied as a liquid using a 20-foot wide spray boom. From the soil analysis results, the base fertilizer application of 130 pounds K20 (KCl), 45 pounds S (Ammonium

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Thiosulfate), and 2 pounds Boron (Solubor) per acre was applied to all plots except the no-fertilizer treatment. The phosphorus was applied as phosphoric acid in 60-pound increments from 0 to 240 pounds P205 per acre.

The treatments in the main experiment were as follows:

A: No fertilizer
B: Base application, No Phosphorus
C: Base + 60 lbs. P205 per acre
D: Base +120 lbs. P205 per acre
E: Base +180 lbs. P205 per acre
F: Base +240 lbs. P205 per acre

Additional treatments were appended to the edges of the main test. Bio Huma-netics applied its products to several areas at the south edge of the experiment. The products were liquid organic based materials with some nitrogen, phosphorus and potassium (Table 1, treatments, G,H,I). North West Trading Company provided a material called PKZ. This material was applied at two rates at the north edge of the test (Table 1, treatments J,K).

The plots were harvested from the center 3 feet of each plot and were weighed. Whole plant samples were collected for protein and fiber analysis. Samples from the top 6 inches were collected for macro and micro nutrient analysis.

The field was irrigated with a hand line system at an interval of about every 7-10 days.

RESULTS

The first cutting showed a statistically significant protein response to phosphorus applied at 180 pounds per acre P205 at the 5 percent level of significance (Figure 1 LSD=1.8). The first cutting yield steadily increased from treatment A to treatment D, but fell short of statistical significance at the 95% level (LSD=21.2). However, it was significant at the 10% level. The other cuttings showed no statistically significant increases in either yield or quality (Figure 2).

Bio Huma-netics materials applied in treatment H showed the greatest difference from treatment A (no fertilizer) and was significant at the 95% level. None of the other Bio Huma-netics treatments showed a significant response for either yield or protein.

The PKZ applications resulted in a significantly lower yield than treatment A (no fertilizer). This was a dry material and was still visible on the surface of the soil at the time of first cutting. The material probably should be incorporated into the soil for best use of this material.

The tissue levels for the macronutrients and most micronutrients were above the critical nutrient range (CNR) as defined by the Western Regional Extension Publication 43 (Dow et. al.).

The plant nutrient concentration relative to the high value of the critical nutrient range indicated the only elements that are below the high value of the critical nutrient range are the copper and manganese (Figure 3). The copper and manganese values were not included in the WREP 43 publication and were taken from a Bio-Humanetics Publication and may not compare directly. These results would suggest that all of the macronutrients and most of the micronutrient were supplied in adequate quantities even in treatment A with no fertilizer applied.

DISCUSSION

The results showed only one statistically significant response to phosphate at the 180 pounds per acre application rate and only the first cutting for the replicated portion of the experiment. A trend toward higher yield for the first cutting fell short of statistical significance at the 5% level, but was significant at the 10% level. Other cuttings showed no quality or yield improvement over the different treatments.

Fertilizer was adequate according to plant tissue data for the production level at the Experiment Station. It could be speculated that this irrigation method, with intervals of approximately 7 to 10 days, tends to develop a root system that is more active to water and nutrient uptake deeper in the soil. Phosphate applications to the soil surface tend to be fixed rapidly near the soil surface. In the spring, when less evaporation and frequent rains occur, the conducting roots would be more active near the soil surface where the phosphorus was applied. As a result, early cutting would show more response to phosphorus as this test did. During the summer, the increased evaporation dries the soil surface quickly and the water and nutrient uptake occurs deeper in the soil away from the phosphate at the soil surface. This could explain why the tissue P, with later harvest, did not reflect the additional P applied.

Also, irrigation at a 7-to 10-day interval may be one factor limiting the potential yield during the summer period when evaporation rates are much higher and the soil dries quicker. The yield for the second cutting decreased substantially when compared to the first cutting.

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Table 1. Additional fertilizer treatments added to main test grown at Hermiston Research and Extension Center, Hermiston, Oregon, 1984

Treatments	Date Applied	Material	Analysis
G:(10 plots)	2/1/84	Base + 60 lbs/A P205	
		1 quart/A Humablend	8-0-0
		1 gallon/A PEK	4-0-0
H:(5 plots)	2/1/84	1 quart/A Humablend	
		1 gallon/A PEK	
	3/3/84	1 gallon/A HumaPhos	36%+Humablend
		2 gallons/A HumaK	42%+Humablend
		2 gallons/A PEK	
I:(5 plots)	2/1/84	1 quart/A Humablend	
		1 gallon/A PEK	
	3/3/84	2 gallons/A HumaPhos	
		4 gallons/A HumaK	
		2 gallons/A PEK	
J:(5 plots)	2/15/84	300 lbs/A PKZ	0-18-9-0-6Zn
K:(5 plots)	2/15/84	600 lbs/A PKZ	

Table 2. Critical Nutrient Range in Tissue for Alfalfa, (*Medicago sativa*)

Element	Low	High
P	0.25	0.30
S	0.19	0.21
Ca	0.4	1.2
Mg	0.17	0.28
Zn	10.00	14.00
B	10.00	20.00
Cu	7.00	14.00
Mn	25.00	43.00

Figure 1. Protein response of alfalfa to phosphorus applications.

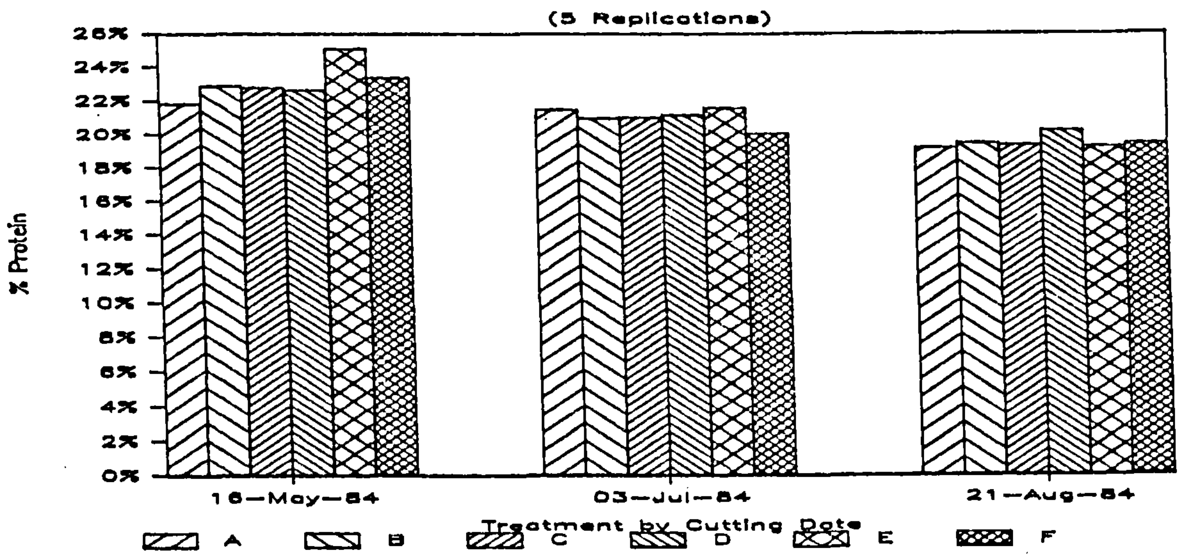


Figure 2. Yield response of alfalfa to phosphorus applications.

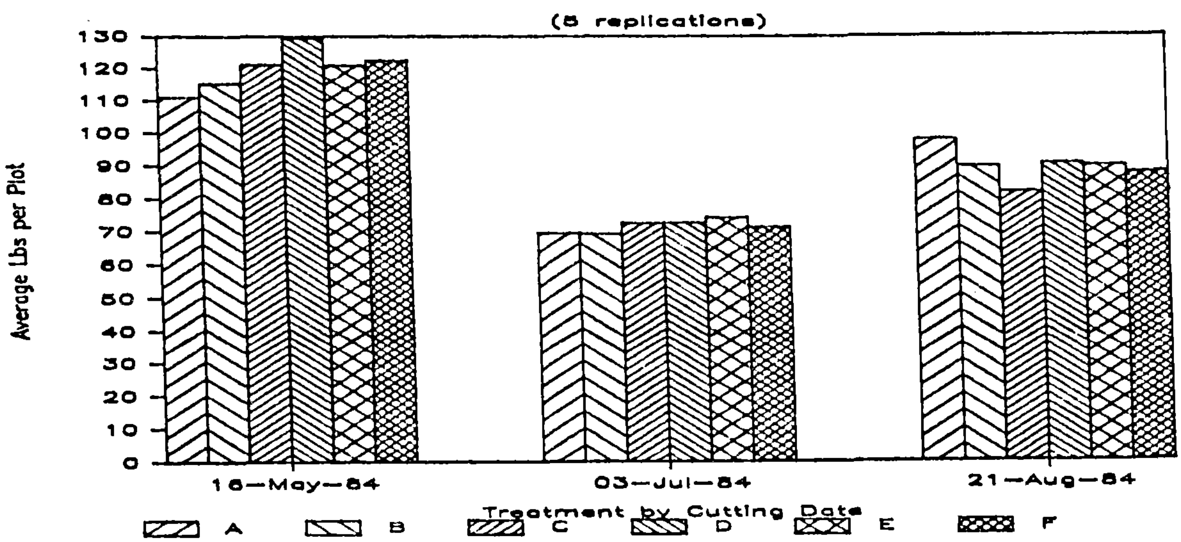
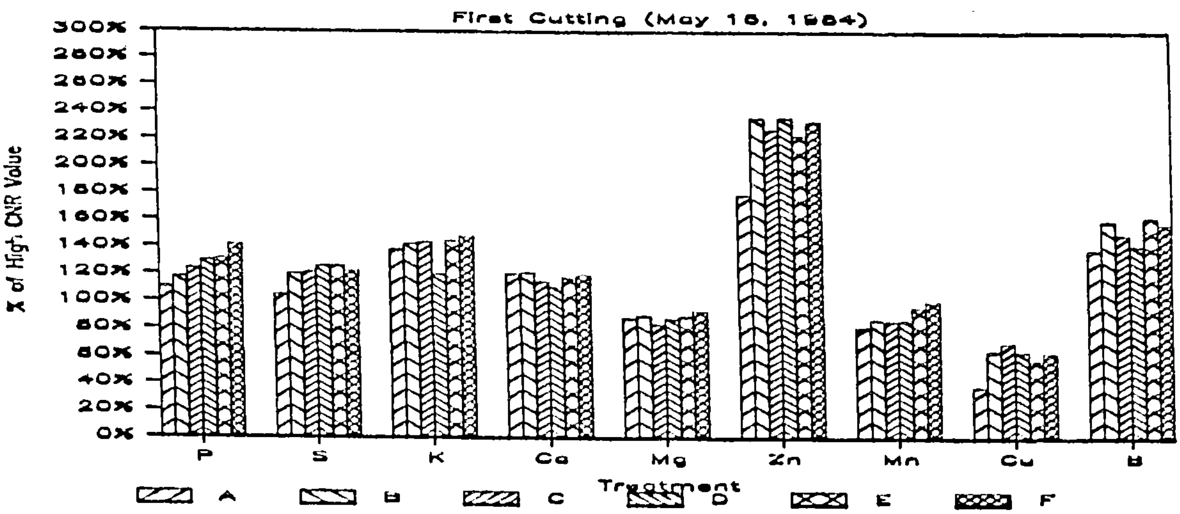
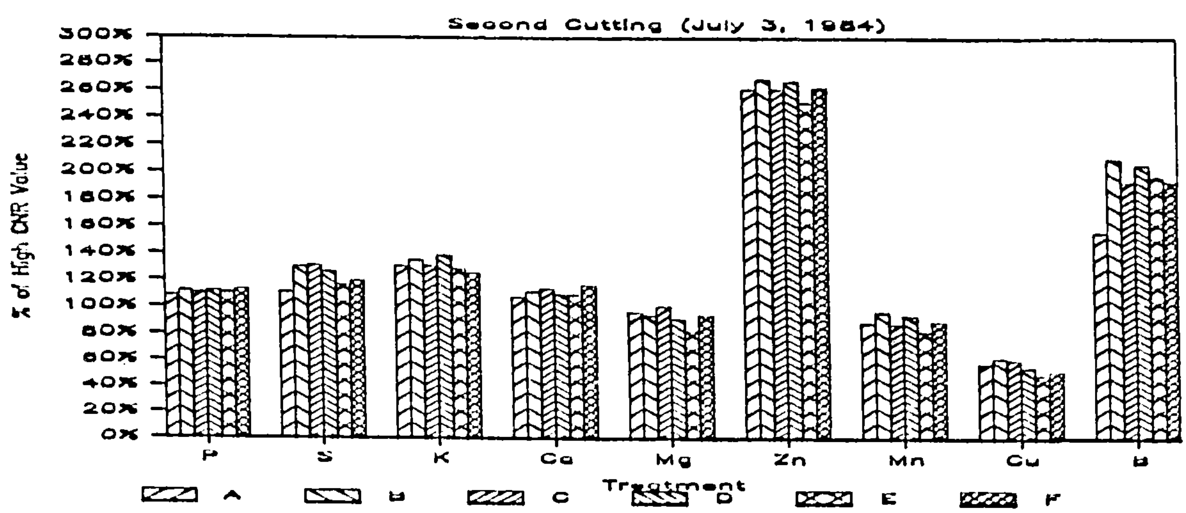
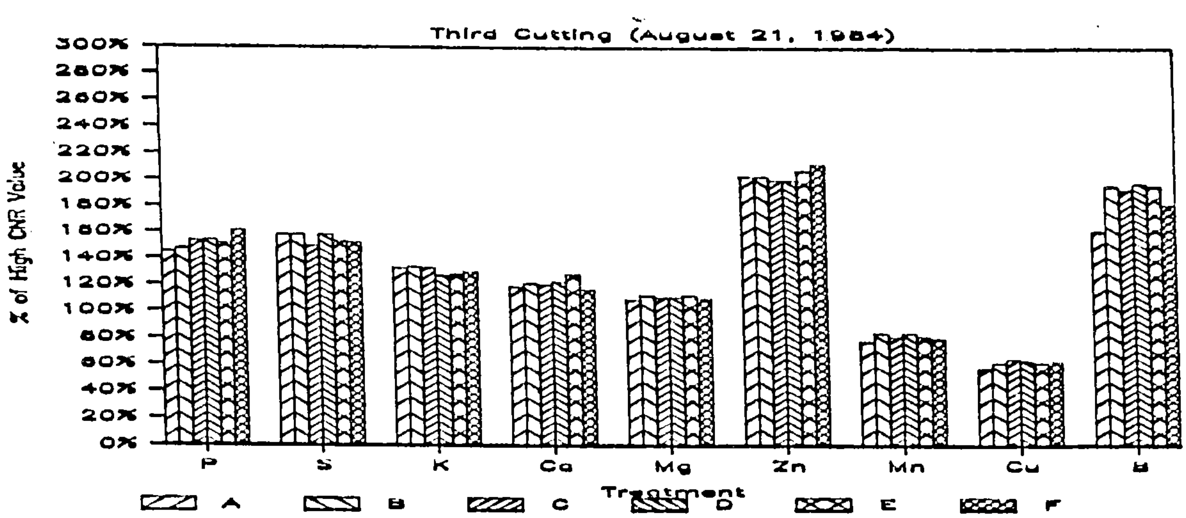


Figure 3. Plant nutrient response of alfalfa to phosphorus applications.







PLANT GROWTH REGULATOR TREATMENT OF WINTER WHEAT AND SPRING BARLEY TO PREVENT LODGING AND INCREASE YIELD

L. A. Morrison, F. V. Pumphrey, D. O. Chilcote, and M. F. Kolding[a]

Stem lodging may occur in cereal grains when the weight of the developing seed head is too great for the culm to support. Bending occurs in the lower internodes and can range from slight to severe. The timing of lodging as well as the degree of stem bending is critical to the effects on yield. Significant yield reductions can result when lodging occurs before seed filling.

An interaction of genetic and environmental factors leads to lodging. The taller the plant the more susceptible it is to lodging under conditions of high moisture, high nitrogen, and under adverse weather conditions such as wind and hail. Lodging is a problem in the tall weak-strawed cereals such as spring barley and oats. Even in semidwarf varieties, lodging can potentially pose a problem when yield-promoting nitrogen and moisture regimes cause increased plant growth.

Lodging can be controlled chemically with the use of plant growth regulators (PGR's), which simply act in the plant to reduce elongation of the internodes. Lodging is less likely to occur on a shorter plant because the environmental forces that cause a stem to bend will have a lesser effect.

PGR experiments were conducted at the Hermiston Station and near Boardman, Oregon in 1984 to test two experimental PGR chemicals on Stephens, a soft white stiff-strawed winter wheat, HRAY 16, a hard red stiff-strawed winter wheat selection, and Morex barley, a six-row weak-strawed malting barley. High density planting, high fertility, and irrigation were used to promote lodging. The experiments were designed to measure the yield enhancement derived from reduced height and lodging control due to PGR treatment.

METHODS

Stephens wheat and the selection HRAY 16 were fall planted in a high density planting, at Hermiston. Each was cross-drilled in a seven-inch spacing at a total seeding rate of 160 pounds per acre. The plot area was fertilized with a preplant nitrogen (N) treatment of 50 pounds per acre followed by 100 pounds per acre after seedling emergence.

The Boardman experiment was located in a cooperator's field where Stephens wheat was produced using conventional intensive cultural practices and pivot irrigation.

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Two high density barley experiments were spring planted on the Hermiston Station. They were cross-drilled in a seven-inch row spacing at a seeding rate of 180 pounds per acre. The seedbed was treated with a nitrogen split of 50 pounds of N worked into the soil and 100 pounds per acre N after seedling emergence. A third barley trial was seeded in standard seven-inch rows at a seeding rate of 100 pounds per acre. It was fertilized as above with a split of 50 and 50 pounds per acre for the low N treatment and a split of 50 and 100 pounds per acre for the high N treatment.

Two PGR's were applied in separate experiments to the wheat and barley fields. Paclobutrozol (Parlay), an experimental chemical available from ICI Americas, was applied at the time the plants were entering early tillering growth stage (Feekes Scale 5-6). Application was by bicycle sprayer in the wheat and by backpack sprayer in the barley. Treatment levels ranged from 0.09 to 0.45 pounds per acre active ingredient for the wheat and 0.36 to 0.89 pounds per acre active ingredients for the three barley experiments.

XE 1019, a Chevron product similar in activity to Parlay, was applied in early and late applications. In the wheat, early treatments of 0.03 and 0.06 pounds per acre active ingredients when plants were at Feekes Scale 5-6 and late treatments at the same rates were applied shortly before booting at Feekes Scale 8. In the cross-drilled barley, treatments of 0.03, 0.06, and 0.12 pounds per acre active ingredients were applied at early jointing. The XE 1019 treatments were applied with a backpack sprayer.

After heading and anthesis, lodging scores were taken using a scale of 1 to 5 where 1 is no lodging and 5 is severe lodging (i.e., plants laying on the ground). The degree of lodging in each plot was estimated by the percent of the plot lodged. Height measurements were taken in the field when the plants reached full maturity. Height measurements, including internode lengths, also were taken from samples collected from the HRAY 16 experiments and the barley nitrogen experiment. The plots were harvested with a Hege plot combine and yields were calculated in bushels per acre.

RESULTS

Wheat. No significant increase in wheat grain yields was derived from application of either Parlay or XE 1019 (Tables 1, 2, and 3). Highly significant decreases in grain yield and test weight were measured where the higher rates of Parlay were applied. The application of XE 1019 had no effect on grain test weight.

Lodging did not occur in the control of treated wheat plots. Both Parlay and XE1019 caused significant height shortening (Tables 1 and 3). Visual evaluation of plants in the field revealed detrimental effects due to excessive shortening. The compressed plant structure created in the higher Parlay treatments prevented adequate light penetration and enhanced conditions for disease development. An evaluation of stem samples taken from the HRAY 16 plots revealed that Parlay significantly shortened all five internodes whereas XE 1019 late treatments only shortened the upper three internodes.

Barley. Significant differences in yield did occur in the Parlay treated barley. Significant yield increases were measured in the nitrogen experiment; a nitrogen x Parlay interaction was not evident (Table 4). A yield increase was measured in the Parlay cross-drilled plots (Table 5). The XE 1019 did not produce any significant yield increase (Table 6).

Parlay treated plants were significantly shorter than control plants with height decreasing as the treatment rate increased (Table 4 and 5). An evaluation of stem samples taken from the nitrogen plots showed that shortening occurred in the lower internodes. XE 1019 caused a significant reduction in height only when applied at 0.12 pound per acre active ingredient (Table 6).

Lodging occurred in all three experiments. The checks lodged early during the critical seed-filling period following anthesis. Treated plots lodged later in the growing season.

DISCUSSION

The success of PGR's as lodging-control agents depends on their ability to both reduce lodging and to improve yield. The results of the semidwarf wheat experiments indicate that in the absence of lodging, yields benefit is negligible.

The semidwarf wheats used in the experiments generally are lodging resistant. Lodging did not occur at any time during the growing season. Although the PGR-treated plots showed height shortening, no benefit was gained from reduced height. Treatment of semidwarf lodging-resistant varieties with a PGR may reverse the beneficial height-yield relationship attained by breeding and have an adverse effect on grain yield and grain test weight.

Semidwarf wheat experiments conducted in 1983 were measured in several locations in Oregon. No significant increases in yield from applying PGR's. Further research efforts with PGR's concentrated on the tall-growing cereal varieties susceptible to lodging may produce positive results. The conditions of high nitrogen fertility and increased stand density also offer possibilities in testing the yield enhancing potential of chemicals such as Parlay and XE 1019.

The spring barley experiments show some positive effects from chemical shortening of the plant. Morex is a tall-growing, weak-strawed variety in Oregon. Parlay treatment successfully shortened plants to prevent lodging during the critical early seed filling period. Although no significant interaction between nitrogen rate and Parlay application was evident, additional testing is needed to evaluate the possibility of combining nitrogen with a PGR for increased yield.

The cross-drilled barley experiment was an effort to evaluate high density planting with PGR treatment. Lodging control and yield increases were accomplished, although the yield increases were not as favorable as those found in the single-drilled nitrogen experiment. Additional work is needed to explore the possible yield enhancement of a combined density-PGR regime. Future tests could compare narrow-row spacing with the cross-drill arrangement. European systems, for example, have reported improved yields in high density plantings using a narrow four-inch row spacing.

Rates of application in the XE 1019 experiments were considerably lower than those in the Parlay experiments. Because these compounds appear similar in effect, rates for the XE 1019 were probably too low. Although the later treatments, made at Feekes Scale 8 plant growth, produced a trend for shorter plants, yield did not increase. In future tests of XE 1019, similar treatment rates and dates in those used for Parlay are advisable for a direct comparison between the two chemicals.

Chemical shortening with PGR's appears to have either a detrimental or beneficial effect depending on the inherent susceptibility of the cereal variety to lodging. Chemical height control may be economically beneficial when plant height and environmental conditions promote lodging during the period of growth when yield will be adversely affected. When these conditions are not present, PGR's appear to cause yield decreases.

Table 1. Effect of Parlay growth regulator on grain yield, test weight, and height of Stephens and HRAY 16 wheat, Hermiston Agricultural Research and Extension Center, Hermiston, Oregon.

	VARIETY					
	Stephens			HRAY 16[1]		
Rate[2]	Grain Yield	Test Weight	Plant Height	Grain Yield	Test Weight	Plant Height
	bu/a	pounds	inches	bu/a[3]	pounds	inches
0.00	152	60.9	41	129	64.3	45
0.09	145	59.1	33	135	64.1	40
0.17	138	58.2	28	135	63.0	36
0.27	131	56.9	26	131	62.3	34
0.36	121	56.6	23	120	61.5	31
0.45	118	55.7	22	117	61.6	30

[1]HRAY 16 is a line of hard red winter wheat having the pedigree SWD 71271...2HH, Inia, 66R/2/HBGN/CO.
[2]Pounds of active ingredient per acre.

Table 2. Effect of parlay growth regulator on grain yield and test weight of Stephens wheat, Boardman, Oregon, 1984.

Active[1] Ingredient	Grain Yield	Test Weight
	bu/a	lbs/bu
0.00	159	58.2
0.09	145	55.7
0.17	137	54.7
0.27	126	52.6
0.36	130	53.1
0.45	115	52.4
LSD. 01	18	2.4

[1]Pounds of active ingredient per acre.

Table 3. Effect of XE 1019 growth regulator on grain yield and height of Stephens and HRAY 16 wheat, Hermiston Research and Extension Center, Hermiston, Oregon, 1984.

Active[1] Ingredient	Stephens Grain Yield	Stephens Plant Height	HRAY 16 Grain Yield	HRAY 16 Plant Height
	bu/a	inches	bu/a	inches
0.00	154	41	134	46
0.03 early	152	42	133	46
0.03 late	---	--	127	42
0.06 early	157	39	131	44
0.06 late	148	34	131	40
LSD .05	NS		NS	
LSD .01	NS	2	NS	3

[1]Pounds of active ingredient per acre. No late treatment at the 0.03 rate was applied in the Stephens wheat experiment.

Table 4. Effect of Parlay on height and grain yield of normally drilled Morex Barley. Hermiston Research and Extension Center, Hermiston, Oregon, 1984.

Rate[1]	Plant Height	Grain Yield
	in	bu/a[2]
0.00	55	82
0.36	48	108
0.53	46	111
0.71	43	125
0.89	42	126
LSD .01	2	12

[1]Pounds of active ingredient per acre.
[2]Bushels per acre were calculated using a standard 48 pound bushel.

Table 5. Effect of Parlay treatment on height and grain yield of cross-

drilled Morex barley. Hermiston Agricultural Research and Extension Center, Hermiston, Oregon.

Rate[1]	Plant Height	Grain Yield
	inches	bu/a[2]
0.00	50	66
0.36	46	90
0.53	41	92
0.71	39	94
0.89	39	99
LSD .01	2	2

[1]Pounds of active ingredient per acre.
[2]Bushels per acre were calculated using a standard 48 pound bushel.

Table 6. Effect of XE 1019 on grain yield and height of cross-drilled Morex barley. Hermiston Agricultural Research and Extension Center, Hermiston, Oregon. 1984.

Rate[1]	Plant Height	Grain Yield
	Inches	bu/a[2]
0.00	49	65
0.03	49	66
0.06	48	76
0.12	45	81
LSD .01	2	NS
LSD .05		NS

[1]Pounds of active ingredient per acre.
[2]Bushels per acre were calculated using a standard 48 pound bushel.

WINTER HARDINESS OF GRAPES AT HERMISTON, OREGON

F. V. Pumphrey[6]

Twenty five years ago over thirty varieties of table grapes (Vitis Labrusca), wine grapes (Vitis Vinifera) grown as table grapes, and hybrids of these two species were planted on the Hermiston Research and Extension Center. In 1974 numerous varieties of wine grapes were planted, and in recent years seedless grape varieties were planted. Temperatures of minus five degrees or lower have occurred since these plantings were made. Two extended colder periods were January 6, 7, 9, and 10, 1974 with low temperatures of -8, -8, -11, and -10 degrees F, respectively and December 21, 22, 23, and 24, 1983 with low temperatures of -10, -13, -17, and -15 degrees F, respectively. All but the most winter hardy grapes are injured by temperatures below minus five degrees.

Several conditions interacted to cause more than the usual injury to grapes during the 1983-84 winter. Warmer than average fall temperatures plus too much late summer and fall irrigation promoted vegetative growth which minimized plant hardening for surviving an abrupt change to freezing temperatures or subzero temperatures during the winter. Winter injury was evaluated in mid-May, 1984 during normal vigorous leaf and new cane growth on uninjured plants.

Several of the table grape varieties are vigorous and productive after 25 years (Table 1). Some of the new seedless varieties have sufficient winter hardiness for the home gardener. All the wine grape varieties planted did not exhibit sufficient winter hardiness (Table 2). Most varieties sprouted abundantly from the base when the trunk was killed so that a new trunk could be developed. Re-establishing a new trunk is a possibility for the home gardener, but is a disaster for the commercial producer.

Winter killing of the terminal portions of canes can be tolerated since the killed areas are removed during pruning. For persons not acquainted with successful grape growing, pruning appears quite severe. Each year in late winter, or early spring all canes of table grapes are removed at the trunk except for a few of the stronger, better located canes. These few canes are cut back to short spurs containing two to four buds. Grape flowers are borne on shoots of the present season which arise from canes of the previous season. Wine grape pruning varies slightly from table grape pruning.

Professor, Oregon State University, Hermiston Agricultural Research & Extension Center, Hermiston, Oregon, 97838.

Table 1. Winter injury of table grape varieties grown at the Hermiston Research and Extension Center, May, 1984.

Variety	Age[1]	Remarks
Aqawam	25	No winter injury, vigorous
Athens	25	No winter injury
Baco 1	25	No winter injury, vigorous
Blackrose	25	Trunk dead, sprouting from base
Buffalo	25	Sprouting from trunk, weak
Cardinal	2	Trunk dead, sprouting from base
Catawba	25	No winter injury, vigorous
Cinsout	25	Dead trunk, sprouting from base
Concord	25	No winter injury, vigorous
Deleware	25	No winter injury, vigorous
Flame	2	No winter injury
Golden Muscat	25	No winter injury, vigorous
Hector	25	No winter injury, vigorous
Himrod	2	Slightly injured, vigorous
Interlaken	2	Trunk dead, sprouting from base
Keuka	25	Trunk injured, weak sprouting from base
Lakemont	2	Cane injury, moderately vigorous
Muscat Ottonell	2	Weak, sprouting from base
Niagara	25	No winter injury, vigorous
Ribier	25	Trunk dead, sprouting from base
Ruby	25	No winter injury, vigorous
Sanderson	25	No winter injury, vigorous
Scarlet	25	Trunk dead, sprouting from base
Sheridan	25	No winter injury, vigorous
Steuben	25	No winter injury, vigorous
Suffolk Red	2	No winter injury, vigorous
Sweetwater	25	Winter injury to canes
Urbana	25	Slight winter injury
Weingarten	25	Slight winter injury
Worden	25	No winter injury, vigorous
Yates	25	No winter injury, vigorous

[1]Number of years since planting.

Table 2. Winter injury of wine grapes (Vitis vinifera) grown at the Hermiston Research and Extension Center, Hermiston, Oregon, May 1984.

Variety	Age[1]	Remarks
Black Monukka	3	Trunk dead, sprouting from base
Carignane	9	Trunk dead, sprouting from base
Chordonnay	3	Trunk dead, sprouting from base
Flora	9	Winter injury to canes
Gamay	9	Trunk dead, sprouting from base
Grenache	9	Trunk dead, sprouting from base
Helena	9	Trunk dead, sprouting from base
Limberger	2	Injured, moderately vigorous
Muscat Blanc	9	Trunk dead, sprouting from base
Pearl DeCsaba	3	Trunk dead, sprouting from base
Pinot Blanc	9	Trunk dead, sprouting from base
Pinot Noir	25	Trunk dead, sprouting from base
Red Veltliner	2	Trunk dead, sprouting from base
Thompson Seedless	2	Trunk dead, sprouting from base
Sauvignon Blanc	9	Trunk dead, sprouting from base
Sylvaner	9	Trunk dead, sprouting from base
White Riesling	9	Trunk dead, weak sprouting from base

[1]Number of years since planting.

AGRICULTURAL IRRIGATION SCHEDULING

Gary Prothero and Fred Ziari[7]

The north Morrow and west Umatilla counties irrigate 170,000 acres, 140,000 of them sprinkler irrigated. With power costs increasing and allocation of water resources becoming a more important issue, there is a great potential to increase irrigation efficiency through scheduling.

The Irrigation Scheduling in Umatilla and Morrow counties is one of the most successful in the nation primarily because of the method of information delivery and the availability of local help to the grower.

First, providing irrigation scheduling information to farmers is a communication problem. One major bottle neck to farmer acceptance has been the timely delivery of scheduling information. A cooperative project with Umatilla Electric Cooperative significantly improved communications between the farms and the scheduling information.

Climatic information (wind, solar radiation, temperature, rainfall, relative humidity) is collected by an automated weather station installed by BPA in Boardman and beamed to Boise by satellite. Then the information is sent to Umatilla Electric via telephone modem. The information is integrated into a Computerized Irrigation Scheduling Model and the results are made available to the local growers via a computer bulletin board or telephone answering machine, Figure 1.

Second, Umatilla Electric Coop (Fred Zairi) and the O.S.U. Extension Service in Hermiston (Gary Prothero) have presented workshops and worked with growers on an individual basis to help the local growers understand and use the irrigation scheduling information to save water and energy.

For 1986, an estimated 50,000 acres of irrigated farm land are being scheduled using this information. Water savings have been estimated at between 30% to 40%. ?How many $$$$$$$$?

Accurate scheduling of irrigation water is important to all of us because it preserves our natural resources, both water and energy, and because it provides more reliable and less expensive food production for the U.S. consumer.

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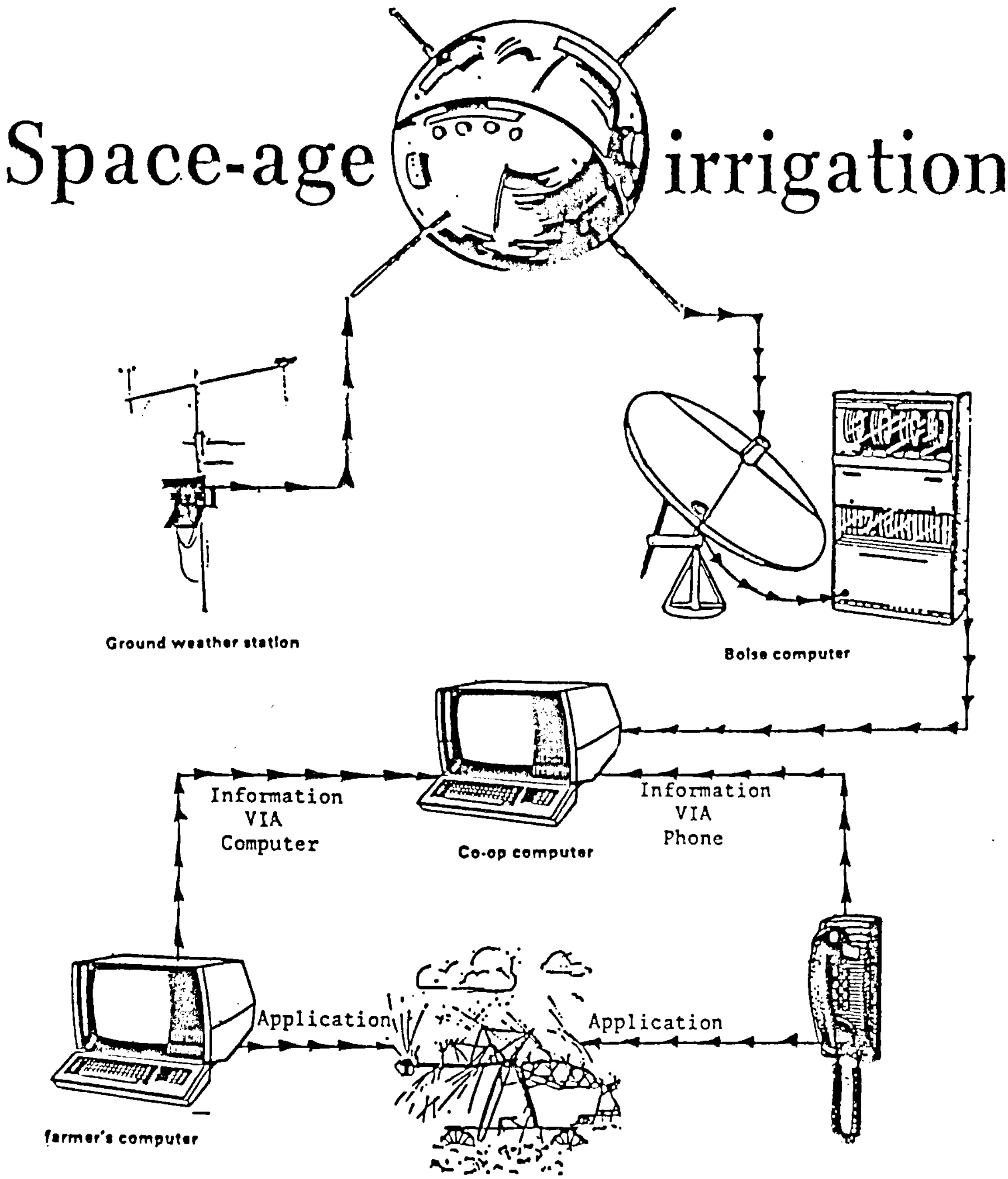
[7]Area Extension Agent, Oregon State University, Hermiston Agricultural Research & Extension Center, Hermiston, Oregon 97838 and Irrigation Specialist, Umatilla Electric Cooperative Association, Hermiston, Oregon 97838.

Figure 1. Cooperative agricultural irrigation scheduling: Umatilla Electric Cooperative Association + OSU Extension Service + Bonneville Power Administration + Grower.



SCHEDULING LAWN IRRIGATION

Gary L. Prothero[a]

Controlling the volume of water applied to our lawns is generally a hit or miss situation. Often this leads to problems with the lawn and higher than necessary water bills. Since plants use water according to the growth stage and weather conditions (the hotter the day, the more water a plant will use), it is possible to predict water usage from historical weather records. The following procedure can be used to estimate how much water your lawn needs on the basis of historical weather records from the OSU-HAREC station:

1. From Table 1, find the average evaporation for the next week.

   - pick a day of the week on which you wish to schedule your irrigation. Find the Average Weekly Pan ET from table Table 1 that day.

     example: On May 25, the Weekly Pan ET was 2.00 inches

   - multiply the Weekly Pan ET times 0.8 to estimate the inches of water used by the lawn for the next 7 days.

     example: For May 25 to May 31, the estimated water needed is 2.00 times 0.8 equals 1.6 inches.

   - calculate the hours to irrigate for the week by dividing the inches required by the application rate of your sprinkler system (see tuna can method below).

     Hours = inches per week / inches per hour

2. Determine the amount of water your are applying per hour.

   - set out 3 tuna cans under the sprinkler.
   - measure the inches of water collected by each can during 10 minutes.
   - average the inches collected for the 3 tuna cans.
   - calculate the application in inches of water applied per hour as follows:

     Inches in the can times 6 equals inches/hour

3. This procedure should be repeated each week throughout the irrigation season.

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[a]Area Extension Agent, Oregon State University, Hermiston Agricultural Research & Extension Center, Hermiston, Oregon 97838.

Table 1. Average Weekly Pan Evaporation (Pan ET) Data from the Oregon State University, Hermiston Agricultural Research & Extension Center, Hermiston, Oregon. 1970 to 1984.

Date	Pan ET	Date	Pan ET	Date	Pan ET	Date	Pan ET	Date	Pan ET	Date	Pan ET
Mar 03	0.58	Apr 07	1.21	May 12	1.80	Jun 16	2.23	Jul 21	2.62	Aug 25	1.75
04	0.60	08	1.23	13	1.82	17	2.25	22	2.61	26	1.72
05	0.63	09	1.26	14	1.84	18	2.25	23	2.61	27	1.70
06	0.67	10	1.28	15	1.86	19	2.26	24	2.62	28	1.68
07	0.70	11	1.30	16	1.89	20	2.27	25	2.62	29	1.68
08	0.72	12	1.32	17	1.92	21	2.28	26	2.62	30	1.67
09	0.74	13	1.33	18	1.93	22	2.29	27	2.63	31	1.68
10	0.77	14	1.34	19	1.94	23	2.29	28	2.63	Sep 01	1.69
11	0.79	15	1.34	20	1.95	24	2.30	29	2.62	02	1.68
12	0.81	16	1.33	21	1.96	25	2.31	30	2.58	03	1.67
13	0.82	17	1.33	22	1.96	26	2.32	31	2.55	04	1.64
14	0.84	18	1.33	23	1.97	27	2.33	Aug 01	2.51	05	1.61
15	0.86	19	1.34	24	1.98	28	2.33	02	2.48	06	1.58
16	0.87	20	1.35	25	2.00	29	2.31	03	2.44	07	1.54
17	0.89	21	1.37	26	2.02	30	2.32	04	2.40	08	1.51
18	0.91	22	1.40	27	2.03	Jul 01	2.33	05	2.37	09	1.48
19	0.93	23	1.44	28	2.06	02	2.33	06	2.35	10	1.46
20	0.95	24	1.49	29	2.08	03	2.34	07	2.33	11	1.44
21	0.97	25	1.53	30	2.09	04	2.35	08	2.29	12	1.42
22	0.99	26	1.55	31	2.10	05	2.38	09	2.25	13	1.39
23	1.00	27	1.59	Jun 01	2.11	06	2.42	10	2.22	14	1.35
24	1.01	28	1.61	02	2.12	07	2.45	11	2.17	15	1.30
25	1.02	29	1.63	03	2.13	08	2.47	12	2.13	16	1.26
26	1.03	30	1.64	04	2.12	09	2.51	13	2.08	17	1.22
27	1.04	May 01	1.64	05	2.12	10	2.54	14	2.03	18	1.19
28	1.04	02	1.65	06	2.12	11	2.57	15	1.99	19	1.16
29	1.06	30	1.66	07	2.13	12	2.60	16	1.95	20	1.14
30	1.07	04	1.68	08	2.14	13	2.62	17	1.91	21	1.13
31	1.09	05	1.69	09	2.14	14	2.63	18	1.89	22	1.12
Apr 01	1.10	06	1.71	10	2.16	15	2.65	19	1.87	23	1.11
02	1.12	07	1.72	11	2.18	16	2.66	20	1.85	24	1.10
03	1.13	08	1.74	12	2.19	17	2.66	21	1.83	25	1.08
04	1.15	09	1.76	13	2.20	18	2.66	22	1.81	26	1.07
05	1.17	10	1.77	14	2.21	19	2.65	23	1.80	27	1.06
06	1.19	11	1.78	15	2.22	20	2.64	24	1.78		

1984 - MONTHLY METEOROLOGICALSUMMARY
OSU, HERMISTON AGRICULTURAL RESEARCH & EXTENSION CENTER, HERMISTON, OREGON

D. C. Hane and G. L. Reed[9]

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TEMPERATURE - Degrees Fahrenheit												
Overall Average												
1984	33	44	47	50	56	62	70	71	60	50	42	30
LT[10]	32	38	45	54	61	64	74	73	64	53	41	36
Average Maximum												
1984	40	48	58	61	67	75	84	86	74	62	49	38
LT	40	47	57	70	74	81	90	88	80	67	51	45
Average Minimum												
1984	26	32	37	39	44	52	56	56	46	37	34	22
LT	23	28	33	37	47	47	58	58	48	39	31	27
Monthly												
Maximum	60	64	69	77	90	90	98	97	91	80	64	53
Minimum	8	23	24	29	33	34	45	44	31	21	25	-5
EXTREMES												
Maximum	69	74	82	93	102	108	112	113	102	88	77	70
Year	1971	1972	1960	1934	1983	1951	1939	1961	1944	1943	1934	1941
Minimum	-31	-29	8	19	22	34	39	38	26	7	-12	-17
Year	1957	1950	1955	1972	1954	1984	1962	1980	1983	1935	1955	1983
PRECIPITATION - Inches												
1984	.4	1.0	1.4	1.1	1.0	.8	.0	.1	.7	.4	1.9	.1
LT	1.2	.9	.8	.7	.7	.6	.2	.3	.4	.8	1.2	1.3
LT Maximum	3.1	2.7	2.7	2.1	2.2	2.2	1.0	1.8	2.0	3.9	3.8	3.5
Year	1970	1940	1957	1974	1962	1948	1968	1979	1946	1957	1973	1973
EVAPORATION - Inches												
1984			2.9	5.4	7.1	8.4	10.9	9.5	6.4	Total	50.6	
LT			3.2	5.3	8.1	9.6	11.2	9.7	6.2	Total	53.3	
WIND VELOCITY - Average Miles Per Hour												
1984	2.5	2.8	3.2	4.1	4.4	4.1	2.9	3.0	3.1	2.9	2.8	2.8
LT	2.5	2.9	3.8	4.3	4.0	4.1	3.6	3.1	2.6	2.2	2.2	2.5

[9]Potato Specialist and Vegetable Crops Specialist, Oregon State University, Hermiston Research & Extension Center, Hermiston, Oregon, 97838.

[10]Long Term Average - 1932-1984.

1985 - MONTHLY METEOROLOGICAL SUMMARY
OSU, HERMISTON AGRICULTURAL RESEARCH & EXTENSION CENTER, HERMISTON, OREGON

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
TEMPERATURE - Degrees Fahrenheit													
Overall Average													
1985	28	32	45	54	61	67	77	69	58	51	30	21	
LT[11]	32	37	45	54	61	64	74	73	64	53	41	35	
Average Maximum													
1985	31	42	57	67	74	80	94	83	71	63	38	26	
LT	40	47	57	70	74	81	90	88	80	67	51	44	
Average Minimum													
1985	25	21	32	41	48	53	60	54	45	38	21	16	
LT	23	27	33	38	47	47	58	58	48	39	31	27	
Monthly													
Maximum	40	61	67	80	90	95	102	94	82	76	65	39	
Minimum	16	-10	23	29	32	41	48	44	25	25	-11	-7	
EXTREMES													
Maximum	69	74	82	93	102	108	112	113	102	88	77	70	
Year	1971	1972	1960	1934	1983	1951	1939	1961	1944	1943	1934	1941	
Minimum	-31	-29	8	19	22	34	39	38	25	7	-12	-17	
Year	1957	1950	1955	1972	1954	1984	1962	1980	1985	1935	1955	1983	
PRECIPITATION - Inches													
1985	.3	1.1	2.1	.6	.1	.6	.0	.4	.5	.9	1.7	.2	
LT	1.2	.9	.8	.7	.7	.6	.2	.3	.4	.8	1.2	1.3	
LT Maximum	3.1	2.7	2.7	2.1	2.2	2.2	1.0	1.8	2.0	3.9	3.8	3.5	
Year	1970	1940	1957	1974	1962	1948	1968	1979	1946	1957	1973	1973	
EVAPORATION - Inches													
1985			3.7	6.3	8.8	9.7	12.0	9.4	4.8	Total	54.7		
LT			3.3	5.4	8.1	9.5	11.2	9.6	6.1	Total	53.1		
WIND VELOCITY - Average Miles Per Hour													
1985	1.3	3.0	3.6	4.4	4.2	3.4	2.8	3.4	2.9	3.4	3.3	1.7	LT
LT	2.5	2.9	3.8	4.4	4.1	4.1	3.6	3.2	2.6	2.3	2.3	2.5	

[11]Long Term Average - 1932-1984.

WEATHER EXTREMES

FROST-FREE DAYS

1984	153 days	April 28 to September 28
1985	139 days	May 12 to September 28
LT	169 days	April 23 to October 9
Longest Frost Free Period	211 days	1937
Shortest Frost Free Period	126 days	1970

EXTREMES

Spring

Earliest	March 27, 1948	19 degrees
Latest	May 23, 1964	30 degrees

Fall

Earliest	September 13, 1970	30 degrees
Latest	November 4, 1937	32 degrees

PRECIPITATION

Accumulated

1984	9.41 inches
1985	8.69 inches
LT	9.06 inches

EXTREMES

Maximum	14.74 inches	1983
Minimum	4.43	1967
24 - hour period	3.36	October 6, 1957

SNOW EXTREMES

24 hour period	7 inches	December 14, 1948
On ground at 8AM	12 inches	January 10, 1980
Month of December	11 inches	1983