Potato, Cereal, and Forage Research, 1988

Klamath Agricultural Experiment Station

in cooperation with

Klamath County

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Contents

INTRODUCTION

The Klamath Experiment Station (KES) staff is pleased to present to our clients, colleagues, supporters, and friends a summary of research progress in 1988. As an introduction some of the many changes that have occurred in the past year in KES staff, programs, facilities, and partnerships have been highlighted.

The KES was founded nearly fifty years ago as a partnership between Oregon State College and Klamath County. Those who have served as county government officials over this half-century have recognized the importance of agriculture to the local economy, the need for locally based research to support the industry, and the benefits that have accrued to all residents of Klamath County from this partnership. The relationship is unique in the Oregon Agricultural Experiment Station network, and is a model desired by other counties and Branch Experiment Stations.

At KES, as at other units, aging facilities and limited financial resources have combined to restrict the ability to meet maintenance needs, conduct state-of-the-art research programs, and retain quality staff. In 1988 the Klamath County Board of Commissioners and the layperson budget committee members set a course to remedy serious deficiencies and upgrade the facilities at KES. A three-year facilities improvement plan was requested and the first phase was funded for 1988-1989.

Mike Crounse joined the KES county staff on August 1 to implement the facility improvement package. Major accomplishments to date have included construction of a new hazardous chemical storage room, a remodeled storage area for irrigation equipment, installation of metal siding and roofing on one building, and upgraded electrical service in two buildings. Work has been initiated on a complete renovation of an existing building to a quality laboratory for potato and other high-value crops. This facility will be ready for use in 1989.

Progress has been made on updating equipment. Oregon Agricultural Experiment Station funds have been used to upgrade the computer capability, assist with electrical service improvements, and acquire specialized research equipment. Several vehicles, farm equipment items, and laboratory equipment have been obtained through government surplus property programs. A spring sale of outdated vehicles and equipment will provide funds to fill several additional urgent needs.

Grounds maintenance and improvement projects have been a joint effort enthusiastically shared by all staff. Goals for the future include an aesthetically pleasing blend of buildings and grounds with reduced maintenance requirements. The proximity of KES to an ambitious Klamath County Airport expansion project justifies some urgency to this aspect of station improvements.

Research programs have undergone revisions and changes in emphasis. Forage research is focused on management of grass pastures and wetland meadows, very important components of the cattle industry. Grazing management, species composition, and pasture improvement through interseeding will be evaluated. Cooperative studies with University of California faculty are underway.

Variety evaluation for cereals will continue in cooperation with several northwestern breeding programs. Outstanding performance has been identified under local conditions for two malting barley types and a hard white wheat line. Oat production and soil fertility research programs, particularly micro-nutrients in organic soils of the lower basin, is receiving increased attention. Cooperative programs with the University of California Tulelake Field Station are being initiated.

The potato research program has also been revised and expanded. Increasing emphasis is directed at the development of variety specific cultural management systems for varieties which are either new releases or new to the region. The first red-skinned variety screening program in the Northwest was established in 1988 to assist the local industry in achieving a market share in this small but growing segment of the industry. A data base on the suitability of local crops for processing is being developed. The eventual establishment of a processing industry in the Klamath Basin seems likely if processing quality can be achieved. This would add stability to an industry presently susceptible to the wide fluctuations in fresh market prices. An evaluation of fertilization requirements under current cropping practices and economic conditions has also been implemented. Completion of a potato quality laboratory facility will allow expanded efforts in identification of superior lines in Oregon and western regional potato variety development programs. The KES will continue to participate in the statewide variety development program, with emphasis on identification of superior fresh market lines suited to the short growing season of the Klamath Basin.

Professor George Carter retired in January 1989 after a 28 year career at KES. George devoted much of his efforts to potato research and was instrumental in the establishment of a potato variety development program in Oregon. He served as station Superintendent from 1972 until July 1987. The KES staff wish George and Rowena all the best in their retirement years.

Greg Chilcote was promoted in 1988 from Research Aide to Research Technician. Greg has been an important part of the cereals program for seven years. His electronic expertise has been invaluable in updating computer technology at KES.

All KES staff members enthusiastically embrace a period of change as the 1990's are approached. Clients, colleagues, supporters, and friends are invited to visit KES and observe progress firsthand. Your comments on this progress report and any suggestions on how we might better fulfill our mission are welcome.

Ken Rykbost, Superintendent
KLAMATH EXPERIMENT STATION

APPRECIATION

The assistance of those who contributed in numerous ways to KES programs in 1988 is gratefully recognized. We particularly wish to express our gratitude to: The Klamath County Board of Commissioners; Chairman Sam Henzel and members of the KES Advisory Board; Chairman Ron Hathaway, Rodney Todd, and Dale Beck of the Klamath County Extension Service; The Oregon Potato Commission; Dr. Harry Carlson and other faculty members of the University of California; and many faculty members at Oregon State University and Branch Experiment Stations.

STAFF AT KES

Dr. Kenneth A. Rykbost.. Superintendent, Associate Professor of Crop Science
Dr. Randy L. Dovel...................... Assistant Professor of Crop Science
George E. Carter............................. Associate Professor Emeritus
Betty Bragg.. Clerical Specialist
Jerry Maxwell.................... Experimental Biology Technician (potatoes)
James Rainey III................. Experimental Biology Technician (forages)
Philip G. Wilson... Farm Unit Foreman
Greg Chilcote.................Research Technician (grain) - (Klamath County)
Larry Johnson...................... Facility Maintenance - (Klamath County)
Mike Crounse............................ Utility Worker - (Klamath County)

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Agriculture in Klamath County

K. A. Rykbost

Agriculture is second only to lumber and wood products in importance to the economy of Klamath County. Gross sales of agricultural products in the county are estimated to total $95,000,000 for 1988. This represents a 20 percent increase over the previous four-year average, due mainly to price increases for the major commodities sold - hay, grain, potatoes, and cattle.

Agricultural production in Klamath County has remained stable over several decades. While Oregon's agriculture is highly diversified, the industry in Klamath County is highly concentrated in just four commodities. This can be largely attributed to climatic limitations, isolation from large population centers, and a lack of secondary processing industries.

Crop production acreages have declined slightly over the past five years (Table 1), mainly due to diversion of grain acreages into government conservation and set-aside programs. Hay and potato acreages have remained quite stable over this period.

An overview of the agricultural economy is perhaps best seen in an economic context (Table 2). Cattle and calves account for 40 percent of total sales and 80 percent of livestock and animal product sales. They also account for significant consumption of locally produced hay and grain crops. Summer grazing by a large transient herd of California cattle is not clearly documented in statistical summaries, as most of these cattle are sold in California. Transients do not appear on cattle inventories which are compiled in January. The total impact of cattle on the county's economy, therefore, may be underestimated.

Potatoes are the second leading commodity in sales. Approximately 15 percent are grown for seed. The majority of the seed is utilized in the Klamath Basin and in the Bakersfield area in California. The remaining acreage is predominantly Russet Burbank destined for fresh markets in California. While potato acreage has remained fairly constant over the five-year period, cash value has fluctuated widely in response to price instability. Potatoes offer the best potential for profitability in high-price years. However, production costs are high and losses can be substantial.

Alfalfa hay accounts for the third highest sales volume and has been the most stable commodity. Most of the crop is sold to the California dairy industry. Other hay represents a significant acreage and cash value, but over 70 percent is used locally to feed overwintering cattle. Interestingly, the majority of this is quackgrass, considered a noxious weed in most areas of the world, but an important forage species in Klamath County.

Grain production is dominated by spring barley marketed largely as feed grain in California. A small percentage of malting barley is produced; however, price premiums may not compensate for lower yields achieved with currently available malting quality cultivars. Wheat has accounted for a steady 20 percent of the grain acreage. Oat production has declined over the five-year period. Oat quality in Klamath County has historically been exceptional but market opportunities have been less favorable. This appears to be changing presently and oat acreage may increase sharply in the near future.

Dairy products are the only other commodity with a significant sales volume. Sales value has increased by 40 percent in the last five years. A northerly migration of California dairies may eventually impact Klamath County significantly.

Irrigation is the key to crop production in Klamath County. Potato crops are universally grown under solid-set sprinklers for frost protection capability. Alfalfa and a major portion of grain crops are also sprinkler-irrigated. Dryland grain is flood-irrigated prior to planting. Large acreages of other hay and pastures are flood irrigated periodically throughout the season. Irrigation water is derived mainly from Klamath Lake and Clear Lake which are linked through a series of canals and drains installed as the Klamath Reclamation Project in the early 1900's. This system is the lifeblood of agriculture in the Klamath Basin.

To complete the overview of local agriculture it is necessary to include the northern portions of Modoc and Siskiyou counties of California which represent approximately one-half of the region known as the Klamath Basin. The crop distribution is different in California's portion of the basin, but includes the same major crops. Total farm sales are approximately double Klamath County sales. Total basin acreages are approximately: grains - 110,000; alfalfa - 70,000; potatoes - 25,000. Cattle numbers are similar to those of Klamath County in the California portion of the basin.

This brief glimpse of agriculture in Klamath County explains the historical direction of agricultural research efforts at KES. The main emphasis continues to be in forages, cereals, and potatoes. Although livestock studies are not a part of the current program, the efforts in forage research have direct application to the cattle industry. Undoubtedly the near future will see some shift in emphasis to address emerging issues such as sustainable (low-input) agriculture, soil and water conservation, water quality, and biotechnology. However, the first priority will continue to be providing clients in the Klamath Basin with the tools necessary to remain competitive in the agricultural community.

Table 1. Estimated crop acreages[1] in Klamath County.

CROP	HARVESTED ACRES 1984	1985	1986	1987	1988
Grain:	53,200	50,800	45,000	44,500	45,500
Barley	37,500	33,000	30,000	30,000	30,000
Wheat	6,700	9,300	10,000	8,000	9,000
Oats	8,000	7,500	4,000	5,500	5,500
Rye	1,000	1,000	1,000	1,000	1,000
Hay and Forage:	73,000	73,000	77,250	78,250	74,500
Alfalfa	43,000	43,000	44,000	43,000	43,000
Other Hay	30,000	30,000	32,000	34,000	30,000
Hay Silage	--	--	1,250	1,250	1,500
Potatoes:	10,600	11,500	10,500	10,900	10,000
All Crop Total:	136,800	138,500	133,050	134,030	130,250

1/ Source - various sources compiled by the Oregon State University Department of Agricultural and Resource Economics.

Table 2. Estimated Gross Cash Farm Income[1] for Klamath County, Oregon

Commodity	VALUE OF SALES (000'S $) 1984	1985	1986	1987	1988
Grain:	11,149	8,200	6,786	8,014	11,283
Barley	7,481	5,144	4,303	5,110	6,929
Wheat	2,158	2,136	1,773	1,764	2,964
Oats	1,456	869	672	1,090	1,337
Rye	54	51	38	50	56
Hay & Forage:	11,775	11,183	11,139	10,513	11,573
Alfalfa	10,979	10,244	10,303	9,423	10,430
Other Hay	796	939	836	1,090	1,080
Hay Silage	--	--	--	--	63
Grass & Legume Seed:	10	--	115	100	80
Potatoes:	19,570	15,980	19,525	12,468	20,671
All Crop Summary:	43,244	37,843	38,789	32,533	45,007
Cattle & Calves:	30,069	30,441	31,591	34,418	40,456
Dairy Products:	4,938	5,002	5,890	6,948	6,960
Sheep & Lambs:	1,012	1,033	954	1,037	1,116
Hogs & Pigs:	104	87	109	101	77
Chicken Eggs:	794	514	692	584	630
Wool:	93	72	86	101	127
Horses & Mules:	450	410	300	300	240
Livestock Summary:	37,576	37,672	39,710	43,574	49,705
Total Farm Cash Income:	80,820	75,515	78,499	76,107	94,712

1/ Source - various sources compiled by the Oregon State University Department of Agricultural and Resource Economics.

Weather and Crop Summary

K.A. Rykbost, G. Chilcote, and J. Maxwell[1]

The Klamath Basin's 1988 growing season was best described as a year of extremes. Precipitation was 50 percent above the 10-year mean from April 1 through mid-June. No significant rainfall events occurred between June 18 and November 2. Air temperatures were generally below the 10-year average through June and above the 10-year average from July through October. Daily maximum temperatures reached 90^{o} F or above on 28 days, nearly double the long-term record for Klamath Falls. The frost-free season was short, extending from June 30 through September 12, just 74 days.

Long-term climatic conditions and seasonal patterns determine the suitability of a region to crops, the occurrence or severity of disease and pest problems, and the physiological performance of crops grown. At 4,100 feet elevation, in the rain-shadow of the Cascade Mountain Range, the Klamath Basin experiences a high-desert climate. Rainfall averages less than 11 inches/year. Frosts are possible in every month. Daily temperature extremes of 40^{o} F are common during summer months. These conditions account, to a large degree, for the agricultural base of spring grains, hay and pasture crops, potatoes, and livestock that dominate the agricultural economy.

An official weather station is located at Kingsley Field, one-half mile from the Klamath Experiment Station. It is at 4,090 feet elevation, 42^{o}10'N latitude, and 121^{o}45' W longitude. A station is also maintained at KES. Climatological Data, Oregon, published by the National Oceanic and Atmospheric Administration, was used as the data base for official weather records (Tables 3 through 6). KES data were used for pan evaporation for 1984 through 1988, and to replace missing observations in other records. There is generally good agreement in data between the two stations, with the exception that minimum temperatures are consistently lower at KES by 1 to 3^{o} F.

Weather records for the most recent 10-year period were summarized on a weekly basis from April 1 through October 27. Weekly average maximum, minimum, and mean daily temperatures are presented for 1988 and the 1979-1988 period (Table 3). The departure of 1988 mean daily temperature from the 10-year average indicates periods of below-normal temperatures in late April, late May, and early June. Above-normal temperatures were experienced in early April, mid-July, late August, and throughout October. Average 1988 mean daily temperature for the 30-week period was 57.8^{o} F. This was 1.3^{o} F above the 10-year mean, but 0.9^{o} F below the 1987 mean.

1/ Superintendent/Associate Professor, Klamath County Research Technician, and Experimental Biology Technician, respectively, Klamath Experiment Station.

Frosts on June 10, June 29, and September 13, 17, 18, 19, and 20 (Table 4) impacted grain and potato crops. Minimum temperatures at various locations in the Klamath Basin are typically 3 to 7^{o} F lower than Kingsley Field observations. The June frosts severely damaged some cereal crops in the lower basin. Potato vines were effectively desiccated by the series of frosts in September.

Precipitation was above average in April, May, and June (Table 5). Rainfall events were very timely in relation to planting periods, and greatly reduced irrigation requirements for crop establishment. From mid-June through October no significant precipitation occurred. The last half of the growing season was the driest on record. Total precipitation for the 30-week period was 73 percent of the 10-year average. Pan evaporation data (Table 6) show evaporation losses during the growing season were slightly higher than normal.

Cereals crops in the basin were generally lower in yield and quality than in 1987. June frosts reduced stands. In isolated fields under dryland management the June 29 frost coincided with flowering, virtually destroying the crop. Late season heat and moisture stress reduced kernel size and test weight in some crops. While a 10 percent crop loss may have occurred overall, excellent fall weather allowed all crops to be harvested in a timely manner. No serious disease or pest problems occurred in 1988.

Hay and pasture crops benefitted from early season rainfall but were delayed by the cool spring weather. Hay quality was generally excellent and most crops were successfully harvested without rain damage. Late season production of unirrigated grass hay and pastures was seriously restricted by the lack of rainfall. Army worm infestations were treated in scattered alfalfa crops late in the season. In general, the 1988 season was relatively free from serious problems.

Potato crops in the basin experienced some stand loss due to seed piece decay in cool and wet soils following planting. Early season growth was delayed by cool conditions. June frosts damaged plants and reduced stands on a few fields. Mid-season growth was excellent. Heat stress in August and frosts in September reduced crop size and, therefore, yields. Damage from late-season infections by root-knot nematodes was more widespread than in 1987. Tobacco Rattle Virus was also observed in some fields. Harvesting conditions were favorable and crops generally went into storage in good condition. Soft rot problems that have been extensive in some years were very minimal in 1988.

Table 3. Weekly average maximum, minimum, and mean temperatures for 1988 and the 10-year period from 1979 to 1988 and the accumulated departure of 1988 weekly means from the 10-year average at Klamath Falls.

WEEKLY PERIOD		1979 - 1988 WEEKLY AVERAGE			1988 WEEKLY AVERAGE			1988 ACCUMULATED DEPARTURE[1]
		MAX	MIN	MEAN	MAX	MIN	MEAN	
				°F				
April	1- 7	52	28	41	62	31	47	+ 6
	8-14	57	29	43	65	29	47	+10
	15-21	59	32	46	55	34	45	+ 9
	22-28	60	33	47	57	32	45	+ 7
	29- 5	61	34	48	51	29	40	- 1
May	6-12	60	33	47	60	36	48	0
	13-19	67	37	52	67	35	51	- 1
	20-26	71	41	57	77	38	58	0
	27- 2	70	41	56	59	38	49	- 7
June	3- 9	69	42	56	58	38	48	-15
	10-16	74	44	59	74	44	59	-15
	17-23	76	46	61	87	52	70	- 6
	24-30	80	48	64	78	45	62	- 8
July	1- 7	78	46	63	78	44	61	-10
	8-14	80	48	64	84	49	67	- 7
	15-21	83	50	67	87	52	70	- 4
	22-28	85	50	68	93	55	74	+ 2
	29- 4	85	49	67	89	53	71	+ 6
Aug.	5-11	87	50	69	86	49	68	+ 5
	12-18	83	47	65	80	44	62	+ 2
	19-25	82	47	65	87	51	69	+ 6
	26- 1	80	45	63	89	50	70	+13
Sept.	2- 8	80	45	63	92	49	71	+21
	9-15	75	40	57	77	37	57	+21
	16-22	71	37	54	65	32	49	+16
	23-29	69	37	53	72	34	53	+16
	30- 6	72	36	55	80	38	59	+20
Oct.	7-13	67	35	51	78	39	59	+28
	14-20	61	30	46	71	33	52	+34
	21-27	62	32	47	73	33	53	+40

[1]/ Accumulated difference between 1988 and 10-year mean weekly temperatures.

Table 4. Weekly minimum temperatures and percent of days with frost for 1988 and the 10-year period from 1979 to 1988 at Klamath Falls.

WEEKLY PERIOD		WEEKLY MINIMUM TEN YEAR	WEEKLY MINIMUM 1988	FROST DAYS/WEEK TEN YEAR	FROST DAYS/WEEK 1988
		°F		%	
April	1- 7	11	24	79	71
	8-14	17	17	73	57
	15-21	17	32	57	29
	22-28	21	26	50	57
	29- 5	22	23	37	86
May	6-12	22	26	50	14
	13-19	24	30	31	43
	20-26	24	31	11	14
	27- 2	27	29	14	29
June	3- 9	28	34	7	0
	10-16	29	29	3	14
	17-23	33	49	0	0
	24-30	31	31	1	14
July	1- 7	33	36	0	0
	8-14	35	47	0	0
	15-21	36	45	0	0
	22-28	40	48	0	0
	29- 4	39	45	0	0
Aug.	5-11	37	42	0	0
	12-18	34	39	0	0
	19-25	39	44	0	0
	26- 1	35	44	0	0
Sept.	2- 8	32	43	0	0
	9-15	29	31	10	14
	16-22	24	29	19	57
	23-29	26	33	23	0
	30- 6	22	34	17	0
Oct.	7-13	18	36	24	0
	14-20	20	29	70	43
	21-27	20	29	60	29

Table 5. Weekly and accumulated precipitation for 1988 and the 10-year period from 1979 to 1988 at Klamath Falls.

WEEKLY PERIOD		1979 - 1988 WEEKLY	1979 - 1988 ACCUMULATION	1988 WEEKLY	1988 ACCUMULATION
			Inches		
April	1- 7	.10	.10	.06	.06
	8-14	.14	.24	.41	.47
	15-21	.15	.39	.36	.83
	22-28	.14	.53	.05	.88
	29- 5	.24	.77	.07	.95
May	6-12	.16	.93	.24	1.19
	13-19	.15	1.08	.25	1.44
	20-26	.09	1.17	0	1.44
	27- 2	.20	1.37	.61	2.05
June	3- 9	.27	1.64	.49	2.54
	10-16	.13	1.77	.07	2.61
	17-23	.08	1.85	.38	2.99
	24-30	.11	1.96	.01	3.00
July	1- 7	.11	2.07	0	3.00
	8-14	.02	2.09	0	3.00
	15-21	.17	2.26	0	3.00
	22-28	.06	2.32	0	3.00
	29- 4	.10	2.42	0	3.00
Aug.	5-11	.01	2.43	.01	3.01
	12-18	.06	2.49	.02	3.03
	19-25	.16	2.65	.03	3.06
	26- 1	.22	2.87	0	3.06
Sept.	2- 8	.13	3.00	0	3.06
	9-15	.14	3.14	0	3.06
	16-22	.21	3.35	.09	3.15
	23-29	.20	3.55	0	3.15
	30- 6	.05	3.60	0	3.15
Oct.	7-13	.22	3.82	0	3.15
	14-20	.17	3.99	.01	3.16
	21-27	.35	4.34	0	3.16

Table 6. Weekly and accumulated pan evaporation for 1988 and the 10-year period from 1979 to 1988 at Klamath Falls.

WEEKLY PERIOD		1979 - 1988 WEEKLY	1979 - 1988 ACCUMULATION	1988 WEEKLY	1988 ACCUMULATION
		Inches			
June	3- 9	1.76	1.76	1.43	1.43
	10-16	1.99	3.75	1.91	3.34
	17-23	2.21	5.96	2.47	5.81
	24-30	2.18	8.14	2.33	8.14
July	1- 7	2.12	10.26	2.26	10.40
	8-14	2.30	12.56	2.68	13.08
	15-21	2.32	14.88	2.46	15.54
	22-28	2.32	17.20	2.58	18.12
	29- 4	2.24	19.44	2.34	20.46
Aug.	5-11	2.28	21.72	1.95	22.41
	12-18	2.15	23.87	2.04	24.45
	19-25	1.93	25.80	2.41	26.86
	26- 1	1.77	27.57	2.08	28.94
Sept.	2- 8	1.64	29.21	1.83	30.77
	9-15	1.53	30.74	1.65	32.42

Statewide and Western Regional Potato Seedling Screening Trials at the Klamath Experiment Station

K.A. Rykbost and J. Maxwell[1]

INTRODUCTION

The Oregon Potato Variety Development Program presently screens approximately 80,000 first-generation seedlings. Survivors of the first two levels of selection at Hermiston, Powell Butte, or Ontario are advanced to replicated yield trials. The KES participates in the program from this point forward. In 1988 KES conducted five individual trials as part of the statewide variety selection program.

The KES program was modified in 1988 to strengthen the total effort. For the first time a Western Regional Trial was conducted at KES. This trial is the final step in selection of advanced lines prior to official release. Entries are included from several states and trials are conducted at 10 to 12 locations in the western states. An experiment was conducted to determine whether alternative screening procedures would improve the efficiency of the selection process. Larger plot size and a greater volume of samples for grading were used in all trials to improve experimental precision.

PROCEDURES

All variety screening trials were conducted in a randomized complete block design. Cultural practices and other conditions that varied between individual experiments will be discussed separately for each trial. All trial areas were fumigated with 15 gpa of Telone II applied on April 15. Herbicides included Eptam applied at 3.5 lb ai/A on June 7, and metribuzin applied aerially at 0.30 lb ai/A on July 5. Insect control practices included aldicarb banded with fertilizer at 3.0 lb ai/A at planting, methamidophos applied aerially at 0.75 lb ai/A in combination with Ridomil - MZ at 2.0 lb/A on July 22, and methamidophos applied aerially at 0.5 lb/A in combination with Duter at 20 oz/A on August 23. Vines were desiccated with diquat applied at 1.5 pints/A on September 6 and shredded with a rotobeater several days prior to harvest.

1/ Superintendent/Associate Professor, Experimental Biology Technician, respectively, Klamath Experiment Station.

Acknowledgements: Partial funding for variety development programs by the Oregon Potato Commission, the Cooperative State Research Service (USDA), the Agricultural Research Service, and Plant Genetics, Inc. is gratefully recognized.

Potatoes were planted with a two-row assisted feed planter using 32-inch row spacing. All trials received 800 lb/A of 16-20-0-13 fertilizer banded on both sides of rows at planting. Seed was hand-cut to 1.5 to 2.0 ounce size, treated with thiophanate-methyl at 0.50 lb/cwt, and suberized for 10 to 14 days prior to planting.

Trials received 1.7 inches of rainfall and 18.0 inches of irrigation water during the season. Irrigation was applied with solid-set sprinklers on a 40 foot x 48 foot spacing, twice weekly, to replenish 65-90 percent of pan evaporation, depending on growth stage.

Potatoes were harvested with a one-row digger-bagger. Total weights of all tubers were determined in the field. Samples were tagged and stored until grading was done in October and November. Specific gravity was determined on a 10 pound sample of 6 to 10 ounce No. 1 grade tubers by the weight-in-air weight-in-water method. Internal defects were observed by cutting the 10 largest tubers in each sample. Yields of No. 1's were not adjusted for surface blemishes such as scab or nematodes, or for internal defects such as hollow-heart or spraing (corky ring spot). Statistical analyses of data were performed with MSU Stat software.

RESULTS AND DISCUSSION

Preliminary Yield Trial

Eighty-five numbered selections, three seed lots of Russet Burbank and four other named varieties were planted at 12-inch seed spacing on May 17. Three replications included one with 8 hills per entry and two with 12 hills per entry. Fertilizer applied at planting was supplemented with 100 lb N/A applied as solution 32 and incorporated with a rolling cultivator on June 7. Plots were harvested on September 27 and all tubers were saved for grading.

Plant stands and canopy vigor were generally excellent and yields and tuber type were quite good. Nematode damage was fairly widespread in these and other KES trials. Root-knot nematode damage affected nearly all tubers in some plots. Spraing was observed in up to 40 percent of cut tubers. The 1988 season was favorable for nematodes of various species and control measures applied were less than satisfactory. Hollow-heart was also observed frequently but was generally confined to the oversize tubers.

Russet Burbank performance was similar for the standard Powell Butte seedlot and nuclear seed (clone-39) from the Oregon Foundation Seed Project (Tables 1 and 2). A G-IV commercial seed source of Russet Burbank produced a 30 percent higher yield of No. 1's in this trial. Yukon Gold was far superior to Yellow Finn. HiLite was not outstanding in yield but demonstrated nice appearance and a high percentage of No. 1 tubers.

Several outstanding lines were identified in the trial. The best entry was A084180-1. Other promising selections included A084183-1, A084175-6, ND02904-1, and C0084206-2. All of these entries have been promoted to the Statewide Trial for further evaluation in 1989.

Performance of selections at the four statewide locations was quite varied. Using only the ranking in total yield as a criterion, the best entry at KES (A084180-1) ranked 6, 11, and 41 at other sites. Ontario's top-yielder ranked 14, 87, and 21 at Hermiston, Powell Butte, and KES, respectively. This illustrates the importance of screening material at each location.

Twenty-four of the entries were advanced to the Statewide Trial for 1989. They included 12 out of the top 20 in yield of No. 1's at KES. It is interesting to note that Russet Norkotah was the male parent for 25 percent of the lines promoted and 20 percent of the lines entered in the trial.

Oregon Statewide Trial

A total of 55 entries were planted on May 18, including 43 numbered lines tested at all sites, and several advanced selections and named varieties evaluated only at KES. Thirty-hill plots at 12-inch seed spacing were replicated four times. Nitrogen, applied at 100 lb N/A as solution 32 on June 7, supplemented banded fertilizer. Plots were harvested on October 3. Approximately 50-pound samples were saved from each plot for grading and specific gravity determination.

Crop performance was similar to that observed in the Preliminary Yield Trial. All Russet Burbank seed sources ranked very low in yield of No. 1's (Table 3). The G-IV commercial source yielded less than Powell Butte or clone-1 sources in this trial. All Russet Burbank lots were considered rough and unattractive (Table 4). HiLite and Norgold yields were very similar to those observed in the Preliminary Yield Trial. Russet Norkotah was equivalent in yield to Norgold and slightly better than A7411-2 and A74114-4, both of which are being considered for release in the near future.

A74212-1 was the outstanding entry in this trial at KES and at the other locations. Yield of No. 1's was ranked in the top three for both clones at all four locations. Performance of this selection at KES over several years will be summarized later in this report.

The screening line A081178-12 was an excellent lot at KES and ranked quite high at other locations. It is being retained in this trial for 1989. A083110-3, A083037-10, and A083119-3 performed well at KES and were promoted to the Tri-State Trial along with entry numbers 9, 16, 18, and 41. A081216-1 will advance to the Western Regional Trial, but ranked very low at KES.

Statewide Chipping

Five named varieties and five potential chipping selections were planted on May 18. Individual plots were one row, 30 feet long with seed spaced at 8.7 inches, replicated four times. Banded fertilizer was supplemented with 50 lb N/A as solution 32, applied on June 7. Plots were harvested on September 29. Approximately 60-pound samples were saved from each plot for grading and specific gravity determination. A 10-pound subsample was delivered to Corvallis for evaluation of chip color.

Norchip has been the local standard for a small volume of chip stock grown for early fall delivery. Atlantic was superior to Norchip in yield, solids content,and color (Tables 5 and 6). Monona had higher yields than Atlantic but very low solids, a serious deficiency for chip processing. Kennebec produced high yields but had excessive size. BR7093-24 and ND2382-4 were the best numbered selections. BR7093-24 will be released by Idaho in 1989 under the tentative name of Gemchip. This selection and Atlantic appear to be promising candidates for a small but growing market for Klamath Basin crops. BR7093-24 will be evaluated for response to cultural management practices in 1989.

Western Regional Trial

Entries, including seven named varieties and 13 numbered selections, were planted on May 19 in 30-hill plots at 12-inch seed spacing with four replications. An application of 100 lb N/A as solution 32 on June 7 supplemented banded fertilizer. The potatoes were desiccated with diquat on September 12 and harvested on September 28. Approximately 60-pound samples were saved for grading and specific gravity determination.

Russet Burbank benefitted from the additional length of growing season compared with Preliminary and Statewide Trials, achieving a higher yield in this trial (Table 7). The outstanding russeted selection was A74114-4, which is being considered for release by Idaho in 1990. This selection has maturity similar to Norgold (Table 8), excellent appearance, and would have achieved higher yields at a more appropriate planting density and fertilization rate. It will be evaluated for response to nitrogen rates and seed spacing in 1989.

Red Lasoda produced an exceptionally high yield but had excessive size and poor appearance. NDTX9-1068-11R had good shape and skin color for a red, but experienced severe skinning damage in harvest, as did SH-1. The SH-1 selection from Plant Genetics, Inc., produced a significantly higher yield than its sister line, Shepody; however, it has very late vine maturity and is probably not suited to local climatic conditions.

Sierra and Cal Gold are both of interest locally for seed production for the Bakersfield, California, area. Cal Gold produced a high yield of large tubers but also had fairly high percentages of No. 2's and culls. Sierra had very poor early season vigor which undoubtedly reduced yields. ND840-1 has excellent type and has demonstrated good storability; however, low yields and low solids combined with late maturity indicate that this seedling may not hold promise for the region.

Out of ten selections entered for testing at all locations (A7816-4 through AC77226-13), only one demonstrated excellent appearance at KES. BC0038-1 had a nice plant type, good vigor, and attractive tubers. Its maturity appears to be earlier than Russet Burbank. This entry, C08011-5, and AC77101-1 have been selected for seed increase in Colorado and will remain in the trial. AC79100-1, AC80369-1, and AC77226-13 are being discarded. Washington will continue working with C008014-1, which has graduated from this trial. The other entries will be retained for further evaluation.

This trial will be continued at KES if seed availability is sufficient. In the future an 8.7-inch seed spacing will be used and nitrogen fertilizer rates will be reduced by about 25 percent. This will enhance performance of most of the entries. New varieties from other North American breeding and selection programs that may be of interest locally will be included if possible.

<u>Seedling Screening Procedure Trial</u>

Russet Burbank and five entries from the Oregon Statewide Trial were planted on May 18. Individual plots were two rows, 30 feet long with four replications. Seed spacing was 8.7 inches, and supplemental fertilizer was applied at 50 lb N/A as solution 32 on June 7. Vines were desiccated on September 6, at the same time as the Oregon Statewide Trial. Plots were harvested on September 29. All tubers were saved and graded from both rows of each plot.

The objective of this experiment was to determine whether larger plot and sample size, and different cultural management practices, would change the conclusions of potato selection screening trials. This trial used double the plot size, and four times greater sample size for grading than the Oregon Statewide Trial. Planting density was 40 percent greater and nitrogen rate was reduced by 50 lb N/A to more nearly represent cultural management requirements of varieties with lower tuber set and earlier maturity than Russet Burbank.

In 1987 Preliminary and Statewide trials each of the five selections exceeded Russet Burbank yield of No. 1's by over 50 percent, and had a relatively high percentage of 10 ounce tubers (Table 9). A083037-10 and A082616-18 exhibited poor shape in large tubers. This characteristic usually leads to discarding selections even though the Russet Burbank standard may show similar problems.

The relative merits of the five selections varied between trials in 1988. A083010-7 produced a higher yield with better size distribution in the Oregon Statewide Trial at 12-inch spacing and a high nitrogen rate. A083019-10 and A083037-10 were similar in both trials except that the latter showed better type at the higher planting density and lower nitrogen rate. A083196-15 performed substantially better at higher density and a lower nitrogen rate. A082616-18 had similar yields under both management regimes, with slightly better size distribution at higher density and a lower nitrogen rate. Russet Burbank experienced a large increase in small tubers at the closer seed spacing.

Experimental precision was improved slightly by increasing plot size and sample volume; however, differences were insufficient to justify the large increase in effort and cost associated with this change in procedures.

SUMMARY AND CONCLUSIONS

Several outstanding selections were identified at each screening level in the Oregon and western regional programs. The majority of entries at early stages demonstrate higher yields than Russet Burbank, some by very large margins. Oregon's selection program includes a number of very attractive russeted selections which could become leading contenders to replace a portion of the Russet Burbank acreage in less than 10 years.

In the short term A74212-1 appears to be a good selection for fresh market production in the Klamath Basin. The A74114-4 selection has excellent potential for an early fresh market russet. Preliminary tests suggest this seedling has better culinary quality than Russet Norkotah. BR7093-24 and Atlantic may find a place as chipping varieties in a local market that has considerable growth potential. Each of these lines need to be evaluated in more detail to determine their management requirements.

Large differences in seedling performance between the four trial locations in Oregon emphasize the importance of conducting the trials at KES. The Western Regional Trial is the only opportunity for local evaluation of advanced lines from out-of-state programs. Including it in the KES program is highly desirable for the future.

In past years the screening trials were conducted at KES using 15-hill plots and cultural practices considered optimum for Russet Burbank. In 1988 trials, 30-hill, or larger, plots improved experimental precision substantially. An increase in planting density and reduction in nitrogen rate will result in improved performance for most varieties and selections other than Russet Burbank. These changes will be incorporated in future screening trials beyond the Preliminary Yield Trial level.

Table 1. Tuber yield by grade for entries in the Preliminary Yield Trial, Klamath Experiment Station, 1988.

ENTRY NO.	SELECTION	U.S. NO. 1'S 4-6 oz	6-10 oz	>10 oz	TOTAL cwt/A	TOTAL RANK	%	B's	No 2's	TOTAL cwt/A	YIELD RANK
		---------cwt/A---------						----cwt/A-----			
1.	Russet Burbank	110	124	49	283	76	75	53	18	375	58
2.	Yukon Gold	55	122	216	392	25	94	17	10	419	41
3.	Norgold	57	145	188	390	26	83	27	19	468	25
4.	HiLite	71	154	121	346	49	90	34	0	385	57
5.	NDO 2845-1	98	239	48	386	28	82	69	10	473	23
6.	NDO 2848-8	229	134	17	379	34	75	102	17	506	15
7.	NDO 2863-6	129	189	62	380	32	81	76	9	470	24
8.	NDO 2864-1	136	173	40	349	47	86	57	0	408	48
9.	NDO 2871-1	48	133	283	464	11	90	21	26	514	13
10.	NDO 2872-1	155	114	34	303	64	82	61	8	371	64
11.	NDO 2876-1	146	137	40	323	57	80	55	10	406	49
12.	NDO 2876-3	169	62	0	232	85	73	88	0	319	84
13.	Yellow Fin	119	96	0	214	89	48	88	91	447	31
14.	NDO 2904-1	74	133	300	507	4	89	25	27	567	4
15.	NDO 2904-6	75	116	278	469	10	93	18	10	507	14
16.	NDO 2904-7	70	157	161	387	27	93	25	0	415	44
17.	NDO 2952-1	96	77	4	177	90	69	55	17	257	91
18.	NDO 2962-7	110	135	98	343	50	82	31	15	417	43
19.	NDO 2965-4	152	133	3	289	71	74	95	0	389	56
20.	NDO 2971-1	110	145	154	409	21	86	39	22	473	21
21.	NDO 2976-3	88	69	0	157	92	61	101	0	257	92
22.	NDO 3003-3	45	112	206	363	38	80	20	55	452	29
23.	NDO 3056-3	61	169	199	430	17	95	13	10	453	28
24.	NDO 3057-2	152	214	123	489	7	90	57	0	545	8
25.	COO 84088-1	64	113	116	293	70	83	22	29	353	72
26.	COO 84115-1	111	152	117	329	54	89	42	0	371	63
27.	COO 84116-1	187	141	26	354	45	81	78	2	435	36
28.	COO 84159-4	88	166	60	298	66	88	17	13	337	77
29.	COO 84171-2	78	159	122	360	41	86	34	24	418	42
30.	COO 84171-3	57	123	103	283	77	96	12	0	296	87
31.	COO 84205-2	72	117	66	255	82	89	29	0	285	90
32.	COO 84206-2	80	239	170	489	6	86	49	27	566	5
33.	COO 84254-2	104	97	14	216	88	75	60	4	287	89
34.	COO 84300-2	85	106	109	300	65	88	16	11	340	76
35.	AO 84026-1	77	158	89	324	56	89	31	0	363	67
36.	AO 84040-1	121	224	69	413	19	86	61	0	479	20
37.	AO 84050-2	98	214	41	353	46	87	54	1	408	47
38.	AO 84060-8	113	166	91	370	35	86	51	5	432	38
39.	AO 84071-2	96	153	68	317	60	88	34	9	361	69
40.	AO 84107-1	44	137	230	410	20	93	27	0	441	33
41.	AO 84134-1	78	173	120	370	36	89	20	12	414	45
42.	AO 84136-2	94	138	65	297	67	89	35	0	333	79
43.	AO 84154-1	61	171	115	347	48	82	30	34	423	40
44.	AO 84154-2	97	127	170	394	24	75	30	3	522	12
45.	AO 84164-4	170	188	38	396	23	81	87	4	489	19
46.	AO 84168-1	85	178	230	494	5	92	25	3	539	9
47.	AO 84170-1	162	233	67	462	12	87	60	0	532	10
48.	AO 84172-2	120	140	27	286	75	78	65	7	365	66
49.	AO 84172-3	98	191	92	381	31	86	46	7	441	34
50.	AO 84172-4	173	116	7	295	68	74	83	0	398	52

Table 1.(cont'd) Tuber yield by grade for entries in the Preliminary Yield Trial, Klamath Experiment Station, 1988.

ENTRY NO.	SELECTION	U. S. No. 1's 4-6 oz	6-10 oz	>10 oz	TOTAL cwt/A	TOTAL RANK	TOTAL %	B's	No 2's	TOTAL cwt/A	YIELD RANK
		---------cwt/A---------						----cwt/A-----			
51.	AO 84172-6	155	179	46	380	33	85	44	18	447	30
52.	AO 84175-6	84	288	138	510	3	91	25	11	558	6
53.	AO 84177-2	153	176	34	363	37	78	72	14	468	26
54.	AO 84180-1	79	256	258	592	1	96	27	0	619	1
55.	AO 84180-2	100	166	157	423	18	92	34	0	460	27
56.	AO 84183-1	100	258	163	521	2	89	52	3	587	2
57.	AO 84190-1	131	145	35	310	63	83	47	14	374	60
58.	AO 84190-2	99	193	168	459	13	94	30	0	489	18
59.	AO 84209-5	117	151	72	340	51	84	47	8	404	51
60.	AO 84217-1	123	150	111	385	29	87	43	10	445	32
61.	AO 84217-4	76	84	62	221	86	70	14	40	316	85
62.	AO 84217-5	68	143	103	313	62	84	22	24	374	59
63.	AO 84223-1	82	150	128	361	39	83	22	29	436	35
64.	AO 84276-3	104	120	65	289	72	86	41	4	337	78
65.	AO 84276-4	117	128	42	288	74	88	40	0	327	82
66.	AO 84303-2	90	115	50	255	81	78	58	10	327	83
67.	AO 84311-2	57	126	172	355	44	91	12	7	391	54
68.	AO 84327-2	113	160	125	398	22	84	45	12	473	22
69.	AO 84327-3	131	44	0	175	91	50	174	0	349	73
70.	AO 84345-1	90	135	36	262	80	85	45	0	309	86
71.	AO 84355-1	133	130	30	293	69	82	52	11	358	70
72.	AO 84355-2	89	179	115	383	30	90	28	12	426	39
73.	AO 84364-4	101	100	77	277	78	80	64	5	346	74
74.	AO 84364-10	115	99	3	217	87	66	113	0	330	81
75.	AO 84364-11	90	146	125	361	40	89	37	0	404	50
76.	AO 84366-4	106	206	123	435	16	83	27	59	526	11
77.	AO 84366-10	66	150	118	334	52	91	17	9	368	65
78.	AO 84377-6	21	145	314	480	8	82	15	41	585	3
79.	COO 84026-201	159	212	103	474	9	86	49	18	553	7
80.	COO 84055-205	68	90	157	315	61	84	22	5	373	61
81.	COO 84056-201	58	113	118	289	73	88	20	5	330	80
82.	COO 84056-202	65	142	150	356	43	96	10	4	371	62
83.	COO 84056-203	65	115	58	238	84	80	55	0	296	88
84.	AO 84408-203	74	135	116	326	55	83	30	10	391	55
85.	AO 84418-202	137	109	0	245	83	71	99	2	346	75
86.	AO 84427-203	73	158	33	264	79	74	53	21	355	71
87.	AO 84428-203	117	171	154	442	15	89	46	0	496	17
88.	AO 84439-205	120	197	41	358	42	87	49	0	410	46
89.	AO 84439-208	93	184	44	321	59	82	53	3	393	53
90.	AO 84441-212	83	129	110	322	58	89	37	3	362	68
91.	R.B.-Clone 39	142	157	64	329	53	76	68	0	435	37
92.	R.B.-Gen. IV	167	224	58	449	14	89	51	3	505	16
	AVERAGE	102	151	98	351	--	84	46	11	417	--
	CV (%)	33	32	52	19	--	--	43	151	16	--
	LSD(.05)	55	78	82	106	--	--	32	26	107	--

Table 2. Performance of entries in the Preliminary Yield Trial, Klamath Experiment Station, 19

ENTRY NO.	SELECTION	STAND %	SPECIFIC GRAVITY	H.H. % [1]	TYPE [2]	COLOR [3]	COMMENTS
1.	Russet Burbank	97	1.086	13	4-5	4	CRS
2.	Yukon Gold	84	1.088	13	3	2	Ne, Rz.
3.	Norgold	97	1.068	40	5	4	Ne, Nice
4.	HiLite	84	1.073	20	5	4	Ne, Nice
5.	NDO 2845-1	88	1.080	0	3	2	Ne
6.	NDO 2848-8	97	1.084	0	3	2	Ugly, IBS
7.	NDO 2863-6	100	1.085	23	5	4	Ne, Tearddrops
8.	NDO 2864-1	100	1.077	17	5	4	Rz.
9.	NDO 2871-1	94	1.078	0	5	4	Nice, Smooth
10.	NDO 2872-1	97	1.067	13	4	4	Pointy
11.	NDO 2876-1	97	1.077	0	5	4	Ne, Rz., Knobs
12.	NDO 2876-3	100	1.069	7	3	4	Ne, small
13.	Yellow Finn	100	1.085	0	2	2	Ugly, poor
14.	NDO 2904-1	97	1.076	0	4	4	Nice
15.	NDO 2904-6	94	1.068	0	5	4	Ne, big
16.	NDO 2904-7	69	1.065	23	5	4	Very nice
17.	NDO 2952-1	97	1.062	7	3	4	Ugly
18.	NDO 2962-7	97	1.082	50	5	4	Growth cracks
19.	NDO 2965-4	100	1.091	7	3	2	Ne, IBS
20.	NDO 2971-1	81	1.080	7	5	4	Ne, IBS
21.	NDO 2976-3	94	1.070	13	5	4	Small, poor
22.	NDO 3003-3	97	1.072	73	4	4	Ne, ugly
23.	NDO 3056-3	100	1.084	0	5	4	Ne, nice
24.	NDO 3057-2	97	1.065	13	5	4	Rz., Ne
25.	COO 84088-1	97	1.081	17	4	4	
26.	COO 84115-1	97	1.080	0	5	4	Ne Teardrops
27.	COO 84116-1	100	1.089	13	5	4	Ne, IBS
28.	COO 84159-4	100	1.072	33	5	4	Teardrops
29.	COO 84171-2	88	1.081	33	4	4	Big, nice
30.	COO 84171-3	78	1.074	90	5	4	Ne, poor shape
31.	COO 84205-2	94	1.071	0	5	4	Ne, nice
32.	COO 84206-2	94	1.079	0	4	4	Ne, nice
33.	COO 84254-2	97	1.078	0	5	4	Teardrops, poor
34.	COO 84300-2	97	1.090	53	4	5	
35.	AO 84026-1	97	1.087	7	5	5	Teardrops, growth crac
36.	AO 84040-1	94	1.069	0	5	4	
37.	AO 84050-2	91	1.091	0	3	4	Rz.
38.	AO 84060-8	91	1.075	7	5	4	Poor
39.	AO 84071-2	97	1.091	13	5	4	Rz., nice
40.	AO 84107-1	94	1.072	7	5	4	Very nice
41.	AO 84134-1	100	1.081	23	5	4	Nice
42.	AO 84136-2	88	1.076	20	5	4	Rz., Ne
43.	AO 84154-1	91	1.080	37	5	5	Bad cracks, scab
44.	AO 84154-2	94	1.071	13	5	4	Ugly
45.	AO 84164-4	97	1.085	57	5	4	Rot, V.D.
46.	AO 84168-1	94	1.076	57	5	4	Ne
47.	AO 84170-1	100	1.085	7	5	4	Ne
48.	AO 84172-2	97	1.089	27	5	4	Ne
49.	AO 84172-3	97	1.088	33	5	4	Ne, Rz.
50.	AO 84172-4	100	1.074	0	4	4	Rz., poor

Table 2. (cont'd) Performance of entries in the Preliminary Yield Trial, Klamath Experiment Station, 1988.

ENTRY NO.	SELECTION	STAND %	SPECIFIC GRAVITY	H.H. % 1	TYPE2	COLOR3	COMMENTS
51.	AO 84172-6	97	1.090	13	5	4	
52.	AO 84175-6	97	1.099	67	5	4	
53.	AO 84177-2	100	1.086	20	5	4	Teardrops, Rz.
54.	AO 84180-1	100	1.087	23	5	4	Rz., very nice
55.	AO 84180-2	97	1.095	13	5	5	Rz., nice, smooth
56.	AO 84183-1	97	1.084	57	5	4	Ne, Rz., knobs
57.	AO 84190-1	91	1.080	7	5	4	Ne, pointy, poor
58.	AO 84190-2	100	1.076	40	5	4	Rz., very nice
59.	AO 84209-5	100	1.067	0	5	5	Very nice, smooth
60.	AO 84217-1	97	1.093	20	5	4	Big
61.	AO 84217-4	88	1.089	63	5	4	Ugly
62.	AO 84217-5	100	1.078	0	4	4	Rz., Ne, IBS, poor
63.	AO 84223-1	100	1.070	7	4	4	Bad growth cracks
64.	AO 84276-3	84	1.070	7	4	4	Ne, poor shape
65.	AO 84276-4	75	1.071	7	5	4	Ne, IBS
66.	AO 84303-2	94	1.089	0	5	4	Ne, nice
67.	AO 84311-2	97	1.075	23	5	4	Knobs, nice
68.	AO 84327-2	100	1.073	13	5	4	Cracks, knobs
69.	AO 84327-3	100	1.075	0	5	4	Small
70.	AO 84345-1	94	1.076	13	5	4	Nice
71.	AO 84355-1	91	1.076	0	5	4	Ne
72.	AO 84355-2	94	1.088	0	5	4	Nice, smooth
73.	AO 84364-4	91	1.075	63	5	4	Pointy
74.	AO 84364-10	100	1.074	0	5	4	Small, smooth
75.	AO 84364-11	91	1.077	37	5	4	Rz., Ne, smooth
76.	AO 84366-4	100	1.081	20	5	4	Ne
77.	AO 84366-10	97	1.072	70	5	4	Scab, nice shape
78.	AO 84377-6	100	1.084	87	4	4	Pointy, knobs
79.	COO 84026-201	97	1.076	0	3	3	Rz., Ne, poor
80.	COO 84055-205	78	1.091	43	5	3	Ne, nice
81.	COO 84056-201	72	1.080	60	5	5	Ne, scab
82.	COO 84056-202	88	1.081	33	3	4	Ne
83.	COO 84056-203	94	1.071	33	5	5	Nice, smooth
84.	AO 84408-203	100	1.085	7	5	4	Ne, knobs
85.	AO 84418-202	97	1.112	0	5	3	Ne, smooth
86.	AO 84427-203	91	1.096	50	5	4	Rz.
87.	AO 84428-203	100	1.090	0	5	3	IBS, scab
88.	AO 84439-205	97	1.086	13	5	4	Rz., poor shape
89.	AO 84439-208	100	1.069	43	5	3	Knobs, poor lot
90.	AO 84441-212	94	1.070	43	5	4	Ne
91.	R.B. - Clone 39	97	1.086	13	4	4	IBS, Ne, Rz.
92.	R.B. - Gen. IV	100	1.087	0	5	4	Ne, poor

1/ H.H. - hollow heart - percent in ten largest tubers/sample
2/ TYPE - 1-pointed, 2-flat, 3-round, 4-long, 5-blocky
3/ COLOR - 1-red, 2-white, 3-buff, 4-brown, 5-dark brown

Ne -showing Nematode blemish
IBS -Internal Brown Spot
CRS -Corky Ring Spot
Rz. -Rhizoctonia
V.D.-Vascular Discoloration

Table 3. Tuber yield by grade for entries in the Oregon Statewide Trial, Klamath Experiment Station, 1988.

ENTRY NO	SELECTION	U. S. No. 1's 4-6 oz	6-10 oz	>10 oz	TOTAL cwt/A	TOTAL RANK	%	B's	No 2's	TOTAL cwt/A	YIELD RANK
		---------cwt/A---------						----cwt/A-----			
1.	R. Burbank	140	137	42	320	49	69	89	37	463	36
2.	Lemhi	40	113	266	419	14	83	19	43	507	11
3.	Norgold	117	180	86	384	30	93	27	0	415	44
4.	Norkotah	96	172	115	383	32	87	30	19	441	40
5.	A74212-1E	108	226	239	573	1	92	18	27	626	1
6.	A74212-1L	98	192	225	514	2	90	22	19	568	2
7.	A081178-12	71	173	249	494	3	92	14	22	537	5
8.	A081216-1	119	133	62	315	51	83	52	11	381	49
9.	A081362-3	115	166	136	417	15	84	45	25	495	14
10.	A082254-24	93	180	126	398	25	85	37	25	471	27
11.	A082260-8	105	184	112	401	23	85	38	24	470	30
12.	A082281-1	77	164	189	430	11	91	28	10	470	29
13.	A082283-1	71	142	164	377	34	80	36	50	474	26
14.	A082611-7	118	144	112	373	35	80	63	25	466	34
15.	A082616-18	116	185	88	389	28	86	51	10	454	39
16.	C0083008-1	70	157	182	408	21	89	28	19	457	38
17.	C0083020-5	66	130	124	321	47	75	21	68	427	42
18.	C0083021-1	49	113	236	398	26	85	14	43	469	32
19.	C0083021-5	40	52	118	210	55	66	17	61	320	54
20.	C0083023-9	62	99	69	230	54	78	28	24	296	55
21.	C0083066-1	63	176	163	402	22	81	33	48	497	13
22.	C0083067-3	72	154	187	412	17	85	24	42	487	21
23.	C0083085-5	81	163	166	410	19	90	35	11	457	37
24.	C0083120-5	73	108	142	322	46	77	36	41	418	43
25.	C0082177-3	101	179	131	412	16	83	48	19	495	15
26.	A083005-1	86	146	124	356	40	91	21	7	391	48
27.	A083010-7	124	188	121	433	9	82	36	61	531	6
28.	A083019-10	71	199	157	427	12	91	32	6	470	28
29.	A083026-3	161	181	41	384	29	78	55	24	490	18
30.	A083029-8	79	139	139	356	39	74	19	90	487	23

Table 3.(cont'd) Tuber yield by grade for entries in the Oregon Statewide Trial, Klamath Experiment Station, 1988.

ENTRY NO.	SELECTION	U. S. No. 1's 4-6 oz	6-10 oz	>10 oz	TOTAL cwt/A	TOTAL RANK	%	B's	No 2's	TOTAL cwt/A	YIELD RANK
		---------cwt/A---------						----cwt/A-----			
31.	A083037-6	111	152	106	369	36	77	70	37	479	2
32.	A083037-10	89	164	216	469	5	85	30	50	555	3
33.	A083065-2	131	123	32	285	53	77	56	18	372	51
34.	A083088-2	103	157	136	397	27	82	41	33	482	22
35.	A083093-2	97	134	206	437	8	88	22	32	498	12
36.	A083110-3	86	173	219	479	4	87	25	34	551	4
37.	A083119-2	84	125	174	383	31	74	40	64	520	8
38.	A083119-3	72	138	233	443	7	85	29	45	521	7
39.	A083148-1	112	177	110	400	24	86	36	26	465	35
40.	A083177-5	111	170	130	410	18	83	39	46	495	16
41.	A083177-6	134	190	98	423	13	86	46	13	490	17
42.	A083196-12	69	93	163	325	44	79	40	41	414	46
43.	A083196-15	92	147	171	409	20	88	36	21	467	33
44.	A083206-2	34	81	205	320	50	92	12	15	348	53
45.	A083218-10	71	183	194	448	6	92	28	10	489	20
46.	A083222-6	104	191	135	431	10	85	43	29	508	10
47.	A083222-7	56	140	183	379	33	87	30	24	435	41
48.	A081323-4	54	103	162	321	48	78	20	52	413	47
49.	A081323-20	69	147	138	353	42	85	44	18	416	45
50.	HiLite	107	168	57	332	43	88	35	7	376	50
51.	Shepody	47	82	231	360	37	77	29	77	470	31
52.	R.B. Cl 1	130	177	47	355	41	70	60	68	510	9
53.	R.B. G.IV	112	148	42	301	52	63	78	47	476	25
54.	A7411-2	62	121	173	356	38	73	32	88	490	19
55.	A74114-4	55	116	154	325	45	88	19	19	368	52
	AVERAGE	89	150	146	385	--	83	36	33	464	--
	CV(%)	29	23	35	17	--	--	39	63	13	--
	LSD(.05)	36	48	72	91	--	--	19	29	85	--

Table 4. Performance of entries in the Oregon Statewide Trial, Klamath Experiment Station, 1988.

ENTRY NO	SELECTION	STAND %	VIGOR RATING[1]	SPECIFIC GRAVITY	H.H. %[2]	TYPE[3]	COLOR[4]	COMMENTS[5]
1.	R. Burbank	96	1.8	1.085	15	5	4	CRS, tapered, ugly
2.	Lemhi	89	2.0	1.085	58	5	4	CRS, knobs, ugly
3.	Norgold	93	1.0	1.071	30	5	4	CRS
4.	Norkotah	93	1.3	1.068	0	5	4	Nice
5.	A74212-1E	93	1.5	1.079	0	5	4	CRS, nice
6.	A74212-1L	97	2.8	1.081	0	4	4	CRS
7.	A081178-12	85	2.0	1.091	30	5	4	CRS, nice
8.	A081216-1	95	2.0	1.083	30	5	4	CRS, scab
9.	A081362-3	96	1.8	1.082	5	5	3	CRS, Rz., nice
10.	A082254-24	85	1.8	1.083	5	5	4	Tapered, ugly
11.	A082260-8	92	1.0	1.086	25	5	4	IPS
12.	A082281-1	97	1.8	1.081	25	4	5	CRS, very nice
13.	A082283-1	83	2.0	1.086	15	5	4	
14.	A082611-7	95	1.5	1.089	5	4	4	CRS, Rz.
15.	A082616-18	96	1.0	1.092	35	5	4	CRS
16.	C0083008-1	93	1.8	1.088	5	5	4	Nice
17.	C0083020-5	86	2.0	1.086	25	5	4	Cracks, ugly
18.	C0083021-1	98	2.5	1.091	65	5	3	
19.	C0083021-5	87	1.8	1.088	88	4	4	Knobs, ugly
20.	C0083023-9	83	1.8	1.082	15	5	4	Cracks
21.	C0083066-1	93	2.0	1.088	43	5	4	Nice
22.	C0083067-3	93	1.5	1.076	0	5	3	CRS, tapered, knobs
23.	C0083085-5	93	2.5	1.080	10	5	4	
24.	C0083120-5	77	1.8	1.087	45	5	4	Tapered
25.	C0082177-3	90	1.0	1.075	43	3	1	CRS, nice red
26.	A083005-1	93	1.3	1.092	28	5	4	CRS
27.	A083010-7	97	1.5	1.084	35	5	4	CRS, crooked
28.	A083019-10	97	1.0	1.075	0	5	4	CRS, nice
29.	A083026-3	97	1.3	1.084	0	5	4	Bad CRS, knobs, ugly
30.	A083029-8	88	1.3	1.074	0	4	4	Bad CRS, cracks, crooked

Table 4. (cont'd) **Performance of entries in the Oregon Statewide Trial, Klamath Experiment Station, 1988.**

ENTRY NO	SELECTION	STAND %	VIGOR RATING[1]	SPECIFIC GRAVITY	H.H. %[2]	TYPE[3]	COLOR[4]	COMMENTS[5]
31.	A083037-6	93	2.3	1.089	20	5	4	Tapered
32.	A083037-10	86	2.0	1.078	20	5	4	SEB, cracks
33.	A083065-2	98	1.0	1.081	0	4	4	CRS, long-skinny
34.	A083088-2	96	1.5	1.075	68	5	4	
35.	A083093-2	96	1.0	1.067	0	5	4	Nice
36.	A083110-3	97	1.8	1.079	70	5	4	CRS
37.	A083119-2	87	2.0	1.083	5	5	4	Cracks, ugly, rough
38.	A083119-3	95	1.5	1.086	5	5	4	Nice
39.	A083148-1	83	1.8	1.084	15	5	5	Odd shape
40.	A083177-5	94	1.0	1.087	25	5	4	CRS, tapered
41.	A083177-6	98	1.8	1.083	5	5	4	
42.	A083196-12	86	2.0	1.083	40	5	4	Cracks, CRS
43.	A083196-15	89	1.0	1.074	15	5	5	CRS, Nice
44.	A083206-2	96	2.0	1.081	28	5	4	Very nice
45.	A083218-10	90	2.0	1.084	83	4	4	Thumbnail cracks
46.	A083222-6	96	2.0	1.083	43	5	4	Rough
47.	A083222-7	95	2.0	1.082	35	5	4	CRS, nice
48.	A081323-4	98	1.0	1.086	13	4	4	CRS, cracks, knobs
49.	A081323-20	93	1.0	1.086	20	5	4	CRS
50.	HiLite	96	1.0	1.073	0	5	4	
51.	Shepody	94	1.3	1.082	15	4	2	CRS, rough, ugly
52.	R.B. Cl 1	100	1.5	1.083	10	4	4	Cracks, rough, ugly
53.	R.B. G.IV	98	1.5	1.084	8	5	4	Rough, ugly
54.	A7411-2	96	1.8	1.086	5	4	5	CRS, long, odd shapes
55.	A74114-4	98	1.0	1.078	10	5	4	CRS, nice

1/ Vigor rating - September 21, Scale: 1 (completely dead) - 5 (completely green)
2/ H.H. - Hollow Heart - percent in ten largest tubers/sample
3/ Type - 1-pointed, 2-flat, 3-round, 4-long, 5-blocky
4/ Color - 1-red, 2-white, 3-buff, 4-brown, 5-dark brown
5/ Comments - CRS - Corky Ring Spot, SEB - Stem End Browning, Rz.- Rhizoctonia, IPS - Internal Purpling Syndrone

Table 5. Tuber yield by grade for entries in the Statewide Chipping Trial, Klamath Experiment Station, 1988.

SELECTION	YIELD No. 1's 4-6 oz	6-10 oz	>10 oz	TOTAL	YIELD B's	No. 2's	CULLS	TOTAL
	-----	-----	-----	-----cwt/A-----	-----	-----	-----	-----
Norchip	156	112	55	323	90	32	54	500
Atlantic	137	132	121	390	68	13	5	476
Kennebec	79	138	278	494	31	70	100	695
Monona	161	190	96	448	56	5	0	509
Shepody	64	97	305	466	27	51	30	574
NDO 1496-1	185	130	86	401	85	3	26	515
CO083098-1	171	144	68	382	103	1	2	488
NDO 2382-4	210	192	96	499	100	8	12	619
NE 22.75-1	94	112	91	297	53	45	29	423
BR 7093-24	178	208	100	486	79	6	9	580
Average	143	146	129	419	69	24	27	538
CV(%)	19	26	31	17	30	59	64	11
LSD(.05)	40	54	58	100	30	20	25	87

Table 6. Performance of entries in the Statewide Chipping Trial, Klamath Experiment Station, 1988.

SELECTION	STAND %	CHIP COLOR[1]	SPECIFIC GRAVITY	H.H. %[2]	COMMENTS[3]
Norchip	94	3.0	1.077	15	Cracks in 2's & culls
Atlantic	92	2.0	1.089	35	Scab, CRS
Kennebec	98	2.5	1.082	10	Bad cracks
Monona	98	2.5	1.067	10	CRS, brown center
Shepody	91	4.0	1.080	25	
NDO 1496-1	93	2.5	1.091	5	Cracks in culls
CO083098-1	89	3.0	1.084	0	
NDO 2382-4	93	2.0	1.080	10	CRS
NE 22.75-1	92	4.5	1.071	20	Scab, bad cracks
BR 7093-24	100	2.5	1.083	25	

1/ Chip color - based on Potato Chip/Snack Food Assoc. scale of 1-5 (1-light, 5-dark)
2/ Hollow Heart - percent in ten largest tubers/sample
3/ CRS - Corky Ring Spot

Table 7. Tuber yield by grade for entries in the Western Regional Trial, Klamath Experiment Station, 1988.

SELECTION	YIELD U.S. NO.1's 4-6 oz	6-10 oz	>10 oz	TOTAL	YIELD B's	No. 2's	CULLS	TOTAL
	cwt/A							
Russet Burbank	173	195	54	422	88	38	10	559
Norgold	118	141	121	380	54	11	5	451
Lemhi	80	151	249	480	25	65	22	591
Red Lasoda	85	198	343	626	34	40	23	723
A7816-14	111	153	118	382	65	105	27	578
A7961-1	71	144	144	358	27	44	12	441
A79100-1	33	91	310	434	13	62	8	517
AC80369-1	63	125	174	362	22	67	19	470
CO08014-1	96	202	206	504	33	35	11	584
NDTX9-1068-11R	77	165	188	430	36	34	30	530
AC77101-1	83	144	295	521	18	38	10	587
CO8011-5	64	110	184	358	34	33	14	439
BC0038-1	83	131	266	480	33	50	4	567
AC77226-13	84	144	159	387	41	19	3	450
Shepody	51	73	284	407	15	99	38	559
SH-1	57	111	419	587	25	105	31	748
Cal Gold	52	89	297	438	20	69	42	569
ND840-1	117	99	95	311	63	15	5	394
A74114-4	52	92	215	359	20	21	2	402
Sierra	120	170	55	345	52	26	12	435
Average	83	136	209	429	36	49	16	530
CV%	28	31	25	16	38	60	100	13
LSD (P=.05)	33	60	75	98	19	41	23	101

Table 8. Performance of entries in the Western Regional Trial, Klamath Experiment Station, 1988.

SELECTION	STAND %	VINE VIGOR[1]	SPECIFIC GRAVITY	H.H. %[2]	CRS %[3]	SCAB RATING[4]	COMMENTS
Russet Burbank	99	4.0	1.084	10	5	1	
Norgold	91	2.5	1.070	20	5	1	
Lemhi	96	3.8	1.087	43	5	3	Rough, growth cracks
Red Lasoda	100	3.5	1.071	45	10	2	Knobs, skinning, rough
A7816-14	98	4.0	1.088	50	0	3	Rough, ugly
A7961-1	94	3.5	1.081	20	0	1	Growth cracks
A79100-1	94	3.8	1.072	78	10	5	Growth cracks, rough skin
AC80369-1	96	4.0	1.081	43	0	2	Growth cracks
CO08014-1	95	3.3	1.080	5	0	1	Growth cracks, odd shape
NDTX9-1068-11R	83	3.5	1.063	0	10	1	Severe skinning, cracks
AC77101-1	99	3.3	1.072	10	0	3	Flat, growth cracks, ugly
CO8011-5	85	4.8	1.063	0	0	1	Flat, growth cracks
BC0038-1	95	3.3	1.079	0	30	1	Nice
AC77226-13	83	3.5	1.075	10	0	1	Flattened, nice
Shepody	95	3.0	1.078	10	0	1	Crooked
SH-1	94	4.8	1.076	43	5	4	Crooked, severe skinning
Cal Gold	95	3.0	1.069	0	0	1	Growth cracks, nice shape
ND840-1	88	4.5	1.066	25	0	1	Nice shape
A74114-4	98	2.5	1.076	25	0	1	Stem-end disc., nice
Sierra	89	4.3	1.068	0	15	1	

1/-Vine Vigor Rating - Sept. 13 (1-dead, 5-lush) 2/-H.H. - % of 10 largest tubers/plot
3/-Corky Ring Spot - % of 10 largest tubers/plot 4/-Scab Rating - 1-none, 5-severe

Table 9. Tuber yield by grade for Russet Burbank and five potato selections, Klamath Experiment Station.

SELECTION	YIELD							
	U.S. No. 1's							
	4-6 oz	6-10 oz	>10 oz	TOTAL	B's	No 2's	CULLS	TOTAL
	cwt/A							
1987 Preliminary Yield Trial								
Russet Burbank	108	192	97	397	66	56	32	551
A083010-7	68	169	376	613	33	48	22	715
A083019-10	12	142	495	649	14	0	0	663
A083037-10	95	167	414	676	24	116	37	853
A083196-15	20	214	504	738	7	19	11	775
1987 Statewide Yield Trial (Late Harvest)								
Russet Burbank	58	85	66	209	33	71	57	370
A082616-18	42	103	194	339	26	71	67	503
1988 Statewide Yield Trial								
Russet Burbank	140	137	42	320	89	37	17	463
A083010-7	124	188	121	433	36	61	1	531
A083019-10	71	199	157	427	32	6	5	470
A083037-10	89	164	216	469	30	50	6	555
A083196-15	92	147	171	409	36	21	1	467
A082616-18	116	185	88	389	51	10	4	454
Average	105	170	133	408	46	31	6	490
CV(%)	20	27	35	18	28	76	149	14
LSD(.05)	32	70	70	110	20	35	12	103
1988 Screening Procedures Trial								
Russet Burbank	142	144	37	324	132	23	11	489
A083010-7	91	139	84	314	53	59	8	434
A083019-10	94	180	158	432	44	8	2	486
A083037-10	78	147	255	481	34	17	2	534
A083196-15	92	165	216	473	43	13	1	530
A082616-18	91	163	125	379	54	20	5	458
Average	98	156	146	400	60	23	5	488
CV(%)	19	16	35	16	30	62	174	12
LSD(.05)	29	38	69	96	28	24	NS	87

Red-Skinned Potato Variety Development, 1988

K.A. Rykbost[1], H. Carlson[2], and J. Maxwell[1]

INTRODUCTION

Small red-skinned potatoes for gourmet markets consistently receive very high prices. Larger red potatoes are also in demand and usually command higher prices than other fresh market crops. The Klamath Basin enjoys a geographic advantage over other regions currently servicing these markets in California and the Northwest. Small acreages of red potatoes for seed and fresh market are currently dominated by Red Lasoda in the Klamath Basin. This variety produces very high yields of large and unattractive tubers with light color and deep eyes. The Sangre variety has received some interest in the last two years. Sangre is a smooth variety with a long dormant period and excellent storage characteristics, but color fades after three to four months in storage.

Finding a red-skinned variety adapted to the Klamath Basin that meets quality requirements of these markets could easily result in a ten-fold increase in this potentially profitable market niche, and a significant seed production business for local and other areas. Potato variety development programs in the Northwest have historically concentrated on russet-skinned varieties suitable for processing. A systematic search for reds has not been undertaken. Further, many of the red potato varieties grown in other regions have not been evaluated under Northwest or Klamath Basin conditions.

In 1988 a program was established at KES to accomplish two objectives: 1) start a red-skinned potato seedling screening program to identify new breeding lines well adapted to the Klamath Basin; and 2) evaluate named and released North American red-skinned potato varieties for adaptability to local conditions.

1/ Superintendent/Associate Professor, Experimental Biology Technician, respectively, Klamath Experiment Station.
2/ Superintendent/Farm Advisor, University of California, Tulelake Field Station.

I SEEDLING SCREENING PROJECT

Procedures:

First-generation mini-tubers from eleven crosses were provided by the North Dakota State Potato Breeding program. Tuber size ranged from a few grams to approximately 25 grams. Standard fumigation, fertilization, insect control, and irrigation practices were followed. Seedlings were planted with a two-row assisted feed planter on May 19. Seedlings were spaced at 24 inches. A herbicide combination of 1.5 pints Dual, 1.0 pint Prowl, and 0.4 lb. metribuzin/A was applied on June 8 and incorporated with a rolling cultivator. Vines were desiccated with diquat at 1.5 pints/A on September 12. The trial was dug on September 26. Selections were made by a team of six.

Results and Discussion:

Frost on June 10 effectively killed some early emerging plants. Herbicide injury severely affected about 10 percent of the selections. Final plant emergence was 78 percent with approximately 50 percent being vigorous, healthy plants (Table 1). At the field selection stage 92 clones were saved. After three months in storage all clones were displayed and evaluated by a team of five. A total of 42 clones were advanced to a second-year screening trial. A number of these exhibited excellent color compared with standard varieties stored under the same conditions.

Five tubers from each of the 42 clones will be planted in 10-hill plots for further selection. Tuber-unit planting will be used to assist in detection of any variety mixing which may have occurred during harvest.

A similar scale first-year selection program will be continued in 1989. Pre-emergence herbicide applications will not include metribuzin. The spacing of seedlings will be increased to 36 inches to reduce the potential for variety mixing at harvest.

II ADVANCED RED VARIETY TRIALS

Procedures:

Seven named and three advanced numbered selections were planted at the KES in a randomized complete block design with four replications on May 20. Individual plots were two rows, 27 feet long. Seed spacing was 8.7 inches, resulting in 72-hill plots. Fertilizer included 800 lb/A of 16-20-0-13 banded at planting and 75 lb N/A as solution 32 applied on June 8. A herbicide combination of 1.5 pints Dual, 1.0 pint Prowl, and 0.4 lb metribuzin/A was applied on June 8. Standard cultural practices were followed for insect and disease control, and irrigation. Vines were desiccated with diquat applied at 1.5 pints/A on September 6. Plots were harvested on October 7. All tubers were saved and graded in early November.

A second experiment planted on organic soils in the Tulelake area on May 10 included six red entries using the same seed sources. This trial was a randomized complete block design with four replications and a total of 21 entries. Individual plots were two rows, 40 feet long. Seed spacing was 9 inches in 36-inch rows. Standard cultural practices were followed. Vines were desiccated with 1.0 pint/A of diquat applied on September 12. The potatoes were harvested on September 27. All tubers from each plot were graded.

Results and Discussion:

In the KES experiment, Redsen experienced severe metribuzin injury, a susceptibility that has been observed elsewhere. Crop vigor was generally good at both locations in all other entries. Yields and size distributions were quite varied (Tables 2 and 3). Norland had the highest yield of small tubers at both sites. Redsen was a close second at the Tulelake site. Reddale and Red Lasoda produced a high percentage of oversize tubers. Dark Red Norland had a favorable size distribution at both sites but a lower total yield at KES. Sangre was smaller at Tulelake. At KES, Viking, NDTX9-1068-11R, and A82705-1 produced high yields but excessive size. The MN12966 selection was low in total yield with large tuber size.

Tuber quality evaluations were made on samples after two months in storage at KES (Table 4). Color, eye depth, and tuber shape were ranked on a scale of 1 (very poor) to 5 (very good). Redsen was the most attractive selection by a wide margin, with Red Lasoda ranked lowest in appearance. Light color was observed in Norland, Viking, Reddale, and Red Lasoda, while Redsen, A82705-1, and NDTX9-1068-11R exhibited the best color. A82705-1 had an uneven shape and growth cracks. Skinning at harvest was serious in NDTX9-1068-11R and moderate in Redsen. This tendency may account for very poor storage performance noted frequently for NDTX9-1068-11R. Redsen is also reported to be somewhat susceptible to storage losses. Quality ratings were not made at the Tulelake site; however, Redsen was considered best on the basis of tuber size, color, yield, and overall appearance.

Conclusions:

The market for red-skinned potatoes pays a premium for small size, bright color, and attractive appearance. The local standard, Red Lasoda, is an unattractive variety that has high yielding ability as its only important attribute. Several of the lines evaluated in these trials appear to be acceptable alternatives. Redsen was the outstanding entry. The sensitivity to metribuzin and a tendency for skinning damage at harvest must be recognized and avoided by management if possible. Dark Red Norland may be the second best entry.

Total yield is not an important criterion for an acceptable red variety. Visual appearance and a high percentage of tubers under 10 ounces are most desirable. Early maturity and resistance to skinning are also important considerations. Trials will continue at both locations with advanced or named selections and at KES to screen new material.

Table 1. First-year red-seedling screening, Klamath Experiment Station, 1988.

FAMILY NO.	PARENTAGE	CLONES PLANTED	STAND %	NUMBER SELECTED SEPT. 26	NUMBER SELECTED JAN.3
NDO - 3432	Erik X NDTX9-1068-11R	160	85	8	3
NDO - 3433	Erik X 1871-3R	200	78	6	2
NDO - 3450	Norland X La 12-59	130	80	7	1
NDO - 3451	Reddale X NDTX9-1068-11R	135	81	9	7
NDO - 3462	Viking X 2428-3R	105	79	4	1
NDO - 3503	La 12-59 X NDTX9-1068-11R	220	65	19	13
NDO - 3404	La 12-59 X 1196-2R	130	87	13	5
NDO - 3511	MN 13035 X NDTX9-1068-11R	145	74	2	1
NDO - 3530	NDTX9-1068-11R X W806R	180	76	5	2
NDO - 3544	W 806R X NDTX9-1068-11R	160	71	6	2
NDO - 3573	1196-2R X La 12-59	150	91	13	5
	Total	1715		92	42

Table 2. Tuber yield by grade for red-skinned selections, Klamath Experiment Station, 1988.

SELECTION	YIELD NO. 1's 4-6oz	YIELD NO. 1's 6-10 oz	YIELD NO. 1's >10 oz	YIELD NO. 1's TOTAL	YIELD B's	YIELD No 2's	YIELD CULLS	YIELD TOTAL
	cwt/A							
Red Lasoda	54	155	325	534	29	62	35	660
Norland	142	212	144	498	53	16	9	576
Dark Red Norland	118	166	58	342	76	5	3	426
Viking	41	131	313	485	15	36	28	564
Sangre	91	159	151	401	55	24	8	488
Reddale	58	107	244	409	29	96	12	546
Redsen	91	119	53	263	52	6	1	322
MN 12966	49	104	134	287	23	17	3	330
NDTX9-1068-11R	71	170	253	494	40	26	6	566
A 82705-1	82	179	333	594	38	30	8	670
CV (%)	27	25	24	14	34	56	97	14
LSD(.05)	31	53	71	90	20	26	16	108

Table 3. Tuber yield by grade for red-skinned selections, Tulelake Field Station, 1988.

SELECTION	YIELD NO. 1's 4-8 oz	8-14 oz	>14 oz	TOTAL	B's	YIELD CULLS	TOTAL
	--------	--------	--------	cwt/A	--------	--------	--------
Red Lasoda	208	165	104	477	16	54	547
Norland	267	79	15	361	32	13	406
Dark Red Norland	226	88	12	327	43	21	390
Sangre	233	75	13	322	38	8	368
Reddale	197	118	69	384	26	29	438
Redsen	252	42	38	298	47	9	353
CV (%)	18	32	48	10	22	34	9
LSD (.05)	49	44	24	48	12	13	48

Table 4. Quality evaluations for red-skinned selections, Klamath Experiment Station, 1988.

SELECTION	SPECIFIC GRAVITY	APPEARANCE RATING COLOR[1]	EYE DEPTH	SHAPE	RANKING[2]
Red Lasoda	1.074	1	2	3	1
Norland	1.064	1	3	3	4
Dark Red Norland	1.062	2	4	3	6
Viking	1.070	1	3	4	3
Sangre	1.069	3	3	4	8
Reddale	1.067	1	4	3	2
Redsen	1.066	5	4	5	10
MN 12966	1.080	3	4	3	5
NDTX9-1068-11R	1.069	4	5	3	9
A82705-1	1.064	4	3	2	7

1/ Rating on scale of 1 (poor) to 5 (excellent).
2/ Ranking on scale of 1 (worst) to 10 (best)-average of nine individuals.

A74212-1, A High Yielding, Russet-Skinned Oregon Selection Adapted to the Klamath Basin.

K. A. Rykbost, G. E. Carter and J. Maxwell[1]

INTRODUCTION

Russet Burbank, which accounts for the majority of production in the Klamath Basin, requires a long frost-free season to achieve high yields and suitable size. Typically only a small percentage of the crop makes the 70-80 count carton grade which commands the highest price. Up to 30 percent of Russet Burbank crops grade out as B's or culls under Klamath Basin conditions.

In 1981 an Oregon selection, A74212-1, was evaluated at KES for the first time. In succeeding years this selection has demonstrated exceptional yield potential at KES and other locations. A high percentage of the A74212-1 crop has graded U.S. No. 1's in the 70-80 and 90 count sizes. Grade out for B's and culls has been about 15 percent of total production.

A74212-1 is not without deficiencies. Skin netting and thickness is less than for Russet Burbank. In organic soils the netting may be unacceptable. In small commercial trials, skinning damage at harvest has resulted in the development of excessive disease in storage on more than one occasion. Seed decay problems have been experienced in research and commercial plantings. Poor stands have resulted in excessive tuber size which compounds the potential for harvest damage.

In 1987 and 1988 several cultural management experiments were conducted at KES to identify practices that would minimize weaknesses in A74212-1. This report will summarize the performance of A74212-1 at KES over eight years, and identify cultural management practices that will enhance the chances for the successful commercialization of this seedling following its official release.

I. VARIETY SCREENING TRIAL PERFORMANCE

Procedures:

Screening trials conducted from 1981 through 1988 included large numbers of entries in a randomized complete block design with three or four replications. Plots were single rows with 12 to 30 hills. Planting dates ranged from May 15 to June 10 and vine desiccation dates from September 1 to September 15. Seed spacings were 12 inches in 32-inch rows. Standard cultural practices for Russet Burbank production were followed.

1/ Superintendent/Associate Professor, Associate Professor Emeritus, Experimental Biology Technician, respectively, Klamath Experiment Station.

Results and Discussion:

In each year since 1981 A74212-1 exceeded Russet Burbank in yield of No. 1's by a minimum of 90 cwt/A (Table 1). More detailed analyses of 1988 performance are presented in the report on the Oregon Statewide Trial. In the 1987 Statewide trial A74212-1 produced 366 cwt/A of No. 1's over 6 ounces, compared with 151 cwt/A for Russet Burbank.

High specific gravity is not an essential quality for all fresh market crops. Early maturing russets, red-skinned varieties and white-skinned fresh market varieties are usually much lower in specific gravity than Russet Burbank. However, for russeted varieties to successfully replace Russet Burbank as an acceptable baking variety, relatively high specific gravity will be a prerequisite. A74212-1 has demonstrated the ability to achieve acceptable solids content when managed under conditions appropriate for Russet Burbank.

II. RESPONSE OF A74212-1 TO SEED SPACING AND N-RATE

Procedures:

In 1987 A74212-1 and other selections were planted at seed spacings of 6, 9, and 12 inches in 32-inch rows on May 26. Individual plots were one row, 15 feet long. Vines were desiccated on September 22 and plots were harvested on October 5. Standard cultural practices were followed.

In 1988 A74212-1 and nine other entries were evaluated in two separate experiments for their response to seed spacing and nitrogen fertilization rates. Procedural details will be presented later in this report.

Results and Discussion:

In several screening trials A74212-1 exhibited plant stands of 80 percent or less. In combination with low planting density, this resulted in the production of very large tubers, some of which would be unacceptable for fresh markets. High nitrogen rates undoubtedly contributed to excessive size and reduced specific gravity.

In both 1987 and 1988 increasing plant populations increased total and No. 1 yields markedly (Table 2). Increased seed spacing consistently reduced yields of all classes up to 10-ounce and increased the percentage and yield of off-grade tubers. The 1987 crop exhibited roughness with increasing percentages of No. 2's and culls at lower populations. In 1988 off-grade tubers were a much smaller percentage of total yields, but a similar response was observed.

The closest seed spacing tested was the most economical in both years, even under a high seed price situation. While relatively high yields are possible at low populations, excessive tuber size enhances the risk of harvest and handling damage. Large tubers used for seed may contribute to poor stands due to inadequate eye distribution and hence "blind" seed pieces. Appropriate management of seed spacing will be essential for optimum performance of A74212-1 for seed and fresh market crops.

The response of A74212-1 to nitrogen rate is less clear. In 1988 the yield of No. 1's increased at higher nitrogen rates (Table 3). However, this increase was achieved by a shift in tuber size distribution toward excessive size, more susceptible to harvest damage. In view of a tendency for difficulty in killing vines and obtaining adequate resistance to harvest damage, a yield sacrifice may be justified. Additional data are needed to clarify this question.

III. RESPONSE OF A74212-1 TO SEED SOURCE AND CUTTING TIME

Previous experiences with poor stands and seed decay may have been due to isolated seed management factors, a genetic weakness in A74212-1, or a combination of both. This experiment compared a range of seed from nuclear to the equivalent of foundation class, under two management regimes that would be expected to affect seed decay problems differently.

Procedures:

Five sources of A74212-1 seed were either cut, treated with TOPS 2.5 D, and suberized for 10 days prior to planting or cut, treated and planted the following day. Three of the sources were stored at KES under identical conditions from October, 1987, until planting. A factorial randomized complete block design with four replications was used. Individual plots were two rows, 30 feet long. Seed spacing was 8.7 inches and nitrogen rate was 180 lb. N/A.

The seed lot designated as 'Deschutes C.' was 100 percent tubers in excess of 10 ounces, most of them with at least one fusarium dry rot lesion. Several exhibited other fungal or bacterial diseases. Other seed lots were 2- to 12-ounce size with very little evidence of storage diseases. All lots were hand cut to 1.5- to 2.0-ounce seed size and batch treated with TOPS 2.5 D. Cutting knives were only disinfected between lots and no effort was made to sort and discard diseased pieces, either at cutting time or at planting. Seed was stored at approximately 55° F and 90 percent R.H. prior to planting.

The potatoes were planted on May 20, desiccated on September 12, and harvested on September 31. All tubers were weighed in the field and approximately 120-pound samples per plot were stored and graded in early November.

Results and Discussion:

Emergence data were obtained 31 days and 46 days after planting (Table 4). KES and Deschutes C. lots were slightly slower to emerge. Cutting time did not affect emergence rate or final stands, in spite of differences in disease inoculum and a period of cool and wet weather between planting and emergence. Final stands were similar and acceptable for all seed lots.

Crop vigor was excellent throughout the growing season. Except for the Oregon Foundation Seed Project (OFSP) nuclear lot, senescence set in by early September. The OFSP lot maintained lush growth and continued flowering until vine desiccation and frost stopped vine growth in mid-September. Vines in this seed lot were not completely desiccated at harvest.

Yields were exceptionally high for all treatments. The average yield of No. 1's was nearly doubled that achieved by Russet Burbank in several adjacent experiments. The OFSP lot was slightly, but not statistically, higher in yield of No. 1's and total yield than other seed sources. Cutting time did not affect yield or tuber size distribution. The fusarium infected Deschutes C. source was equivalent in performance to other seed sources. High levels of fusarium infection in one seed lot did not reduce stands, yields, or quality, in a season when stand and yield problems were experienced in a few commercial fields of Russet Burbank.

Excessive vine vigor in nuclear seed is consistent with observations from other research and suggests that reduced nitrogen fertilization rates may be appropriate for nuclear seed which is relatively pathogen-free.

IV. RESPONSE OF A74212-1 TO SEED TREATMENT

Procedures:

The Deschutes C. seed source, highly infected with fusarium dry rot, was used exclusively. Seed was hand cut to 1.5- to 2.0-ounce seed piece size on May 19. Knives were not disinfected during cutting and no attempt was made to sort and discard fusarium infected material. After cutting, appropriate quantities of seed were batch treated with nine different treatments. One batch remained untreated.

The experiment was a randomized complete block design with 10 treatments and four replications. Individual plots were two rows, 30 feet long. Potatoes were planted on May 20, desiccated on September 12, and harvested on October 5. All tubers from both rows were weighed in the field and approxately 60-pound samples per plot were stored and graded in early November.

Results and Discussion:

Treatment of cut seed with Spotless resulted in delayed emergence, phytotoxic injury to emerged plants, a slight reduction in yield, and a significant effect on tuber size distribution (Table 5). A reduction in tuber set appears to be responsible for the dramatic shift in size distribution. The TOPS-Rovral treatment also reduced final stands slightly.

The highest yield of No. 1's occurred in the untreated control. This is surprising for a seed lot with a high level of fusarium infection, particularly when a period of cool, wet conditions followed planting. However, failure to observe stand and yield effects under adverse conditions is an indication that A74212-1 has some level of tolerance to fusarium infection in seed.

SUMMARY AND CONCLUSIONS

Over a period of eight years the A74212-1 selection has demonstrated outstanding yielding ability in the Klamath Basin. Management of cultural practices to control tuber size will be very important for successful commercialization of this seedling. A combination of relatively high plant populations and modest nitrogen rates maintained appropriate size distribution for fresh markets.

A74212-1 has a thinner skin than Russet Burbank. A 1987 experiment at KES demonstrated a greater susceptibility to skinning damage at harvest for A74212-1 at 10 days after topkilling. One commercial experience in the Klamath Basin in 1988 confirmed the importance of delaying harvest until skin maturity is adequate to resist damage. It seems likely that seed decay problems experienced in the past were at least partially caused by damage at harvest and subsequent infection by fungal and or bacterial diseases. The use of a fungicide on crops at storage loading time would reduce the risk of storage disease losses.

The A74212-1 selection has experienced very little hollow-heart, brown center, or other physiological disorders. Hollow-heart was observed extensively in the 1988 Oregon Statewide Trial in a number of entries, but not at all in A74212-1, even in very large tubers. A74212-1 has apparent field resistance to early blight and the early dying complex. In 1988 trials A74212-1 was susceptible to root-knot nematodes and tuber infection with spraing.

Table 1. Performance of A74212-1 vs. Russet Burbank in Klamath Experiment Station Statewide Variety Trials 1981-1988.

YEAR	RUSSET BURBANK TOTAL YIELD	RUSSET BURBANK YIELD NO 1's	RUSSET BURBANK SPECIFIC GRAVITY	A74212-1 TOTAL YIELD	A74212-1 YIELD NO 1's	A74212-1 SPECIFIC GRAVITY
	cwt/A	cwt/A		cwt/A	cwt/A	
1981	412	294	1.085	471	398	1.081
1982	441	300	1.090	524	395	1.083
1983	421	233	1.077	484	409	1.070
1984	495	371	1.074	634	539	1.076
1985	397	283	1.079	510	414	---
1986	535	390	1.075	621	546	1,068
1987	370	209	1.080	495	405	1.066
1988	463	320	1.085	626	573	1.079
Average	442	300	1.079	546	460	1.075

Table 2. Effect of seed spacing on yield and size distribution of A74212-1 at the Klamath Experiment Station.

YEAR	SEED SPACING inches	YIELD NO #1's 4-6 oz	YIELD NO #1's 6-10 oz	YIELD NO #1's >10 oz	YIELD NO #1's TOTAL	YIELD B's	YIELD NO 2's	YIELD CULLS	YIELD TOTAL
		cwt/A							
1987	6.0	92	161	216	469	55	43	47	613
	9.0	80	143	191	414	49	57	47	568
	12.0	53	107	154	314	39	72	45	470
1988	6.8	133	246	230	609	59	19	7	694
	8.7	119	174	262	555	58	34	10	657
	12.0	92	177	252	521	40	31	16	607

Table 3. Effect of nitrogen rate on yield and size distribution of A74212-1 at the Klamath Experiment Station, 1988.

N RATE (lb N/A)	YIELD NO 1's 4-6 oz	YIELD NO 1's 6-10 oz	YIELD NO 1's >10 oz	YIELD NO 1's TOTAL	YIELD B's	YIELD NO 2's	YIELD CULLS	YIELD TOTAL
	cwt/A							
130	115	171	171	457	54	49	7	567
160	74	177	236	487	46	26	22	581
190	81	172	255	508	42	25	2	577

Table 4. Effects of seed source and cutting time on A74212-1, Klamath Experiment Station, 1988.

SEED SOURCE	CUTTING TIME	YIELD NO.1's 4-6 oz	YIELD NO.1's 6-10 oz	YIELD NO.1's >10 oz	YIELD NO.1's TOTAL	YIELD B's	YIELD NO 2's	YIELD TOTAL	EMERGENCE JUNE 20	EMERGENCE JULY 5
		cwt/A							%	
KES	Pre-	149	228	195	572	55	12	641	70	89
Powell Butte	Pre-	175	261	134	570	63	10	643	89	93
Klamath C.	Pre-	152	266	160	578	71	15	671	83	91
Deschutes C.	Pre-	153	259	152	564	64	13	642	77	89
OFSP Nuclear	Pre-	128	290	206	624	57	35	721	92	96
KES	Fresh	109	265	217	590	55	21	673	66	92
Powell Butte	Fresh	176	276	155	606	68	11	688	92	97
Klamath C.	Fresh	195	227	111	532	86	20	648	85	94
Deschutes C.	Fresh	151	221	181	552	65	13	633	74	93
OFSP Nuclear	Fresh	143	315	175	633	63	20	716	93	97
<u>Source Main Effect</u>:										
KES		129	247	205	581	55	16	657	68	91
Powell Butte		175	269	144	588	66	10	666	91	95
Klamath C.		174	246	135	555	78	18	660	84	93
Deschutes C.		152	240	166	558	65	13	638	76	91
OFSP Nuclear		136	302	191	629	60	27	719	93	97
<u>Cutting Time Main Effect</u>:										
Pre-Cut		151	261	169	582	62	17	664	82	91
Fresh Cut		155	261	168	583	67	17	672	82	95
CV(%)		17	13	32	9	23	56	9	--	--
LSD(.05)		38	51	NS	NS	22	13	NS	--	--

Table 5. Effect of seed treatment on A74212-1, Klamath Experiment Station, 1988.

SEED TREATMENT	YIELD NO 1's 4-6 oz	YIELD NO 1's 6-10 oz	YIELD NO 1's >10 oz	YIELD NO 1's TOTAL	YIELD B's	YIELD NO 2's	YIELD TOTAL	EMERGENCE JUNE 20	EMERGENCE JULY
	cwt/A							%	
Control	167	196	204	566	72	6	652	68	91
Gypsum	173	191	173	537	81	15	637	68	90
TOPS 2.5 D	169	173	178	520	102	29	654	78	88
TOPS - Rovral	157	188	132	476	93	10	602	63	82
TOPS - Rizolex	201	233	113	547	89	43	689	82	90
Captan 7.5	167	198	151	515	86	55	691	84	90
Spotless	71	91	326	488	42	29	578	48	83
TOPS - Anchor	174	220	101	495	88	23	619	78	89
TOPS - Manzate	192	186	73	451	136	42	653	80	87
TOPS - Benzimidazole	156	201	171	528	70	38	667	75	87
Average	163	188	162	512	86	29	644	72	88
CV(%)	18	23	34	13	27	69	10	--	--
LSD(.05)	42	63	79	99	34	29	NS	--	--

Cultural Management Practices for Optimum Performance of New Varieties and Advanced Selections.

K. A. Rykbost and J. Maxwell[1]

INTRODUCTION

North American potato breeding programs are releasing several new potato varieties annually. Very few, if any, will achieve optimum performance under cultural management practices appropriate for Russet Burbank. Without prior knowledge of specific requirements most new varieties will be evaluated initially in commercial production using standard practices that have evolved from a combination of research findings and individual grower experience. If the variety is a replacement for Russet Burbank, there is a high probability that it will not approach its potential, and a significant risk that very poor performance will be experienced.

The development of variety-specific cultural management systems prior to commercial scale production of new varieties will greatly improve the chance for successful introduction. The additional experience during the conduct of this research may also result in identification of weaknesses that have not surfaced in selection trials in other regions under small-scale tests. If serious limitations are identified during this stage of evaluation, future commercial failures can be prevented.

Increasing diversity in potato market opportunities has intensified the search for new varieties by researchers as well as producers. In the Northwest and the Klamath Basin early processing, chipping, fresh market russets, and specialty varieties are all in demand. This research is directed toward identification of plant population and nitrogen fertilizer requirements for the most promising candidates. The findings may not have precise application for other production regions but will be a useful starting point for adapting new varieties to local conditions.

1/ Superintendent/Associate Professor, Experimental Biology Technician, respectively, Klamath Experiment Station.

NEW VARIETIES OF INTEREST IN THE REGION

Russet Norkotah

This early-maturing, long, russet-skinned variety is rapidly replacing Norgold Russet as an early fresh market crop. It is exceptionally attractive in appearance, and produces a high percentage of No. 1's; however, it does not possess good culinary quality and is unsuitable for french fry production. Norkotah is very susceptible to white mold, early blight, and verticillium wilt, which accounts for its highly variable performance in commercial fields. Rapid initial acceptance by markets has been tempered more recently due to its culinary limitations.

Krantz

This oblong, russet-skinned variety is slightly later in maturity than Norgold Russet. A small plant type is typical, and may account for lower yield potential. Krantz does not appear to be particularly susceptible to the diseases that limit Russet Norkotah performance, and has shown more consistent yielding ability. Tuber appearance is acceptable but growth cracks are common in large tubers. Krantz acceptance has been relatively slow but Klamath Basin growers remain interested in this variety.

Shepody

Shepody is gaining rapidly as an early processing variety in the Northwest. This long, white-skinned variety with medium maturity now accounts for 50 percent of french fry production in Maine and eastern Canada. Superior culinary quality could give Shepody an important niche in fresh markets. However, it is not attractive when washed. Shepody is susceptible to both common and powdery scab and moderately susceptible to pink rot. It is resistant to tuber net necrosis caused by the potato leaf roll virus. Cultural management requirements have been extensively researched in the East. It requires very different management than Russet Burbank for optimum performance. This is the first new variety to impact the traditional place of Russet Burbank in the french fry industry.

Yukon Gold

This round, light yellow-fleshed variety with medium maturity has excellent culinary quality. Plant type is erect, tending toward spindly. Yields are usually moderate with uniform size and a high percentage of No. 1's. Agronomically it is far superior to Yellow Finn but flesh color is lighter. Yukon Gold could capture a share of the yellow-fleshed market with better returns to growers than are possible with Yellow Finn.

Atlantic

Atlantic is the second leading chipping variety in North America. It has round, buff colored, slightly netted tubers, high yields, high dry matter content, and low sugar content. In Atlantic Coast sandy soils internal necrosis has been sufficiently prevalent that the variety is not presently grown there. In other regions Atlantic is becoming more widely grown. This variety could serve Northwest chip markets well.

Sierra

Sierra is a long, dark-russetted selection with a short dormant period and relatively early maturity, that is gaining acceptance in Kern County, California. There is an immediate market, although small, for seed production in the Klamath Basin.

Tejon

This long, white, fresh market variety is also of interest in Kern County, California, as a replacement for White Rose.

A74212-1

This selection has consistently produced the highest yield of No. 1's of any selection tested in the Klamath Basin. It is discussed in detail in the preceding section of this report.

A7411-2

This Idaho seedling is a long, russeted, processing type that has shown moderate resistance to dark end development in Malheur County and Western Idaho. It is currently being evaluated extensively by processors in that region. The decision to release will be made within the next year or two.

PROCEDURES

Separate experiments were conducted to evaluate plant population and nitrogen fertilization responses for 10 varieties or advanced selections. Both employed a split-plot design with four replications, and standard management practices for weed control, pest management, and irrigation.

The variety by seed spacing experiment was planted on May 23. Seed spacings of 6.8, 8.7, and 12.0 inches were main-plot treatments. Plots were two rows, 30 feet long. Fertilization included 800 lb/A of 16-20-0-13 banded at planting and 50 lb N/A applied as solution 32 on June 7. Vines were desiccated with diquat applied at 1.5 pints/A on September 12 and potatoes were harvested on October 4. Field weights were determined on all tubers from both rows. Approximately 60-pound samples were stored and graded in early November.

The variety by nitrogen rate trial was planted on May 24. Main-plot treatments were N-rates of 130, 160, and 190 lb/A, achieved by supplementing 800 lb/A of 16-20-0-13 with 0, 30, or 60 lb N/A applied as solution 32 on June 8. Individual plots were four rows, 30 feet long, with Russet Burbank spaced at 12 inches in the two outside rows, and test varieties spaced at 8.7 inches in the two center rows. Vines were desiccated as above and plots were harvested on October 6. Vine vigor ratings on a scale of 1 (completely dead) to 5 (lush vines) were made on September 13. Total weights were determined in the field for the two center rows. Approximately 60-pound samples were stored and graded in early November.

RESULTS AND DISCUSSION

Plant emergence varied between varieties but was quite consistent between main-plot treatments (Tables 1 and 2). Norgold, Russet Norkotah, Shepody, Atlantic, and A7411-2 emerged uniformly and achieved final stands over 90 percent. Yukon Gold and A74212-1 were slower to reach final stands of about 85 percent. Sierra emerged slowly but achieved an 80 percent stand. Krantz and Tejon had uniform emergence but very poor stands in both experiments.

Russet Norkotah, Yukon Gold, Krantz, Norgold, and Atlantic were earliest in maturity, respectively, with Shepody, A7411-2, A74212-1, Sierra, and Tejon following in order. Sierra and Tejon are normally earlier than demonstrated in these experiments. Seed spacing treatments did not influence maturity. Higher nitrogen rates delayed maturity slightly for Sierra, Tejon, A74212-1, and A7411-2.

Percentages of No. 1's and off-grade tubers varied widely between varieties. A74212-1 had the highest percentage of No. 1's, while A7411-2 produced the most off-grades. Effects of seed spacing and nitrogen rates on grade-out varied by variety. Hollow-heart was observed extensively only in Norgold. Specific gravity varied widely between varieties and trended lower for higher nitrogen rates and greater seed spacing.

Large differences between varieties in yield, size distribution, and grade were observed (Tables 3 and 4). In general, yields were relatively high and in good agreement with those obtained in other experiments with the same varieties.

Norgold Russet produced high yields with large tubers in both experiments. In commercial production it would normally be topkilled at least two weeks earlier. Under extended season conditions optimum yields and size distribution were achieved at 8.7-inch seed spacing and 190 lb N/A. Yields of off-grade tubers were decreased as nitrogen rate and plant population increased.

In 1987 and 1988 trials Russet Norkotah performed best at approximately 9-inch spacing. Excessive size occurred at 12-inch spacing. A significant yield response and size increase was obtained at the highest N rate. This was a result of delayed onset of early dying, suggesting that fertility management will be an important factor in disease control for this variety.

In both 1987 and 1988 Krantz performed best at the highest plant population. In part, this was due to poor stands. High cullage, due to growth cracks, was observed in 1987. The problem was not as severe in these experiments. The 130 lb N/A rate was optimum for Krantz.

Shepody's Klamath Basin management response has been consistent with results obtained in the East. Shepody requires a high plant population to achieve optimum yield and size. Spacings of 6.8 inches in this trial and 6.0 inches in 1987 were optimum. The 130 lb N/A rate was adequate. Shepody has poor eye distribution. Seed size must be controlled carefully to avoid 'blind' seed and stand reductions.

Yukon Gold produced a relatively high yield of very attractive tubers. Optimum performance was observed at a spacing of 8.7 inches and an N Rate of 130 lb/A.

Atlantic produced the highest dry matter of the 10 varieties included. Yields and size distribution were excellent for a chipping variety. Internal
necrosis, which has occurred in other regions, was not observed in 1988 trials on KES sandy soils. Optimum performance was obtained at 8.7-inch seed spacing and 130 lb N/A.

Sierra's performance in these trials was influenced by poor seed vigor and may not be representative of typical behavior. Under these conditions 8.7 inch seed spacing and 130 lb N/A were optimum. Very low specific gravity may indicate poor culinary quality.

Tejon's poor stands and early season vigor resulted in low yields, excessive size, severe skinning damage, and poor appearance. Seed spacing and nitrogen responses are probably not valid in view of the poor stands.

A74212-1 was significantly higher in yield of No. 1's and total yield than all other entries in the seed spacing trial. Only Norgold achieved equivalent yields in the nitrogen rate experiment. Commercial success with A74212-1 will require very careful crop management.

A7411-2 exhibited poor type and a high percentage of No. 2's and culls. It was the only entry that had an optimum seed spacing of 12 inches. The minimum nitrogen rate was optimum for A7411-2. The rather poor tuber type raises a question about its acceptability for fresh market production in the Klamath Basin.

SUMMARY AND CONCLUSIONS

Varietal responses to seed spacings and nitrogen rates were quite pronounced in some cases. Most of the entries required higher plant populations and lower nitrogen rates than Russet Burbank for optimum performance. The development of management response data for new varieties prior to large scale commercial production will minimize the risk of commercial failures.

These experiments will be continued with promising new varieties or advanced seedlings added as they become available. For 1989 Shepody, Tejon, and Yukon Gold will be dropped from the trial. Russet Burbank will replace Norgold as the standard variety. HiLite, A74114-4, and BR7093-24 will be added in anticipation of growing interest in these selections.

Table 1. Effect of seed spacing on performance of ten potato varieties, Klamath Experiment Station, 1988.

VARIETY	SEED SPACING inches	EMERGED 6/27 %	VIGOR RATING	NO. 1's %	NO 2's & CULLS %	H.H. %	SPECIFIC GRAVITY
Norgold	6.8	95	2.5	85	9	43	1.070
	8.7	84	2.3	82	11	20	1.068
	12.0	87	2.3	79	16	48	1.067
R. Norkotah	6.8	93	2.0	79	6	0	1.068
	8.7	90	1.8	80	9	0	1.067
	12.0	93	1.5	89	2	15	1.068
Krantz	6.8	65	2.3	80	12	0	1.072
	8.7	66	2.0	79	15	0	1.072
	12.0	67	2.3	74	20	0	1.070
Shepody	6.8	85	2.8	73	23	10	1.079
	8.7	87	3.0	75	20	0	1.078
	12.0	87	3.3	70	27	15	1.079
Yukon Gold	6.8	80	2.0	85	7	5	1.080
	8.7	79	2.0	87	6	5	1.076
	12.0	84	2.0	85	10	10	1.080
Atlantic	6.8	91	2.5	77	7	0	1.087
	8.7	90	3.0	76	12	5	1.089
	12.0	94	2.3	73	14	5	1.087
Sierra	6.8	52	4.5	71	16	0	1.062
	8.7	68	3.8	79	6	0	1.066
	12.0	64	4.3	69	15	5	1.061
Tejon	6.8	47	4.3	73	20	13	1.071
	8.7	64	5.0	76	20	20	1.073
	12.0	59	5.0	74	21	5	1.070
A74212-1	6.8	64	3.8	88	4	0	1.074
	8.7	75	3.8	84	7	5	1.073
	12.0	71	4.8	85	8	0	1.073
A7411-2	6.8	100	3.8	55	31	0	1.085
	8.7	96	3.5	66	24	0	1.086
	12.0	97	4.0	69	24	0	1.083

Table 2. Effect of nitrogen rate on performance of ten potato varieties, Klamath Experiment Station, 1988.

VARIETY	N RATE lb/A	EMERGED 6/27 %	EMERGED 7/5 %	VIGOR RATING	NO. 1's %	NO 2's & CULLS %	H.H. %	SPECIFIC GRAVITY
Norgold	130	89	92	2.8	78	17	38	1.071
	160	91	93	2.5	81	15	28	1.070
	190	89	89	2.5	89	5	25	1.069
R. Norkotah	130	90	96	1.8	84	5	0	1.069
	160	91	93	2.0	79	8	0	1.067
	190	93	96	2.0	90	1	20	1.068
Krantz	130	60	60	2.8	78	18	0	1.076
	160	55	55	3.0	74	21	5	1.073
	190	66	68	3.0	66	27	0	1.072
Shepody	130	93	97	3.0	76	19	5	1.081
	160	86	93	3.0	82	14	0	1.078
	190	84	90	2.8	73	22	0	1.080
Yukon Gold	130	77	85	2.0	90	3	0	1.083
	160	78	87	2.3	84	7	15	1.081
	190	78	83	2.5	87	5	15	1.080
Atlantic	130	89	95	3.0	76	11	18	1.092
	160	85	89	3.0	83	5	0	1.090
	190	88	91	2.8	77	10	10	1.089
Sierra	130	62	79	4.3	81	11	0	1.065
	160	64	80	4.8	75	13	0	1.062
	190	65	76	4.3	76	15	0	1.064
Tejon	130	44	46	4.3	84	11	5	1.071
	160	43	43	5.0	80	13	5	1.070
	190	49	50	5.0	80	14	5	1.069
A74212-1	130	73	87	3.8	81	10	0	1.077
	160	64	82	4.0	83	9	5	1.074
	190	71	84	4.8	88	5	0	1.074
A7411-2	130	94	97	3.5	63	28	0	1.084
	160	94	94	3.5	52	37	0	1.083
	190	91	93	4.3	55	33	5	1.086

Table 3. Effect of seed spacing on tuber yield and grade of ten potato varieties, Klamath Experiment Station, 1988.

VARIETY	SEED SPACING inches	YIELD NO 1's 4-6 oz	YIELD NO 1's 6-10 oz	YIELD NO 1's >10 oz	YIELD NO 1's TOTAL	YIELD B's	YIELD NO 2's	YIELD CULLS	YIELD TOTAL
		---cwt/A---							
Norgold	6.8	87	170	243	500	40	26	26	592
	8.7	95	165	242	502	43	36	35	616
	12.0	56	130	259	445	29	56	35	565
R. Norkotah	6.8	148	147	94	389	73	18	9	489
	8.7	119	170	147	436	60	17	32	545
	12.0	80	134	228	442	43	5	6	497
Krantz	6.8	89	150	155	394	39	42	16	491
	8.7	53	103	204	360	29	42	26	456
	12.0	46	88	180	314	27	54	30	425
Shepody	6.8	64	102	284	450	28	111	31	620
	8.7	75	131	240	446	34	95	21	596
	12.0	56	72	265	393	19	119	35	566
Yukon Gold	6.8	106	180	165	451	38	28	11	528
	8.7	88	154	228	470	36	17	17	540
	12.0	65	105	265	435	27	29	21	512
Atlantic	6.8	121	190	120	431	90	21	16	558
	8.7	149	161	125	435	70	24	43	572
	12.0	93	141	150	384	72	43	31	530
Sierra	6.8	76	123	138	337	62	34	44	477
	8.7	129	196	108	433	80	26	6	545
	12.0	111	134	88	333	77	63	11	484
Tejon	6.8	46	77	153	275	26	61	15	378
	8.7	39	86	173	298	17	49	29	393
	12.0	49	61	126	236	17	47	17	317
A74212-1	6.8	133	246	230	609	59	19	6	694
	8.7	119	174	262	555	58	34	10	657
	12.0	91	177	252	520	40	31	16	607
A7411-2	6.8	115	121	90	326	84	129	58	597
	8.7	109	166	120	394	56	105	42	597
	12.0	63	133	200	396	45	122	11	574
Variety Main Effect: (Average of three spacings)									
Norgold		79	155	248	482	37	39	32	591
R. Norkotah		116	150	156	422	59	13	16	510
Krantz		63	114	179	356	31	46	24	457
Shepody		65	102	263	430	27	108	29	594
Yukon Gold		86	146	220	452	34	24	16	527
Atlantic		121	164	132	416	77	29	30	553
Sierra		105	151	111	368	73	41	20	502
Tejon		44	75	151	269	20	53	20	363
A74212-1		114	199	248	561	52	28	11	653
A7411-2		96	140	137	372	62	119	37	589
CV(%)		26	25	27	13	31	57	97	7
LDS(.05)		19	28	40	44	12	23	19	32
Seed Spacing Main Effect: (Average of ten varieties)									
6.8"		98	151	167	416	54	49	23	542
8.7"		97	150	185	433	48	45	26	552
12.0"		71	118	201	390	40	57	22	508
CV(%)		27	32	32	20	35	43	95	16
LSD(.05)		13	24	32	NS	9	12	NS	NS

Table 4. Effect of nitrogen rate on tuber yield and grade of ten potato varieties, Klamath Experiment Station, 1988.

		YIELD NO 1's				YIELD			
VARIETY	N-RATE lb/A	4-6 oz	6-10 oz	>10 oz	TOTAL	B's	NO 2's	CULLS	TOTAL
		cwt/A							
Norgold	130	67	151	248	466	31	47	51	595
	160	84	170	237	491	27	59	29	606
	190	78	189	263	530	34	16	11	594
R. Norkotah	130	112	211	86	409	54	18	7	488
	160	94	183	119	396	67	19	20	502
	190	107	211	175	493	47	3	2	545
Krantz	130	37	92	171	300	16	40	25	381
	160	41	89	171	301	21	49	33	404
	190	52	74	172	298	34	68	50	450
Shepody	130	61	131	266	458	32	77	37	604
	160	60	145	255	460	24	69	9	562
	190	48	104	257	409	26	88	39	562
Yukon Gold	130	82	168	161	411	33	4	10	458
	160	94	131	164	389	45	22	9	466
	190	79	138	189	406	38	15	10	469
Atlantic	130	136	139	128	403	66	30	29	528
	160	127	169	127	423	61	12	16	512
	190	120	145	133	398	70	19	32	519
Sierra	130	91	162	150	403	42	51	5	502
	160	105	162	102	369	60	45	18	492
	190	72	126	151	349	41	59	12	461
Tejon	130	33	81	141	255	17	31	3	306
	160	30	74	146	250	16	39	7	312
	190	32	63	163	258	19	37	5	319
A74212-1	130	115	171	171	457	54	49	8	567
	160	74	177	236	487	46	26	23	581
	190	81	172	255	508	42	25	1	577
A7411-2	130	94	127	138	359	50	142	17	568
	160	69	111	106	286	62	160	42	550
	190	75	117	113	305	65	155	30	555
Variety Main Effect: (Average of three seed spacings)									
Norgold		76	170	249	496	31	42	30	598
R. Norkotah		104	201	127	433	56	13	10	512
Krantz		43	85	171	300	24	52	36	412
Shepody		56	127	260	442	27	78	28	576
Yukon Gold		85	146	172	402	39	13	10	464
Atlantic		128	151	129	408	66	20	26	520
Sierra		89	150	134	374	48	51	12	485
Tejon		32	73	151	255	17	36	5	313
A74212-1		90	173	221	484	47	33	11	575
A7411-2		80	118	119	317	59	152	30	557
CV(%)		23	22	24	13	35	55	107	8
LDS(.05)		15	25	34	41	12	22	17	32
Seed Spacing Main Effect: (Average of ten varieties)									
130#N/A		83	143	166	392	40	49	19	500
8.7"		78	141	166	385	43	50	21	499
12.0"		74	134	187	396	42	49	19	505
CV(%)		26	17	35	15	40	58	57	16
LSD(.05)		NS	NS	NS	NS	NS	NS	NS	NS

Effects of N, P, K and S rates on Nutrient Status and Crop Performance of Russet Burbank, Klamath Experiment Station, 1988.

K. A. Rykbost[1], N. W. Christensen[2] and J. Maxwell[1]

INTRODUCTION

During the past two decades potato production practices have changed significantly in the Klamath Basin. Improved irrigation efficiency, higher quality seed, better pest control, and other improvements have increased average yields. Shorter rotations, increased use of soil fumigants, improved drainage, acidification of mineral soils, and modified fertilization practices have altered soil fertility status and crop nutritional needs, and may require changes in fertility practices.

Recent research in the northwest has suggested yields and quality can be improved by modifying traditional P and K fertility management. A relationship between fumigation and P nutrition has been suggested. Both K rate and source have been found to affect yield and quality. There are indications that higher N and K rates may reduce susceptibility to early dying and perhaps other diseases, including pink rot.

This experiment was established in 1988 to evaluate Russet Burbank response to fertilization on mineral soils in the Klamath Basin under current management practices and economic conditions.

PROCEDURES

Russet Burbank potatoes were planted in Poe fine sandy loam at 12-inch seed spacing in 32-inch rows on May 25. Twelve pre-mixed fertilizer blends were shanked in on both sides of rows with a continuous belt applicator on June 6. Treatments were arranged in a randomized complete block design with four replications. Individual plots were four rows, 40-feet long. Standard cultural practices described elsewhere in this report were followed (page 14).

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Vines were frost killed in mid-September. Tubers were harvested on October 10. Harvest areas included the two center rows, trimmed to 36-foot length. Total weights were determined in the field. Approximately 100-pound samples were stored and graded in mid-November.

Crop values were estimated based on January, 1989 net price to growers for each size and grade component of total yield, for fresh market crops in the Klamath Basin. These prices are: 4-6 oz. No. 1's - $6.00/cwt; 6-10 oz. No. 1's - $11.00/cwt; >10 oz. No. 1's - $16.00/cwt; B's and culls-$1.00/cwt; No. 2's - $3.00/cwt.

RESULTS AND DISCUSSION

Soil test sampling prior to planting indicated very high soil P and K levels, low to medium S and Ca, a soil pH of 5.7, and very low organic matter content (0.6 percent). The Poe soil is quite typical of potato production soils in the area.

Early season growth was slowed by cool weather in mid-June. High temperatures in July and August stressed crops mildly and delayed tuber bulking. A killing frost on September 13 effectively stopped tuber enlargement. The combined effect of weather factors was lower yields and smaller size than normal for Klamath Basin Russet Burbank potatoes.

Petiole samples were obtained from all plots on July 14 and August 8. The 0 and 40 lb S/A plots were sampled on August 15. Petiole levels of P and K were within the sufficiency range through this portion of the season and were unaffected by application rates of P or K (Table 1). Petiole nitrate - N levels exhibited considerable variability. On July 14 N levels were within the sufficiency range for all N rates. By August 8 N levels had dropped below the sufficiency range for 60 and 120 lb N treatments and plants were beginning to appear N deficient. On August 15 the 180 lb N treatment was below 1.0 percent nitrate-N and on the borderline of deficiency for that stage of development.

On September 13 vines had sensesced quite severely at the lowest N rate and moderately at 120 lb N/A. A continuation of favorable growing conditions would have resulted in substantially increased yields and sizing at the two highest N rates, but very little gain for the low rate. P and K rates had no measurable effect on vine vigor at this time.

Yield responses to fertility treatments were small in general (Table 2). Increasing N rate tended to increase tuber size. The lowest P rate resulted in the highest yield and largest tuber size. K and S rates had very little effect on size distribution or yields. These findings are consistent with the lack of petiole nutrient level response to P and K rates. An economic analysis of crop values and fertilizer costs shows optimum rates were: N-180 lb/A; P_2O_5 -60 lb/A; K_2O - 60 lb/A; and S-40 lb/A.

Crop quality for processing is closely related to tuber dry matter content. The response of specific gravity to fertilization rates followed expected trends. Each increment of N reduced specific gravity by .002 (Table 2). Phosphorous rates did not affect specific gravity. Potassium chloride at rates above 60 lb K_2O/A reduced specific gravity slightly. As expected, substitution of potassium sulfate for potassium chloride resulted in higher specific gravity.

Disease and disorder problems were minimal in this experiment. Hollowheart was observed in about 10 percent of the largest tubers but was consistent across all treatments. Very little soft rot was found and no jelly-end rot was observed. Potato foliage on the two lowest N treatments expressed early dying symptoms in early September. Foliage on all other treatments appeared vigorous until frost-killed on September 13.

SUMMARY AND CONCLUSION

Efficient use of plant nutrients is important to growers for economic reasons, but it is also a concern for environmental impact considerations. The Klamath Basin's irrigation and drainage system is closely entwined with two lakes and several wildlife refuges. Algae and aquatic weeds are becoming increasingly problematic in the Basin's surface waters, which are undoubtedly influenced by agricultural practices. Judicious use of fertilizers will be imperative in the future. Potato crops could be grown economically with less phosphorous and potassium than traditionally used in the Klamath Basin. However, each year presents unique circumstances and several years of results will be required to develop firm recommendations.

Table 1. Effects of N,P,K, and S rates on petiole nutrient levels in Russet Burbank, Klamath Falls, 1988.

FERTILIZER RATE				July 14 Samples			Aug. 8 Samples			Aug. 15 Samples		
N	P_2O_5	K_2O	S	NO_3-N	PO_4-P	K	NO_3-N	PO_4-P	K	NO_3-N	PO_4-P	K
--------lbs/A--------				-----------%-----------			----------%----------			----------%----------		
N Response												
60	120	120	0	1.60	0.42	11.35	0.39	0.39	9.92	--	--	--
120	120	120	0	2.08	0.41	10.62	0.82	0.39	8.80	--	--	--
180	120	120	0	2.53	0.40	10.28	1.06	0.40	9.10	--	--	--
240	120	120	0	2.66	0.42	9.38	1.55	0.43	9.23	--	--	--
P Response												
180	60	120	0	2.56	0.40	10.17	1.15	0.42	8.95	--	--	--
180	120	120	0	2.53	0.40	10.28	1.06	0.40	9.10	--	--	--
180	180	120	0	2.54	0.42	9.70	1.15	0.40	10.02	--	--	--
180	240	120	0	2.47	0.44	10.02	1.15	0.47	9.44	--	--	--
K Response												
180	120	0	0	2.70	0.43	10.39	1.29	0.39	8.78	--	--	--
180	120	60	0	2.69	0.44	9.83	0.93	0.53	8.01	--	--	--
180	120	120	0	2.53	0.40	10.28	1.06	0.40	9.10	--	--	--
180	120	180	0	2.46	0.39	10.12	1.04	0.42	9.57	--	--	--
180	120	240	0	2.18	0.40	11.12	0.99	0.48	9.28	--	--	--
S Response												
180	120	120	0	2.53	0.40	10.28	1.06	0.40	9.10	0.78	0.41	9.55
180	120	120	40	2.59	0.43	10.11	1.14	0.46	7.56	0.85	0.46	8.74
CV (%)				8.2	12.2	10.8	42.4	23.2	15.5	--	--	--
LSD(.05)				0.29	NS	NS	NS	NS	NS	--	--	--

Table 2. Effects of N, P, K, and S rates on yield and grade of Russet Burbank, Klamath Falls, 1988.

FERTILIZER RATE				YIELD #1's				YIELD				Value	SPECIFIC GRAVITY
N	P_2O_5	K_2O	S	4-6 oz	6-10 oz	>10 oz	TOTAL	B's	#2'S	CULLS	TOTAL	($/A)	
lb/A				cwt/A				cwt/A					
N Response													
60	120	120	0	167	115	28	310	88	7	16	420	2840	1.085
120	120	120	0	143	118	34	295	83	23	34	435	2886	1.083
180	120	120	0	144	130	54	328	84	29	14	455	3343	1.079
240	120	120	0	141	127	48	316	72	24	26	438	3181	1.077
P Response													
180	60	120	0	130	163	80	372	70	17	17	476	3991	1.080
180	120	120	0	144	130	54	328	84	29	14	455	3343	1.079
180	180	120	0	127	112	46	285	67	37	41	429	2949	1.081
180	240	120	0	149	150	51	350	75	26	20	471	3523	1.082
K Response													
180	120	0	0	158	132	55	345	87	16	19	467	3434	1.083
180	120	60	0	135	143	74	352	71	19	22	463	3717	1.085
180	120	120	0	144	130	54	328	84	29	14	455	3343	1.079
180	120	180	0	135	128	60	323	86	34	13	455	3379	1.081
180	120	240	0	153	140	62	355	67	24	32	478	3621	1.080
S Response													
180	120	120	0	144	130	54	328	84	29	14	455	3343	1.079
180	120	120	40	153	142	48	343	85	18	28	474	3445	1.082
	CV (%)			19	19	38	12	29	58	79	7	--	0.2
	LSD(.05)			40	36	29	55	32	19	27	43	--	0.003

Foliar Fertilization of Russet Burbank Potatoes, Klamath Experiment Station, 1988

K. A. Rykbost and J. Maxwell[1]

INTRODUCTION

Soil and plant analysis data suggest that a portion of the mineral soils used for potato production in the Klamath Basin are marginally deficient in boron and zinc. These nutrients can be provided from several commercially available sources, some of which have been evaluated in research in other areas of the Northwest.

This experiment was established to evaluate the nutrient status of Russet Burbank potatoes grown on soil low in zinc and boron, and to determine whether foliar fertilization would correct nutritional imbalances or affect yields or quality.

PROCEDURES

Russet Burbank potatoes were planted at 12-inch seed spacing in 32-inch rows on May 25. Fertilizer included 650 lbs/A 16-20-0-13 banded at planting and 100 lbs N/A as solution 32 applied on June 7. Standard cultural practices were followed (page 14).

A hand-held plot sprayer was used to apply foliar fertilizers to four-row plots, 40 feet long. Four replications included eight treatments (Table 1) in a randomized complete block design. All fertilizers were applied at 30 gpa of solution.

The crop was frost-killed on September 13 and potatoes were harvested on October 10. Harvest areas were the two center rows, 37 feet long. Total plot weights were determined in the field. Approximately 60-pound samples were saved from each plot for grading in mid-November. Crop values were calculated using prices described in the previous experiment (page 14).

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Acknowledgements: Partial funding by the Cooperative State Research Service and the Oregon Potato Commission, and petiole sample analysis by the Leffingwell Company, contributed to this research project.

RESULTS AND DISCUSSION

Soil samples collected prior to planting indicated P and K levels were very high. Zinc at 0.5 ppm, and boron at 0.6 ppm, were in the low to very low range. The soil pH was 5.9 and organic matter content was 0.6 percent in fine sandy loam.

Petiole samples were collected on August 8 and September 6 (Table 2). Foliar fertilizers did not produce observable differences in vegetative development. Vine growth appeared vigorous until frost occurred.

Petiole nutrient levels did not respond to foliar fertilizers. In all cases, nutrient levels were within sufficiency ranges on August 8. Zinc levels were on the low end of the sufficiency range on September 6, but were unaffected by zinc fertilization. Boron levels in petioles were in the sufficiency range with no differences between treatments.

Zinc-sulfate (36 percent Zn) reduced tuber size, yield, and specific gravity (Table 2). Total yield of No. 1's was significantly lower for this treatment than all treatments except the control. While foliar toxicity symptoms were not observed, crop performance data suggest toxicity may have occurred. Solubor (20 percent B) did not affect crop performance.

All treatments which included Nutra-Phos 24 increased the yield of No. 1's compared with the control. Nutra-Phos 24 and Sorba-Spray Ca was significantly higher than the control in total yield of No. 1's. Costs ranging from approximately $3/A for Solubor, to less than $20/A for all others, were negligible in comparison to increases in crop value for all additives except zinc-sulfate.

SUMMARY AND CONCLUSIONS

Neither zinc nor boron alone improved yields at quantities applied in other regions where deficiencies have been documented. In smaller quantities, blended with other nutrients, small but economical yield responses were obtained. Nutra-Phos 24 in combination with Sorba-Spray Ca increased the yield of No. 1's 63-cwt/A. Petiole analyses did not show responses in plant nutrition to any of the foliar applications.

Similar yield responses to blended foliar fertilization products have been observed elsewhere in the Northwest. These results are sufficiently promising to justify further pursuit of this area of investigation.

Table 1. Rate and Timing of application of foliar fertilization products applied to Russet Burbank potatoes, Klamath Experiment Station, 1988.

TREATMENT	PRODUCT	RATE/A	TIMING
1	Water	30 gal.	7/14, 7/25
2	Solubor	1.25 lbs	7/14, 7/25
3	Zinc-sulfate	1.4 lbs	7/14, 7/25
4	Nutra-Phos 24	5 lbs	7/14
	Nutra-Phos Super K	5 lbs	7/25
5	Nutra-Phos 24	5 lbs	7/14, 7/25
	Sorba-Spray Ca	2 qts	7/14, 7/25
6	Nutra-Phos 24	5 lbs	7/14, 7/25
	Sorba-Spray CaB	2 qts	7/14, 7/25
7	Nutra-Phos 24	5 lbs	7/14, 7/25
	Sorba-Spray ZBK	2 qts	7/14, 7/25
8	Nutra-Phos 24	5 lbs	7/14, 7/25
	Sorba-Spray ZPK	2 qts	7/14, 7/25

Table 2. Petiole nutrient levels in Russet Burbank treated with several foliar fertilizers, Klamath Experiment Station, 1988.

TREATMENT	P	K	Ca	Mg	Zn	B
	%				ppm	
			August 8			
1	0.24	9.2	0.83	0.47	19	38
2	0.26	8.9	0.60	0.39	27	36
3	0.36	9.3	0.77	0.37	62	36
4	0.36	9.5	0.82	0.35	30	34
5	0.25	8.8	0.78	0.47	41	35
6	0.24	9.1	0.62	0.41	35	35
7	0.35	9.5	0.75	0.37	42	37
8	0.35	9.2	0.70	0.35	26	35
			September 6			
1	0.15	7.8	1.54	0.78	7	33
2	0.21	7.4	1.49	0.82	10	36
3	0.15	10.2	1.38	0.77	9	34
4	0.12	8.1	1.31	0.60	9	32
5	0.13	7.8	1.38	0.68	9	34
6	0.15	7.9	1.45	0.77	11	33
7	0.12	7.6	1.42	0.81	7	34
8	0.14	8.7	1.36	0.75	10	34

Table 3. Effects of foliar fertilization on Russet Burbank, Klamath Falls, 1988

TREATMENT	YIELD #1's				YIELD				VALUE	SPECIFIC GRAVITY
	4-6 oz	6-10 oz	>10 oz	TOTAL	B's	#2's	CULLS	TOTAL	($/A)	
	cwt/A				cwt/A					
1	142	124	27	292	84	14	19	408	2793	1.086
2	130	129	37	296	80	13	2	390	2912	1.083
3	131	97	18	246	112	10	4	372	2287	1.079
4	170	118	31	318	103	14	4	439	2963	1.085
5	178	153	24	355	90	5	5	454	3245	1.084
6	140	138	31	309	79	4	8	400	2953	1.083
7	164	140	21	325	106	9	7	447	3000	1.085
8	157	141	24	322	87	6	13	428	2955	1.083
CV(%)	16	23	60	11	21	67	114	7	--	0.2
LSD(.05)	36	NS	NS	49	NS	NS	NS	44	--	0.003

A Comparison of Russet Burbank Seed Sources

K. A. Rykbost and J. Maxwell[1]

INTRODUCTION

Seed potato production in North America is in a period of transition. Meristem propogation techniques, flush through systems, post-harvest testing for virus diseases, and mandatory use of certified seed are in various stages of adoption in seed growing regions. Private companies are entering the system as producers of nuclear seed stocks in growing numbers. Commercial growers are being offered a larger selection of options in 'strains' of a given variety, and in generation or class of seed. Perceptions as to the quality of various sources or 'strains' are guiding seed acquisition decisions. These may or may not be accurate.

Meristem propogation techniques allow very rapid multiplication of large quantities of seed from one or a few tubers. If superior, or inferior, genotypes are used as the initial source, performance of commercial crops several generations later may be quite different. The selection of material to be used as the source for rapid multiplication may be very important if 'strain' differences can be documented. In the short term, commercial growers are more concerned with the performance of available options, including any effects that may be due to storage, handling or shipping of seed to the commercial grower.

This experiment was conducted to compare several generations of Russet Burbank seed, derived from several origins.

PROCEDURES

Nine Russet Burbank potato seed lots of distinct origin were hand-cut, treated with TOPS 2.5 D on May 12, and held at approximately 55'F and 95 percent relative humidity until planting. A second sample of one source was cut and treated one day prior to planting. Two-row plots, 30 feet long, were planted in a randomized complete block design with four replications on May 20. Seed was spaced at 12 inches. Standard cultural practices were followed. Vines were frost-killed on September 13 and plots were harvested on October 10. Field weights were determined on all tubers from both rows. Approximately 60-pound samples were saved for grading.

Seed 'strains' included the standard line of Russet Burbank produced in the Oregon Foundation Seed Project (OFSP), two clones being maintained by OFSP for further evaluation (Clone 1 and Clone 39), a strain being propogated by a commercial company, and a line from Montana that has achieved a

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significant market share in the Northwest. Seed classes ranged from nuclear stock to Foundation. All nuclear lots and the Powell Butte source were stored uniformly at the KES storage. The GI, GII, and GIV lots were grown and stored uniformly by one Klamath County seed grower. A Montana source was grown and stored in Montana and shipped in early spring.

RESULTS AND DISCUSSION

Plant emergence was very uniform, ranging from 93 to 99 percent 33 days after planting. Crop vigor was good with no evidence of virus diseases in any seed lots. No statistically significant differences were observed in yields of various size and grade classes between seed lots at the 95 percent probab-ility level (Table 1); however, at the 90 percent level, yields were different.

The lowest yields were observed for Powell Butte and commercially derived nuclear lots (Table 1). The Powell Butte lot was used as the standard in variety screening trials where its performance was consistent with results observed in this trial. This lot originated from the OFSP.

Nuclear Clone 1 and Clone 39 lots were intermediate in yield. Tuber type was not better than in the OFSP standard strain, as evidenced by yields of No. 2's and culls which were largely poorly shaped tubers (Table 1). The best yields were obtained from the OFSP derived Generation I lot. Pre-cutting appeared to improve tuber type somewhat but did not affect total yield. This lot produced the largest tuber size. At Generation II OFSP and commercially derived material produced similar yields.

Generation IV and Foundation lots are representative of seed that would be used for commercial production of processing or tablestock crops. These seed sources performed similarly in this trial. The Montana source produced a slightly larger tuber size but was no better in tuber type.

SUMMARY AND CONCLUSIONS

Clones 1 and 39 did not demonstrate improved performance over the standard line currently being propogated in the Oregon Foundation Seed Program. At the nuclear generation, both clones produced slightly higher yields than a commercially derived 'strain' of Russet Burbank.

The failure to observe large differences in seed lot performance is consistent with results obtained in the A74212-1 seed source experiment discussed previously. To date an 'improved' strain of Russet Burbank has not been identified in spite of numerous efforts by several research programs.

If an improved line of Russet Burbank can be found it would be very beneficial to the industry to use it as a source for propogation of basic seed stocks. Until such time, seed purchasing decisions are probably best made on the basis of factors other than perceived or advertised claims of superior 'strains' of Russet Burbank.

Table 1. Performance of Russet Burbank seed sources, Klamath Experiment Station, 1988.

SEED SOURCE	YIELD NO 1's			YIELD			
	4-10 oz	>10 oz	TOTAL	B's	NO 2's	CULLS	TOTAL
	cwt/A			cwt/A			
Powell Butte	251	41	291	126	52	31	502
Nuclear[1]	253	28	281	116	50	47	495
Nuclear (Clone 1)[2]	280	53	332	101	86	15	534
Nuclear (Clone 39)[2]	298	60	358	107	45	40	550
G I[2] Precut	274	108	382	103	64	2	551
G I[2] Fresh cut[3]	290	76	365	109	51	34	559
G II[2]	280	50	330	137	43	14	524
G II[1]	277	52	329	130	49	3	512
G IV[2]	267	45	312	133	64	37	546
Foundation-Montana	252	74	326	114	69	34	543
CV(%)	23	52	14	28	46	108	8
LSD(.05)	NS	NS	NS	NS	NS	NS	NS

1/ Derived from commercial seed propagation company.
2/ Derived from Oregon Foundation Seed Project.
3/ Cut one day prior to planting, all other lots precut and suberized 8 days before planting.

Spring Small Grain Variety Trials in the Klamath Basin, 1988

R.L. Dovel and G. Chilcote[1]

INTRODUCTION

In 1988 small grain variety trials were conducted at the Klamath Experiment Station in cooperation with plant breeding and evaluation programs at Oregon State University, Washington State University, the Tulelake Field Station (University of California at Davis), and several Western Region evaluation programs. Cold-tolerant, short-season cultivars are needed in the Klamath Basin due to a short growing season with the possibility of frost throughout the growing season. The presence of high winds in the area makes selection for lodging resistance desirable. In general there is little disease or insect pressure on small grains in the Klamath Basin. However, the introduction of the Russian Wheat Aphid could greatly alter that situation.

PROCEDURES

Most trials were established at the KES; however, an alternative site on organic soil was also used for several trials. All small-grain trials at the KES were planted on land planted in potatoes the previous year. Soils at the station include Poe, Fordney, and Hosley series, all of which have a fine loamy to sandy texture and are moderately deep and somewhat poorly drained. The off-station trials were on very deep, poorly drained, lake bottom soils with high organic matter content. All plots at both sites were sprinkler irrigated.

All trials were arranged in a randomized complete block design with either three or four replications. Trials at the KES were planted between April 25 and 27. All plots at the organic soil site were planted on May 26. Seed was planted to a depth of one inch. The seeding rate for wheat trials was 80 lbs/A while the barley and oat trials received 100 lbs/A. All plots were fertilized with 100 lbs N, 60 lbs P_2O_5, and 44 lbs S/A at time of seeding. Plots measured 5 x 20 feet with a row spacing of six inches. Bromoxynil and MCPA were applied at labeled rates to control broadleaf weeds. Chemical weed control at the organic soil site was achieved using a mixture of 2,4-D and Banvel.

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Acknowledgements: Lynn Long provided the off-station site and crop care.

RESULTS AND DISCUSSION

Comparison of Barley Varieties At Two Locations

Only one released variety, Gustoe, and one numbered line, OSB 783063, had significantly higher yields than Steptoe on the mineral soil site (Table 1). Two lines, OSB 74289-5K and OSB 77289-5W, had higher yields than Steptoe on the organic soil site. Other released varieties which had yields comparable to Steptoe at both sites included Advance, Blazer, Gus, Micah, and Fiesta.

1988 Intermountain Regional Spring Barley Trial

Steptoe continues to be one of the highest-yielding spring barley varieties for this area. Four varieties (Columbia, Gustoe, ORSM 8423, and OSB 783063) had significantly higher yields than Steptoe, which yielded 5333 lbs/A (Table 2). All these varieties had 3 percent or less lodging, compared to 68 percent lodging in Steptoe. The greater yields and increased lodging resistance of the two released cultivars mentioned above should encourage their further adoption as replacements for Steptoe in the area. ORSM 8423 and OSB 783063 have been included in the Spring Malting Barley Elite Yield trial for two years and ranked first and fourth in total yield over that period. These two OSU numbered varieties will be examined further to determine if their release is warranted.

Spring Malting Barley Elite Yield Trial

This was the second year for this trial to be conducted. High-yielding malt-quality barley varieties which are better adapted to the Klamath Basin are needed. Four varieties included in this trial are under consideration as malting varieties and have passed various levels of malt-quality testing. The two-row variety, ORSM 8408, has been approved for plant scale testing. Yields of this variety have been comparable to Klages at KES and in statewide testing; however, ORSM 8408 is much more resistant to lodging than Klages (Table 3). Another two-row line, ORSM 8411, has a yield potential similar to Klages, but is no more resistant to lodging than Klages (Table 3). ORSM 8411 has passed pilot scale brewing and is being considered for plant scale testing. The short-strawed two-row line, ORSM 8623, has shown high malt quality and has passed pilot scale malting tests. Yields are superior to Klages and no lodging has been seen in this line at the KES. The highest yielding line at KES, 2860254, averaged 7,197 lbs/A over a two-year period. This is roughly equivalent to Steptoe, which yielded 6,998 lbs/A over the same period. There has been some objection to this line due to excessive thins. However, this is a longer-season variety and management may be the cause of the high percentage of thins. The excellent yields certainly warrant further investigation.

Washington Source Spring Barley trials

This was the first year that Washington source material has been evaluated at the KES aside from the regional trials. This is a cooperative effort of OSU and WSU. The major breeding emphasis at OSU will be on winter barley and the major emphasis at WSU will be on spring barley. Three 6-row WSU lines exhibited high yields (Table 4). WA007588 was slightly lower in yield than WA007573 and WA007572, but had a higher test and very few thins. The outstanding 2-row selection was WA007345 (Table 5). It produced the highest yield with high test weight and a low percentage of thins.

Comparison of Released Spring Wheat Varieties at Two Locations

White wheat varieties yielded higher than hard red wheats at both locations (Table 6). There was no significant difference in yield among the white wheat varieties at either location. Fieldwin has consistently been the highest yielder on the mineral soil site while Blanca tends to be the highest yielding white wheat on organic soils.

All the hard red varieties tested outyielded Yecoro Rojo at both locations. There was little difference between hard red varieties, excluding Yecoro Rojo, at the mineral soil site. Discovery yielded significantly higher than all other hard red varieties at the organic soil site. It is obvious that the higher-yielding hard red varieties included in this trial could be viable alternatives to Yecoro Rojo provided quality of these varieties is equivalent to Yecoro Rojo.

1988 Intermountain Regional Spring Wheat Variety Trial

The top three yielders in this trial were OSU numbered varieties - one hard white wheat and two hard red varieties (Table 7). Demand for hard white wheats for export to the Asian Rim countries has increased in recent years. Klasic is the standard hard white variety currently being exported. The variety ORS 8413 was the highest yielder in the trial, more than doubling the yield of Klasic. Another OSU hard white variety, PC 790647, substantially outyielded Klasic. Milling and bread-making quality of these two varieties will be analyzed and compared to Klasic to evaluate their potential to replace Klasic in the Intermountain Region.

The two varieties OSR 8509 and ORS 8511 were the highest-yielding hard red varieties in the trial (Table 7), outyielding the current standard varieties in the area, Yecoro Rojo and Westbred 906R. ORS 8509 and ORS 8511 were also top yielders in the variety trial at the Tulelake Field Station. Further quality testing is needed to determine if these two promising varieties have quality to compete with current varieties.

1988 Western Regional Spring Wheat Trial

The highest-yielding line in 1988 was a soft white line from Idaho, ID 372 (Table 8). This was its first year in the regional trial. The three next highest-yielding lines were hard red varieties, WA 7075, ID 366, and UT 884. ID 366 was also in the 1987 regional trial and yielded similarly to Spillman, a promising new hard red spring wheat. Further yield and quality testing is needed to fully assess the value of these promising lines to the Klamath Basin.

1988 Hard Red Spring Wheat Variety Trial

Promising lines based on a two-year average include ORS 8518, ORS 8509, ORS 8511, and ORS 8512. All of these lines yielded an average of over 900 lbs/A more than 906R and over 1,200 lbs/A more than Yecoro Rojo over that period (Table 9). Due to the importance of grain quality in the acceptance of hard red spring wheats, further testing of grain quality will be required to assess the suitability of these promising lines for commercial production. The only released variety to place in the top five yielding lines in the 1988 trial was Borah. It has consistently outyielded both Yecoro Rojo and 906R in test plots for several years; however, adoption of this variety by producers has been minimal due to the failure of field-scale plantings to produce the high yields experienced in plot trials.

1988 Uniform Northwestern States Oat Nursery

Yields were very low this year due to frost and bird damage. Lodging was also very severe. Due to problems with lodging in oats, short-statured varieties are of special interest. In 1987 two semi-dwarf oat varieties, Riel and Steele, were the top yielders in this trial, yielding 24 and 30 percent more than Cayuse, respectively. Both Riel and Steele had slightly higher yields than Cayuse in 1988 (Table 10); however, the difference was not significant. Cayuse had 58 percent lodging in 1988 compared to no lodging for either Riel or Steele. The shortest variety, NPB 86803, had the highest yield; however, this was the first year that NPB 86803 has been in the trial and further evaluation is needed to determine its adaptation to the Klamath Basin.

Table 1. Comparison of Barley Varieties at Two Locations. A comparison of grain yield and test weight of spring barley varieties planted on mineral and organic soil sites in the Klamath Basin, 1988.

ENTRY	YIELD		TEST WT	
	Mineral	Organic	Mineral	Organic
	------lbs/A-------		------lbs/bu------	
Steptoe	5333	5573	49	49
Advance	6350	5621	52	53
Cougbar	4782	4942	51	50
Blazer	5673	4909	51	53
Gus	5967	6162	48	53
Gustoe	7122	6365	55	53
Teton	4620	4320	51	47
Sprinter	5268	4516	52	49
Micah	5271	5971	48	53
Klages	4704	4397	55	54
Morex	5307	3502	51	54
Fiesta	5667	5897	53	53
501 NAPB	--	5584	--	55
OSB 783063	6831	5959	51	52
OSB 763128	5433	5863	51	47
OSB74289-5K	6022	6837	47	51
OSB 77289-5W	--	6915	--	51
OSB 793171	--	5991	--	51
MEAN	5550	5518	51	52
CV	16.1	11.5		
LSD(0.05)	1257	901		

Table 2. 1988 Intermountain Regional Spring Barley Trial. 1988 Observations of grain yield, test weight, percent thins, percent lodging, and plant height of spring barley varieties planted on April 26 at the Klamath Experiment Station.

	ENTRY	YIELD lbs/A	YIELD (RANK)	TEST WEIGHT lbs/bu	THINS 5.5/64 ------%------	THINS PAN	LODGING ---%---	HEIGHT inches
1)	Steptoe	5333	(15)	49	4.2	2.7	68	36
2)	Klages	4704	(23)	55	6.0	4.9	40	37
3)	Gustoe	7122	(2)	55	4.7	2.4	0	33
4)	Advance	6350	(6)	52	11.1	6.5	18	40
5)	Columbia	7131	(1)	52	4.0	1.7	3	38
6)	Gallatin	4553	(25)	56	5.3	5.4	45	35
7)	Teton	4620	(24)	51	4.9	3.4	80	41
8)	Sprinter	5268	(17)	52	7.1	5.1	40	38
9)	Blazer	5673	(11)	51	8.4	7.7	30	44
10)	Fiesta	5667	(12)	53	2.7	2.2	0	33
11)	ORSM 8413	5990	(9)	54	14.3	10.9	3	31
12)	ORSM 8424	6413	(5)	53	9.6	6.7	0	33
13)	ORSM 8618	4870	(20)	50	13.9	15.4	70	37
14)	ORSM 8623	5174	(19)	51	16.3	10.0	50	37
15)	ORSM 8423	7100	(3)	52	15.3	10.2	0	35
16)	82W 44197	4279	(28)	50	13.2	10.7	0	28
17)	83W 43952	6116	(7)	50	5.5	3.2	0	33
18)	83W 41049	5815	(10)	47	19.7	17.3	0	33
19)	BFP 78-77	5601	(13)	48	27.3	14.9	38	35
20)	2B80-350	5267	(18)	55	15.0	11.7	45	35
21)	B1201	4381	(27)	54	8.9	5.7	30	40
22)	B1202	4751	(22)	55	4.5	3.8	48	34
23)	Micah	5271	(16)	48	21.9	20.0	20	31
24)	Cougbar	4782	(21)	51	11.5	11.1	40	40
25)	Triumph	4516	(26)	55	4.2	3.3	38	35
26)	OSB 783063	6831	(4)	51	16.0	10.4	3	35
27)	OSB 763128	5433	(14)	51	8.3	5.8	25	40
28)	OSB 74289-K	6022	(8)	47	23.9	19.6	30	39
	MEAN	**5537**		**52**	**11.0**	**8.3**	**27**	**36**
	CV	**16.1**						
	LSD(0.05)	**1253**						

Table 3. Spring Malting Baley Elite Yield Trial. Summary of 1987 and 1988 observations of grain yield, test weight, lodging, and plant height for spring barley varieties planted at the Klamath Experiment Station.

	ENTRY	YIELD 1987	YIELD 1988	YIELD AVERAGE	(RANK)	TEST WEIGHT lbs/bu	LODGE --%--	HEIGHT inches
		---------lbs/A---------						
1)	Steptoe	7113	6883	6998	(7)	51	13	39
2)	Klages	6046	5665	5856	(18)	55	43	39
3)	Advance	6898	7251	7074	(6)	52	5	35
4)	Morex	5663	5462	5562	(22)	53	28	41
5)	Andre	5245	5523	5384	(24)	54	45	37
6)	ORSM 8408	5751	5792	5771	(19)	55	29	39
7)	ORSM 8411	5571	5688	5630	(21)	53	55	35
8)	ORSM 8413	7060	7564	7312	(2)	54	0	29
9)	ORSM 8423	7805	6728	7267	(4)	53	0	30
10)	ORSM 8424	7857	6693	7275	(3)	52	3	33
11)	ORSM 8616	8271	6877	7574	(1)	52	<1	34
12)	ORSM 8618	7822	5328	6575	(11)	54	23	33
13)	ORSM 8619	6031	4901	5466	(23)	54	53	37
14)	ORSM 8622	6512	5444	5978	(17)	53	42	33
15)	ORSM 8623	6579	5710	6145	(16)	55	0	23
16)	ORSM 8624	6527	6145	6336	(14)	55	0	26
17)	ORSM 8625	7545	5823	6684	(9)	53	0	26
18)	ORSM 8626	6926	6572	6749	(8)	55	0	29
19)	2860351	6649	4862	5756	(20)	55	0	23
20)	2860352	6846	5799	6323	(15)	54	0	28
21)	2860355	6849	6138	6494	(12)	57	0	29
22)	2860357	6933	6284	6608	(10)	55	0	30
23)	2860356	6657	6017	6337	(13)	55	0	28
24)	2860254	8161	6233	7197	(5)	55	5	32
	MEAN	6805	6058	6431		54	14	32
	CV	9.0	9.5	5.7				
	LSD(0.05)	901	946	737				

Table 4. 1988 Washington Source 6-Row Spring Barley Trial. 1988 observations of plant height, grain yield, test weight, and percent thins for spring barley planted on April 26 at the Klamath Experiment Station.

	ENTRY	YIELD		TEST WEIGHT	THINS		LODGING	HEIGHT
		lbs/A	(RANK)	lbs/bu	5.5/64	PAN	---%---	inches
					------%-----			
1)	Steptoe	5614	(19)	50	4.2	2.5	3	45
2)	Advance	6317	(8)	50	8.5	4.4	0	38
3)	Cougbar	6655	(4)	51	6.5	4.3	2	42
4)	Morex	5518	(21)	55	2.6	1.1	0	47
5)	WA006956	6415	(5)	52	2.9	1.8	0	44
6)	WA007402	6334	(7)	51	4.1	2.6	0	47
7)	WA007392	5123	(23)	50	6.2	5.7	0	39
8)	WA007455	5863	(16)	51	3.6	2.9	0	38
9)	WA007391	6012	(14)	48	4.4	2.7	0	41
10)	WA007460	5583	(20)	52	3.8	4.4	0	42
11)	WA007453	5901	(15)	50	5.6	4.1	0	44
12)	WA007461	5041	(24)	47	11.3	7.3	5	47
13)	WA007470	6050	(13)	50	5.8	2.9	0	42
14)	WA007587	6260	(10)	52	3.6	2.6	0	40
15)	WA007588	6778	(3)	54	1.9	0.9	0	41
16)	WA007590	5452	(22)	52	3.6	2.2	0	46
17)	WA007592	6214	(11)	53	4.4	2.1	0	45
18)	WA007572	6847	(2)	50	5.9	4.0	0	43
19)	WA007573	6997	(1)	50	8.2	4.9	0	44
20)	WA007498	6361	(6)	50	6.4	2.9	2	45
21)	WA007568	5848	(17)	51	2.3	1.6	0	41
22)	WA007554	6308	(9)	51	3.9	2.3	0	33
23)	M-47	6170	(12)	53	1.6	1.0	0	47
24)	H-4374	5802	(18)	54	3.4	1.7	0	28
	MEAN	**6061**		**51**	**4.8**	**3.0**	**0.5**	**42**
	CV	**12.78**						
	LSD(0.05)	**1273**						

Table 5. 1988 Washington Source 2-Row Spring Barley Trial. 1988 observations of plant grain yield, test weight, percent thins, percent lodging, and height for two-row spring barley varieties planted on April 26 at the Klamath Experiment Station.

	ENTRY	YIELD lbs/A	YIELD (Rank)	TEST WEIGHT lbs/bu	THINS 5.5/64 ------%	THINS PAN -----	LODGING ---%---	HEIGHT inches
1)	Steptoe	5047	(10)	49	3.9	2.4	30	45
2)	Andre	4595	(18)	53	5.9	5.1	27	43
3)	Klages	4281	(22)	54	9.0	6.3	43	43
4)	Clark	4384	(21)	53	4.4	3.5	57	42
5)	Lewis	4825	(14)	57	2.4	1.6	3	44
6)	Harrington	5026	(11)	56	2.1	1.6	0	38
7)	WA006767	5768	(2)	56	3.8	2.8	13	40
8)	WA007340	5128	(8)	53	8.3	6.0	23	41
9)	WA007345	5775	(1)	56	2.9	1.8	13	42
10)	WA007475	4920	(13)	53	4.4	3.4	50	43
11)	WA007476	5269	(4)	57	4.3	3.0	13	41
12)	WA007478	4938	(12)	56	3.6	3.0	2	37
13)	WA007479	4494	(20)	56	2.8	1.7	0	37
14)	WA007617	5058	(9)	55	3.0	1.3	10	37
15)	WA007593	5207	(6)	54	8.4	5.5	3	35
16)	WA007600	4550	(19)	53	10.1	7.7	27	36
17)	WA007599	4160	(23)	52	8.5	9.6	37	36
18)	WA007350	5228	(5)	54	7.4	5.7	37	40
19)	WA007610	4764	(17)	54	2.0	0.9	27	45
20)	WA007608	5200	(7)	52	3.3	3.2	20	42
21)	WA007612	4807	(15)	55	3.5	3.2	20	42
22)	WA007616	5410	(3)	51	4.5	3.0	7	40
23)	WA007312	4793	(16)	53	9.7	7.4	20	38
24)	WA007511	3590	(24)	51	14.4	17.8	0	34
	MEAN	**4884**		**54**	**5.5**	**4.5**	**20**	**40**
	CV	**14.4**						
	LSD(0.05)	**1161**						

Table 6. Comparison of Released Spring Wheat Varieties at Two Locations. A comparison of grain yield and test weight of released varieties of spring wheat planted on mineral and organic soil sites in the Klamath Basin.

	ENTRY	YIELD MINERAL	YIELD ORGANIC	TEST WT MINERAL	TEST WT ORGANIC
		-------lbs/A------		------lbs/bu------	
Soft White Wheats					
1)	Fieldwin	6328	6149	63	59
2)	Blanca	6070	6461	63	60
3)	Bliss	5622	6224	62	59
4)	Treasure	5697	6202	64	58
5)	Owens	5582	5982	63	62
6)	Waverly	--	6066	--	58
7)	Discovery	5248	6484	59	59
	MEAN	5758	6224	62	59
Hard Red Wheats					
1)	Yecoro Rojo	2390	4633	64	62
2)	Spillman	5390	5726	61	58
3)	Rambo	5588	5362	64	60
4)	Yolo	5543	5870	62	61
5)	Copper	5198	5286	63	60
	MEAN	4822	5375	63	60
	OVERALL MEAN	5332	5870	62.5	59.5
	CV	12.7	6.0		
	LSD(0.05)	911	509		

Table 7. Intermountain Regional Spring Wheat Variety Trial. 1988 observations of grain yield, test weight, lodging and plant height of spring wheat varieties planted on April 25 at the Klamath Experiment Station.

ENTRY		YIELD lbs/A (Rank)	TEST WEIGHT lbs/bu	LODGING ---%---	HEIGHT inches
Soft White Wheats					
1)	Twin	5308	(24)	57	1537
2)	Fieldwin	6328	(4)	63	740
3)	Owens	5582	(18)	63	2037
4)	Blanca	6070	(7)	63	140
5)	Treasure	5697	(13)	64	2537
6)	Penewawa	5700	(12)	63	037
7)	ID 0286	6089	(6)	61	340
8)	ID 0249	5508	(20)	61	538
9)	ID 0266	5830	(10)	64	039
10)	Sterling	6126	(5)	63	039
11)	Bliss	5622	(16)	62	738
12)	Waduel	2496	(43)	65	035
13)	Wakanz	5789	(11)	63	037
14)	ID 0312	4870	(28)	64	035
	MEAN	5501			638
Hard Red Wheats					
15)	Yecoro Rojo		2390	(44)	64 025
16)	Yolo	5543	(19)	62	034
17)	Westbred 906R		4558	(33)	64 036
18)	Probrand 751		4444	(36)	64 031
19)	Copper	5198	(26)	63	937
20)	ORS 8417	5647	(15)	65	037
21)	Stoa	4784	(31)	61	145
22)	85S 8607	4500	(34)	63	029
23)	85S 8608	4780	(32)	63	028
24)	85S 412	4284	(39)	63	025
25)	Spillman	5390	(23)	61	038
26)	Westbred 926		4278	(40)	63 035
27)	Westbred Discovery		5248	(25)	59 540
28)	NA 681-17		5416	(21)	602238
29)	ORS 8509	6374	(2)	65	033
30)	ORS 8410	5668	(14)	65	036
31)	ORS 8511	6341	(3)	65	334
32)	ORS 8512	4833	(30)	64	032
33)	Westbred Rambo		5588	(17)	642235
34)	W2501	5140	(27)	59	336
35)	W2502	5402	(22)	64	036
36)	Butte 86	4289	(38)	62	043
	MEAN	5004		63	335
Hard White Wheats					
37)	Klasic	3143	(42)	64	025
38)	ORS 8413	7374	(1)	63	036
39)	PC 790647		6048	(8)	651040
	MEAN	5522		64	334
Durum Wheats					
40)	Modoc	4293	(37)	66	033
41)	WPB 881	3154	(41)	63	034
42)	Westbred Turbo		4837	(29)	62 033
43)	Imperial	4452	(35)	62	035
44)	Westbred Laker		5971	(9)	64 637
	MEAN	4541		63	134
	OVERALL MEAN		5145		435
	CV	12.6			
	LSD(0.05)		907		

Table 8. 1988 Western Regional Spring Wheat Nursery. 1988 observations of grain yield, test weight, lodging, and plant height of spring wheat varieties planted at the Klamath Experiment Station - April 27, 1988.

	ENTRY	YIELD REP 1	REP 2	REP 3	REP 4	AVG	TEST WEIGHT	LODGING	HEIGHT
		--------	--------	lbs/A	--------	--------	lbs/bu	---%---	inches
1)	McKAY	3537	5461	5970	4737	4926	62	0	34
2)	FEDERATION	4706	3937	4568	2473	3921	58	0	41
3)	OWENS	4178	4486	4511	5225	4600	57	1	33
4)	PENAWAWA	3829	5097	4200	4818	4486	61	0	29
5)	WA 7075	5455	5772	6166	5861	5814	62	0	35
6)	WA 7183	4777	3999	3849	4358	4245	61	0	33
7)	OR 8508	4450	3460	3572	4747	4057	65	0	32
8)	WA 7328	5570	2105	3591	4091	3839	60	0	34
9)	WA 7326	4536	5052	5636	2469	4423	61	0	31
10)	WA 7176	5623	5695	3672	3493	4621	61	0	34
11)	WA 7492	4555	5142	6518	4286	5125	58	0	33
12)	WA 312	5898	4102	4901	5968	5217	60	0	32
13)	ORS 8509	4240	4386	5577	5965	5042	57	0	29
14)	ORS 8510	3673	3255	5574	5524	4507	62	0	31
15)	ORS 8511	5655	5074	4940	6274	5486	63	0	30
16)	ORS 8422	3491	3933	3186	6129	4185	62	0	29
17)	ORS 8512	4072	3311	4909	5833	4531	63	0	30
18)	WA 7496	6196	4268	4758	2613	4458	61	0	29
19)	ID 341	2804	5192	5931	3405	4333	63	0	29
20)	ID 365	2905	4278	4582	4590	4089	60	0	30
21)	ID 366	5891	5986	6331	4881	5772	63	10	37
22)	ID 348	4881	6116	4290	5095	5095	60	0	33
23)	ID 372	5754	5151	7818	5419	6035	63	0	37
24)	ID 373	5040	4818	5415	5055	5082	63	0	34
25)	UT 526	5057	5218	5490	3056	4705	63	0	33
26)	UT 743	4561	5707	3595	5237	4775	62	0	33
27)	UT 817	3860	3128	3369	2642	3250	59	0	30
28)	UT 884	6163	5798	4506	6279	5687	62	0	34
29)	UT 1309	2300	4590	5479	5034	4351	64	0	35
30)	UT 1437	2527	4759	4173	3858	3829	61	0	35
31)	WA 7493	5931	4420	3337	4408	4524	64	0	32
32)	OR 487503	3087	5938	5559	5700	5071	62	0	33
33)	OR 487570	3241	4408	3369	4155	3793	57	10	31
34)	OR 487316	6037	4961	4969	4152	5030	63	0	30
35)	OR 487006	2577	4827	5304	4886	4398	63	10	31
36)	ID 367	2801	5678	6155	5548	5046	63	0	30
37)	ID 368	4947	5133	4010	5597	4922	60	0	36
38)	ID 75021	3893	2929	4523	3873	3805	61	0	32
39)	ID 379	5672	2695	7157	5652	5294	62	0	33
40)	ID 319	5311	4747	4358	4616	4758	62	0	33
	MEAN					4678	61	0.8	32
	CV					21			
	LSD(0.05)					1427			

Table 9. 1988 Hard Red Spring Wheat Variety Trial. Two year summary of grain yield with 1988 observations of test weight and plant height of hard red spring wheat varieties planted at the Klamath Experiment Station.

	ENTRY	YIELD				TEST WEIGHT	HEIGHT
		1988	(Rank)	1987	AVG.		
		----------lbs/A----------				lbs/bu	inches
1	McKay	3559	(25)	5355	4457	62	34
2	Borah	4872	(5)	5179	5025	63	33
3	Bronze Chief	3481	(27)	--	--	60	29
4	Kodiak	3603	(22)	--	--	59	19
5	Westbred 906R	3904	(20)	4703	4303	67	32
6	Yecoro Rojo	3390	(29)	4644	4017	65	24
7	Spillman	4476	(12)		--	62	33
8	ORS 8508	4176	(16)	5110	4698	66	33
9	ORS 8509	5313	(1)	5368	5340	64	30
10	ORS 8510	3946	(19)	--	--	64	33
11	ORS 8511	4947	(3)	5611	5279	63	30
12	ORS 8512	4685	(7)	5802	5243	66	30
13	ORS 8518	4871	(6)	6597	5734	65	29
14	ORS 8418	4287	(13)	5912	5099	65	36
15	ALP 85001	4250	(14)	5091	4670	64	35
16	ALP 85001	4531	(11)	5169	4850	65	33
17	ALP 850017	3880	(21)	5238	4559	66	31
18	ALP 850020	3980	(18)	5007	4493	65	35
19	MCP 851034	4047	(17)	--	--	63	34
20	MCP 850669	3357	(30)	--	--	64	33
21	MSN 850055	3464	(28)	--	--	65	28
22	MSN 850206	3109	(32)	--	--	64	24
23	CIANO	3504	(26)	--	--	63	30
24	ALP 85001	4894	(4)	--	--	62	31
25	ALT 850426	3172	(31)	--	--	62	36
26	ALT 850590	3566	(24)	--	--	61	38
27	ALT 850527	3580	(23)	--	--	59	41
28	MPC 850308	4189	(15)	--	--	64	32
29	MPC 850963	5000	(2)	--	--	64	31
30	MPC 851007	4638	(9)	--	--	64	35
31	MPC 851009	4639	(8)	--	--	66	35
32	Westbred Rambo	4577	(10)	--	--	64	35
	MEAN	4121		5498		64	32
	CV	12.9		12.4			
	LSD(0.05)	1068		963			

Table 10. 1988 Uniform Northwestern States Oat Nursery. 1988 observations of grain yield, test weight, percent lodging, and height of spring oat varieties planted on April 25 at the Klamath Experiment Station.

	ENTRY	YIELD lbs/A	YIELD (Rank)	TEST WEIGHT lbs/bu	LODGING ---%---	HEIGHT inches
1)	Park	1373	(22)	20	85	49
2)	Cayuse	1625	(9)	20	58	50
3)	Otana	1587	(11)	25	70	54
4)	Appaloosa	1433	(18)	17	50	49
5)	Border	1836	(4)	19	68	45
6)	78AB6843	1538	(14)	24	83	47
7)	Cascade	1120	(30)	20	10	58
8)	Monida	1405	(19)	20	65	50
9)	76AB6843	1227	(26)	21	40	52
10)	Ogle	1746	(6)	23	13	49
11)	75AB861	1401	(20)	23	58	49
12)	Calibre	1534	(15)	22	58	47
13)	Porter	1457	(17)	22	65	51
14)	Dumont	1567	(12)	22	30	50
15)	78AB3965	1624	(10)	18	50	50
16)	80AB4725	1074	(31)	21	53	48
17)	81AB5792	1788	(5)	27	13	45
18)	Riel	1721	(8)	29	0	41
19)	80AB988	1486	(16)	14	85	49
20)	80AB5807	1293	(25)	20	45	51
21)	Valley	1214	(27)	23	33	47
22)	80AB5322	1541	(13)	27	13	43
23)	82AB248	1731	(7)	25	70	45
24)	82AB1178	1360	(23)	21	1	43
25)	82AB1142	1333	(24)	27	0	43
26)	NPB 86803	2547	(1)	23	0	33
27)	NPB 86830A	2066	(2)	22	5	43
28)	Robert	1182	(28)	17	9	53
29)	Trucker	1124	(29)	21	35	49
30)	Steele	1846	(3)	28	0	41
31)	WA 6160	1399	(21)	25	38	48
	MEAN	1529		22	38	47
	CV	20.5				
	LSD(0.05)	441				

Small Grains Management In The Klamath Basin

R.L. Dovel and G. Chilcote[1]

INTRODUCTION

Management of small grains is dependent on environmental conditions, economic considerations, and variety requirements. The soil conditions in the Klamath Basin are changing due to the rapidly declining organic content in some recently drained marsh and lake bottom soils, and due to the adoption of sprinkler irrigation, which has lowered soil pH and altered mineral availability. New semi-dwarf small-grain varieties, which are better adapted to more intensive management practices, may need to be managed quite differently than conventional varieties. Studies were established to develop basic management information for the Klamath Basin on N fertilization and seeding rate under the present soil conditions in the Klamath Basin. The development of management strategies for newer varieties, which may have quite different management requirements to optimize profit, was a major objective.

BARLEY MANAGEMENT STUDY

Procedures

This study was conducted over a four-year period at the Klamath Experiment Station on a fairly deep and somewhat poorly drained sandy soil which was classified as a Sandy, mixed, mesic Torripsammentic Haploxeroll. The study always followed a rotation of potatoes. The study was arranged in a split-plot design with four replications. Nitrogen fertilization was the main plot, while seeding rate and variety were sub-plots. Varieties grown were Steptoe, Klages, Morex, Gus, Gustoe, and Advance.

Seed was drilled using a modified Kincaid planter at a rate of 60, 100, 140, or 180 lbs/A. Nitrogen as ammonium nitrate was applied following planting at a rate of 50, 100, or 150 lbs N/A. The plots were sprinkler-irrigated immediately after N application and throughout the growing season. Weeds were controlled with an application of Bromoxynil at 1 pint a.i./A.

Barley was harvested with a plot harvester, and plot yield, test weight, and percent thins were determined. Grain protein content was assayed for the last two years of the study using infrared reflectance spectroscopy calibrated to kjeldahl digestion standards.

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Results

Over the four years of this study, N fertilization significantly affected grain yield in only one year. Residual N in the soil was apparently sufficient to produce near optimal barley yields with the addition of only 50 lbs N/A. In another study on the same soil type examining N fertilization following potatoes, it was found that optimal yields of Klages and Morex were obtained using no N fertilizer following potatoes.

In contrast, seeding rate significantly affected yield in all four years. Each year the 60 lbs/A seeding rate was significantly lower than the two highest seeding rates. Although it was not consistent across years, a slight yield increase was achieved by increasing planting rates above 100 lbs/ A (Table 1). Higher rates of N fertilization were required to optimize yield as seeding rate increased. The highest yield was obtained by using the highest seeding rate/N fertilization combination.

Steptoe was the highest-yielding variety over the four-year period, averaging 4,942 lbs/A (Table 2). Gustoe was less than 400 lbs/A lower than Steptoe, averaging 4,570 lbs/A, with Klages yielding only slightly lower at 4,461 lbs/A. Morex and Gus had very similar yields averaging 4,072 and 4,035 lbs/A, respectively. Advance was the lowest yielding variety.

Although N fertilization did not significantly increase yields, lodging was more severe at high N rates, especially at high seeding rates.

Grain quality, as assessed by test weight, was significantly affected by both N fertilization and seeding rate. Test weight decreased as N fertilization and seeding rate increased. Grain protein content was not significantly affected by N fertilization in either 1987 or 1988. In contrast, increasing seeding rate decreased grain protein content in both years, especially at the lowest N fertilization level. This interaction of the effects of seeding rate and N fertilization on barley protein is of great importance in the malting varieties where protein levels above 13.5 percent may cause a penalty or rejection of the grain. In both Klages and Morex, protein levels were above 13.5 percent, even at the 50 lbs N/A rate, when seeding rates were low. At seeding rates of 140 lbs/A and above, grain protein content of both varieties dropped to acceptable levels.

Conclusions

Except in 1986, N had little effect on yield, indicating that in general the addition of more than 50 lbs N/A is not warranted following potatoes. However, the exception to this rule indicates that soil testing for residual nitrate following potatoes would be an important management tool. An adequate research base for making fertilization recommendations for barley on mineral soil, based on soil nitrate levels, has not been established. Although feed barley varieties may benefit from N fertilization in excess of 50 lbs N/A, the application of 50 lbs N/A or less appears to be appropriate with malting barley varieties due to their low protein requirement. Increasing seeding rates above 100 lbs/A did not increase barley yields substantially.

WHEAT MANAGEMENT STUDY

Procedures

The Wheat Management Study was managed as the Barley Management Study described above, with the exception of seeding rate. Fieldwin, Yecoro Rojo, Borah, and Westbred 906R were planted at 40, 80, 120, and 160 lbs/A.

Results

Wheat yield and quality responses to management inputs were similar to barley. There was no significant increase in wheat yield due to N fertilation in any year. Seeding rate affected yield in all but the final year of the study. In general, yield increased as seeding rate increased; however, yields tended to level off at seeding rates of 80 lbs/A when fertiized with 50 and 100 lbs N/A (Table 3). Yield increased throughout the range of seeding rates employed in this study when barley was fertilized with 150 lbs N/A.

Fieldwin, the only soft white wheat in the trial, was the highest-yielding variety (Table 4). It out-yielded the hard red varieties by an average of almost 1,000 lbs/A. Borah yielded substantially higher than either Yecoro Rojo and Westbred 906R. Westbred 906R was higher-yielding than Yecoro Rojo. One reason for the continued use of these varieties is the high grain protein content commonly obtained. Yecoro Rojo and Westbred 906R averaged 16.9 and 16.0 percent protein over the two-year period that grain protein was measured. This far exceeds protein levels of Borah (14.0 percent protein).

Grain protein content was not affected by N fertilization in either year measured, while increasing seeding rate decreased wheat protein content in both years.

Conclusions

Nitrogen did not greatly increase wheat yields in this study and effected grain protein content even less. The addition of N in excess of 50 lbs N/A, following potatoes in the Klamath Basin is not warranted. No significant increase in yield was obtained by using seeding rates in excess of 80 lbs/A. This and the fact that increasing seeding rate decreased grain protein, indicates that seeding rates of 80 to 100 lbs/A are optimal for grain yield and quality on mineral soils in the Klamath Basin.

Table 1. Effect of N fertilization and seeding rate on grain yield based on four-year average and protein content based on two-year average at the Klamath Experiment Station.

N FERTILIZATION lbs/A	SEEDING RATE lbs/A	YIELD lbs/A	PROTEIN ---%---
50	60	3701	12.3
	100	4295	12.2
	140	4294	11.6
	180	4335	11.5
100	60	4568	12.6
	100	4595	12.5
	140	5073	12.4
	180	4814	12.4
150	60	4869	13.0
	100	5282	12.9
	140	5422	12.7
	180	5576	13.3

Table 2. Four-year average yield and grain quality of six barley varieties grown at the Klamath Experiment Station.

Variety	YIELD* lbs/A	THINS %	TEST WEIGHT lbs/BU
Steptoe	4942 A	2 A	51 C
Klages	4461 AB	4 AB	55 A
Morex	4072 BC	4 AB	53 B
Gus	4035 BC	5 AB	50 C
Gustoe	4570 AB	6 B	51 C
Advance	3673 C	6 B	51 C

*/ Numbers in the same column followed by the same letter are not different at the 0.05 level of significance.

Table 3. Effect of N fertilization and seeding rate on wheat grain yield based on four-year average and protein content based on two-year average at the Klamath Experiment Station.

N FERTILIZATION lbs/A	SEEDING RATE lbs/A	YIELD lbs/A	PROTEIN ---%---
50	40	3234	15.5
	80	3706	14.6
	120	3541	14.4
	160	4080	14.2
100	40	3342	15.6
	80	4008	15.2
	120	4054	15.1
	160	4098	15.1
150	40	3422	15.7
	80	3834	15.2
	120	4031	15.1
	160	4144	15.0

Table 4. Four-year average yield and two-year average grain quality of four spring wheat varieties grown at the Klamath Experiment Station.

VARIETY	YIELD lbs/A	CRUDE PROTEIN %
Fieldwin	4540	12.8
Yecoro Rojo	2919	16.9
Borah	4155	14.0
Westbred 906R	3560	16.0

Winter Small Grains Cover Crop Following Potatoes

R.L. Dovel, K.A. Rykbost, G. Chilcote, and J. Rainey[1]

INTRODUCTION

A major obstacle to sustained agriculture in the Klamath Basin is soil loss due to wind erosion. Light soils and high spring winds provide conditions for substantial soil loss in this region. To ensure the continued productivity of highly erodible soils, federal farm programs are requiring greater erosion control on these soils. The local SCS office has determined that residue covering 33 percent of the soil surface will provide sufficient cover to prevent substantial soil loss. The amount of crop residue left following potato harvest is minimal and vines are sometimes burned to reduce over-wintering pathogens. A cover crop is needed to protect the soil through the winter and especially during the spring following potato harvest. The highest erosive wind energy is received in April in the Klamath Basin.

A small-grain cover crop is one of the most effective methods for erosion control. The cost of erosion control could be minimized if the cover crop could also produce a marketable grain or forage crop. While small grains are an important component of cropping systems in the Klamath Basin, most of the grain planted is sown in the spring. This project was conducted to identify species and varieties of winter grains that are adapted to this region. Screening should include both forage and grain yield as well as the ability to provide adequate soil protection.

PROCEDURES

A trial consisting of seven wheat varieties, seven barley varieties, two oat varieties, and one variety each of cereal rye and triticale was planted at the KES on October 15, 1987. Plots were 5 feet wide and 40 feet long. Seed was planted 1 inch deep with rows 6 inches apart at a rate of 30 seeds per square foot, which corresponds to roughly 100 lbs/A for wheat, barley, and triticale and 85 lbs/A for rye and oats. Fertilizer was banded in at planting at a rate of 50 lbs N, 60 lbs P_2O_5, and 44 lbs S/A. No chemical weed treatment was applied. Seed was sown into fairly dry soil; however, seed did germinate and emerge. Due to low moisture availability, growth was slow until rains on November 9 provided adequate moisture for rapid growth.

1/ Assistant Professor, Superintendent/Associate Professor, Research Technician, Experimental Biology Technician, respectively Klamath Experiment Station.

Three harvests were made: one on May 10, to monitor biomass accumulation and ground cover for the prevention of wind erosion; one on June 12 when most of the cultivars were in the boot stage, to assess forage production; and one after complete grain fill to measure grain production.

RESULTS

No differences were seen between varieties or species in emergence and fall growth. All varieties reached the four-leaf stage before snow cover stopped growth. Adequately monitoring early spring growth was impossible due to grazing by geese. By May 10 effects of the geese damage were no longer seen and plants were harvested. Cereal rye was clearly the highest biomass producer, more than doubling the average yield of all barley varieties and more than tripling the average wheat yield. No real differences among barley varieties for early spring biomass production were evident. Some varieties of wheat were definitely superior to others in early spring biomass production. Hill '81 and Nugains were the highest wheat biomass producers. Cereal rye also dominated total forage yield as assessed by the harvest on June 12. It yielded 4.4 tons/A compared to an average of 3, 2.5, and 2.5 tons/A for barley, wheat, and oats, respectively (Table 1). The forage yield of triticale was roughly equivalent to the barley varieties included in this study.

The highest average grain yield was obtained by barley. Hesk and Boyer significantly outyielded all other barley varieties. Similarly, Hill '81, outyielded other wheat varieties (Table 1).

CONCLUSIONS

In a mild fall and winter, cover crops planted on October 15, following potato harvest, achieved sufficient fall development to provide late fall and early spring erosion protection. Cereal rye produced the greatest biomass and largest amount of early ground cover and is the species most likely to provide protection against wind erosion under adverse conditions. Low grain yields and low price for cereal rye make it a less desirable cover crop alternative. Maury winter barley produced the highest early spring biomass and forage yield and also produced over two tons of grain. Maury provided the option of harvest for either forage or grain while providing ground cover in the early spring. The use of winter wheats studied as ground cover/cash crops does not look as promising as barley due to lower ground cover, hay production, and grain potential.

Table 1. 1987-1988 Winter Small Grains Cover Crop Trial. Observations of forage and grain production of fall seeded winter grains following potatoes, planted on October 15 at the Klamath Experiment Station.

		FORAGE PRODUCTION		GRAIN YIELD	
		May 10	June 12	lbs/A	lbs/bu
		--------tons/A--------			
Barley					
1)	Henry	0.8	2.8	3821	46.5
2)	Maury	0.9	3.8	4155	46.0
3)	Sussex	0.6	2.6	3287	44.0
4)	Wysor	0.8	3.3	3873	46.0
5)	Hesk	0.8	3.2	5674	46.0
6)	Scio	0.8	2.6	4162	42.0
7)	Boyer	0.8	2.9	5267	44.0
	MEAN	0.8	3.0	4320	45.0
Wheat					
8)	Faro	0.4	2.1	2514	52.0
9)	Fortyfold	0.5	2.8	3502	58.5
10)	Stephens	0.5	2.6	2834	54.5
11)	Yamhill	0.2	1.8	2175	50.0
12)	Weston	0.4	2.6	3453	61.5
13)	Hill '81	0.6	2.4	4292	57.5
14)	Nugains	0.7	2.9	2655	60.5
	MEAN	0.5	2.5	3061	56.0
Oats					
15)	Grey Winter	0.5	2.7	1378	32.0
16)	Walken	0.6	2.4	1341	27.0
	MEAN	0.6	2.5	1360	29.5
Triticale					
17)	Flora	0.8	2.8	2644	42.0
Rye					
18)	Rheidol	1.7	4.4	3160	56.5
OVERALL MEAN		**0.7**	**2.8**	**3344**	**48.0**
CV		**29.5**	**30.6**	21.1	**5.8**
LSD(0.05)		**0.3**	**1.2**	1003	**4.0**

Chemical Seed Treatment of Two Hard Red Spring Wheat Varieties

R. L. Dovel and G. Chilcote[1]

INTRODUCTION

Fungal diseases of seedling small grains can cause significant stand losses under certain environmental conditions. Seed-borne diseases can greatly reduce yield when present. The use of seed treatments is advised to prevent yield losses due to seedling pathogens and seed-borne diseases. Five chemical seed treatment combinations were compared with an untreated control to evaluate their effectiveness in suppressing seedling pathogens.

Procedures

Two hard red spring wheat varieties, Yecoro Rojo and Westbred 906R, were treated with various combinations of Vitavax, Flow Pro, Captan, and Baytan chemical seed treatments (Table 1). Seed were planted at a rate of 100 lbs/A in a randomized complete block design with four replications. Plots were established on May 26 on a poorly drained lake bottom soil (Tulana silt loam). Three weeks after emergence, stand counts were taken and percent emergence was calculated. At maturity, grain was harvested and plot yields recorded. Following harvest, plant number and number of tillers per plant were also recorded. Harvested grain was graded and test weights (lbs/bu) determined.

Results

Due to low disease pressures in the spring of 1988, seed treatment did not significantly affect seedling emergence and survival or grain yield. Seed treatment did not affect either the number of tillers per plant or grain test weight. The two cultivars in the study differed significantly in grain yield, test weight, and number of tillers per plant (Table 1). Westbred 906R had higher yields but lower test weights than Yecoro Rojo.

1/ Assistant Professor, Research Technician, respectively, Klamath Experiment Station.

Acknowledgement: Partial funding for this study was provided by Gustafason.

Table 1. 1988 Wheat Seed Treatment Trial. Observations of the effect of chemical seed treatment on grain yield, test weight, percent emergence, and tillers per plant on two wheat varieties planted May 26 in organic soil in the Klamath Basin.

	YIELD lbs/A	TEST WT lbs/bu	EMERGENCE ----%----	TILLERS/PLANT
Untreated Seed				
Yecoro Rojo	4892	62	87	3.9
Westbred 906R	5642	61	79	3.3
MEAN	5267	61	83	3.6
Vitavax 200 @ 3.3 fl. oz./cwt				
Yecoro Rojo	4644	63	88	4.1
Westbred 906R	5613	60	81	3.3
MEAN	5128	61	84	3.7
Vitavax 200 @ 3.3 fl. oz./cwt Flo-Pro IMZ FF @ 0.25 fl. oz./cwt				
Yecoro Rojo	5007	62	94	3.8
Westbred 906R	5610	60	94	2.8
MEAN	5309	61	94	3.3
Captan 400 @ 2 fl. oz./cwt Baytan 30 @ 1.25 fl. oz./cwt				
Yecoro Rojo	4520	61	78	4.4
Westbred 906R	5754	60	87	3.0
MEAN	5137	61	82	3.7
Vitavax 200 @ 3.3 fl. oz./cwt Baytan-Anchor HB @ 8 oz./cwt				
Yecoro Rojo	4648	62	81	4.4
Westbred 906R	5547	59	88	3.0
MEAN	5097	61	85	3.7
Vitavax 200 @ 3.3 fl. oz./cwt Aprov Fl @ 0.75 fl. oz./cwt Flo-Pro IMZ FF @ 0.25 fl. oz./cwt				
Yecoro Rojo	4546	62	92	4.0
Westbred 906R	5635	62	86	3.1
MEAN	5091	62	84	3.6
OVERALL MEAN				
Yecoro Rojo	4710	62	86	4.1
Westbred 906R	5633	60	85	3.1
LSD(0.05) for comparing seed treatments	371(NS)	1(NS)	14.8(NS)	0.5(NS)
LSD(0.05) for comparing varieties	214	0.7	8.5(NS)	0.1

Alfalfa Variety Trial
Klamath Experiment Station, 1988

R.L. Dovel and J. Rainey[1]

INTRODUCTION

This trial was established to evaluate the ability of alfalfa varieties to yield and persist in the Klamath Basin. Yield and persistence will be monitored over a five-year period.

PROCEDURES

Plots were established in August 1986. The trial consists of 48 released and experimental alfalfa varieties arranged in a randomized complete block design with four replications. Soil samples from the plots were analyzed and the appropriate fertilizer applied prior to planting. A tank mix of EPTC and benefin was applied prior to planting at 3 and 1.2 lb a.i./A, respectively. Immediately after application the herbicide was incorporated by disking. Seed was drilled to a depth of 1/4 inch using a modified Kincaid drill at a rate of 20 lbs/A. Plots were 5 x 30 feet with 5-foot borders and alleyways. Alfalfa was sprinkler irrigated with a solid set system during establishment and throughout the first and second growing seasons.

The plants were allowed to grow uncut through the first growing season. Plots were harvested in 1987 and 1988 when plants reached early bud. Plots were harvested using a flail harvester with a three-foot-wide head. All yields are reported on a dry weight basis.

RESULTS AND DISCUSSION

Little difference in yield occurred between most varieties during the first two years of this study. Yield data over a two-year period is not adequate to identify superior alfalfa varieties for the Klamath Basin. Yield and stand persistance data over a four to six year period is needed to accurately access the adaptation of an alfalfa variety to a region.

1/ Assistant Professor and Experimental Biology Technician, respectively, Klamath Experiment Station.

Acknowledgements: Appreciation is expressed to the following companies for financial support for this trial: Allied Seed, DeKalb Seed, North American Plant Breeders, Northrup King Co., Pioneer Hi-Bred International, Plant Genetics, Union Seed Co., W-L Research.

A major factor determining alfalfa stand survival and yield in the Klamath Basin is winter-hardiness. The ability of a variety to survive cold winters is closely linked to how early in the fall growth ceases and the plant goes dormant. Winter-hardy varieties generally go dormant earlier in the fall than less winter-hardy varieties. The higher-yielding varieties in this trial tended to be intermediate dormancy types with less-dormant types yielding higher than more dormant varieties. The difference between winter-dormant and less-dormant types was most pronounced in the third cutting when early dormancy affected growth of winter-dormant varieties. The relative ranking of these varieties will undoubtedly change as the stand ages and stand thinning of less-adapted varieties occurs.

Table 1. **1987-1988 Alfalfa Variety Trial.** Summary of 1987 and 1988 yield data and 1988 observations of dormancy as estimated by regrowth after the last cutting of the season. The trial was established at the Klamath Experiment Station in August, 1986.

	ENTRY	YIELD 1987	1988	AVG	VERNAL[1] %	REGROWTH[2]
		------tons/A-----				
1)	PB 5444	6.5	6.8	6.6	110	1.3
2)	PB 526	6.3	6.7	6.5	108	1.0
3)	PB 532	5.9	6.6	6.3	105	1.0
4)	PB 5432	6.4	6.7	6.6	110	1.8
5)	Brute Brand	6.0	6.1	6.0	100	2.4
6)	Max 85 Brand	6.0	6.7	6.4	107	1.0
7)	Mission 123	6.3	6.0	6.1	102	2.0
8)	Commandor	6.5	6.7	6.6	110	1.3
9)	Pike	6.3	6.3	6.3	105	2.0
10)	Drummor	6.4	6.8	6.6	110	1.1
11)	NK 83580	6.5	6.5	6.5	108	1.8
12)	NK 83632	6.0	6.5	6.2	103	1.1
13)	Phytor	6.4	6.4	6.4	107	1.0
14)	Spreador II	6.0	6.1	6.0	100	0.6
15)	WL 225	6.4	6.7	6.6	110	1.0
16)	WL 315	6.6	6.8	6.7	112	1.3
17)	WL 316	6.1	6.2	6.2	103	1.4
18)	WL 320	6.7	6.8	6.8	113	1.5
19)	83-2	6.0	6.4	6.2	103	1.4
20)	GT 58	6.4	6.2	6.3	105	2.6
21)	Apollo II	5.9	6.5	6.2	103	1.0
22)	Arrow	6.6	6.6	6.6	110	1.1
23)	Armor	5.8	6.2	6.0	100	1.0
24)	Thunder	5.9	6.5	6.2	103	1.0
25)	Peak	6.3	6.5	6.4	107	1.0
26)	Blazer	6.0	6.4	6.2	103	1.0
27)	Epic	6.1	6.6	6.3	105	1.4
28)	Sparta	6.4	6.9	6.7	112	1.1
29)	RS 3309	6.2	6.5	6.4	107	1.1
30)	Excalibur	6.4	6.8	6.6	110	1.2
31)	Centurion	6.7	6.5	6.6	110	1.9
32)	Flint	5.8	6.2	6.0	100	1.0
33)	York	6.0	6.4	6.2	103	1.1
34)	Vortex	6.3	6.8	6.5	108	1.3
35)	Sutter	5.6	5.9	5.7	95	3.0
36)	Vector	6.7	6.7	6.7	112	1.4
37)	DK 120	6.4	6.6	6.5	108	1.3
38)	DK 135	6.0	6.5	6.2	103	1.6
39)	Vernal	6.0	6.0	6.0	100	1.0
40)	003-G	5.9	6.5	6.2	103	1.1
41)	005-S	5.9	6.2	6.1	102	1.0
42)	Sentry	6.0	6.3	6.1	102	1.0
43)	Atra 55	6.0	6.5	6.3	105	1.0
44)	Ranger	6.5	6.7	6.6	110	1.3
45)	Nomad	5.4	6.1	5.7	95	0.8
46)	Rambler	6.2	6.5	6.3	103	0.9
47)	Iroquois	6.3	6.9	6.6	110	1.0
48)	Lahontan	6.0	6.2	6.1	102	1.6
	MEAN	**6.2**	**6.5**	**6.3**	**105.6**	**1.3**
	CV	**7.0**	**5.9**	**---**	--	**21.4**
	LSD(0.05)	**0.6**	**0.5**	**0.4**	--	**0.4**

1/ Percent of Vernal based on an average of 1987 and 1988 data.
2/ Estimate of fall regrowth following the third cutting to evaluate dormancy. 0 = no regrowth, 1 = 2 inches, 2 = 4 inches, and 3 = 6 inches of regrowth.

Chemical Hay Preservation

R.L. Dovel and J. Rainey[1]

INTRODUCTION

There is an increasing interest in hay preservatives which would allow baling forage at moisture contents higher than normally possible. This enables producers to avoid inclement weather and increase yields by reducing the time that hay lies on the field impeding regrowth. Many hay producers are currently using or experimenting with different hay preservatives.

Ammoniation of hay using anhydrous ammonia as a post-baling treatment has reduced yeast and mold growth in wet hay (20 to 30 percent moisture) and improved forage quality by increasing both N content and digestibility; however, hay ammoniation using anhydrous ammonia is both inconvenient and hazardous. Recent research has shown that the application of a urea or an ammonia/urea solution to wet hay can reduce yeast and mold growth without the inconvenience of a post-baling treatment or the hazard of handling anhydrous ammonia. The inclusion of urease in the solution would eliminate the depen-dence on naturally occurring urease on the plant surface. The slow release of ammonia, as urease converts urea to ammonia, also produces similar affects on forage quality as ammoniation.

Other hay preservatives which are currently being used are organic acids (mostly propionic acid) and bacterial inoculants. The preservation of one ton of forage at 25 percent moisture requires the addition of 15 lbs of propionic acid. Current costs for such a treatment would be about $15/ton of conserved forage, which is economically prohibitive to most producers. Inoculants are more affordable than propionic acid and are currently being used by a substantial number of hay producers. The use of lactic acid-producing bacterial inoculants to preserve wet hay has not been adequately documented. There is concern by some researchers that these bacteria are not active in hay at the moisture contents at which they are being used.

A comparison of the efficacy and cost effectiveness of the various hay preservatives is needed to provide producers with information for making hay preservative decisions.

1/ Assistant Professor and Experimental Biology Technician, respectively, Klamath Experiment Station.

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Procedures

Six hay preservative treatments (Table 1) were applied to second and third cutting hay baled at two moisture contents. Hay was baled as close to 21 percent and 25 percent moisture as possible. Chemical hay preservatives used in this trial included propionic acid, a commercially available dry inoculant, two rates of an ammonia/urea/urease solution, a urea/urease solution, and dry urea. Untreated hay was baled before and after the application of the preservatives to serve as a reference for determining treatment effects on microbial growth and forage quality at each moisture content. At least four bales were treated with each preservative at each moisture content. The treated bales were stored in an open pole barn. They were insulated by stacking untreated bales around them to simulate the conditions in a large stack. A thermocouple was inserted in each treated bale to monitor bale temperature, a good indicator of microbial activity. Two core samples were taken from each bale approximately one month after baling to test for moisture content, microbial activity, and forage quality. The second and third cuttings, were swathed on August 9 and September 21, respectively. A leaking roof in the storage shed where the third cutting bales were stored resulted in inconsistent results and made interpretation impossible; therefore, only data for the second cutting will be presented.

Visual estimates of mold growth were taken 45 days after baling using a scale from 1 to 5, with 1 representing green hay with no mold growth. Hay with no objectionable mold growth but some discoloration was rated 2. Hay which was more extensively discolored with a slightly moldy or dusty smell was rated 3. Hay with mycelial growth present and objectionable odor was rated 4. The presence of extensive mycelial growth and an abundance of spores resulted in a rating of 5. Hay rated above 3 was considered to be unmarketable.

RESULTS

Mold Growth

Untreated hay baled at both 25 and 21 percent moisture was too moldy to be marketable. Hay preservatives in general were not effective in suppressing mold growth to acceptable levels in hay baled at 25 percent moisture (Table 1). The only exception to this was propionic acid, which resulted in discolored hay with no visible mold growth. At 21 percent moisture, application of both rates of AUBU resulted in slightly discolored hay of equal or superior visual quality to bales receiving the propionic acid treatment. Application of urea prills also resulted in marketable hay when baled at 21 percent moisture; however, hay treated with urea prills was more discolored than hay treated with either rate of AUBU or propionic acid. Neither the liquid urea nor bacterial inoculant treatments reduced mold growth to marketable levels at either 25 or 21 percent moisture.

Forage Quality

All hay treatments which contained non-protein N (AUBUS, UBUS, and urea prills) resulted in higher estimates of crude protein than untreated hay (Table 1). Similar increases in crude protein (about 6 percentage points) were seen for the full rate of AUBUS, UBUS, and urea prills; however, it should be noted that increasing crude protein levels above 23 percent has not resulted in improved animal performance in some studies. The benefits of high N hay treatments may not be as great in alfalfa as in grass hay, which has a lower protein content.

Digestibility, another measure of forage quality, was also affected by some hay treatments. Both the full-rate application of AUBUS and propionic acid resulted in higher Total Digestible Nutrient (TDN) values than untreated hay (Table 1). Higher digestibility may be a result of reduced microbial activity, thus reducing microbial respiration of available nutrients. In addition, both propionic acid or an ammonia-producing solution may affect the structural integrity of plant cell walls, making the material more digestible.

CONCLUSIONS

Preservation of extremely wet hay (25 percent moisture or greater) is difficult even with propionic acid. Hay which has a lower moisture content can be preserved using propionic acid or an ammonia-releasing material such as dry urea or the ammonia-urea-biuret-urease mixture employed in this study.

Table 1. Effect of hay preservatives and moisture content of hay at baling on mold growth, energy content (% TDN) and protein content (% CP) of alfalfa hay.

HAY PRESERVATIVE TREATMENT	Hay Moisture Content					
	25%	21%	25%	21%	25%	21%
	MOLD RATING		TDN		CRUDE PROTEIN	
			%		%	
No Treatment	4.5	4.0	62	63	21.4	21.1
AUBU	3.8	1.5	64	64	26.5	27.1
UBU	4.5	3.8	62	63	28.3	25.8
Urea Prills	4.0	2.8	63	63	27.9	26.8
Inoculant	4.8	4.0	63	63	23.4	22.3
Propionic Acid	2.8	2.0	64	64	22.1	21.0

Wetland Meadow Forage Management

R. L. Dovel and J. Rainey[1]

INTRODUCTION

Wetland meadows cover over 95,000 acres in Klamath County and provide summer grazing for over 100,000 cattle each year. The major native species encountered in such sites include tufted hairgrass (Deschampsia caespitosa), Kentucky blue grass (Poa prateusis), Meadow foxtail (Alopecurus pratensis), Nebraska sedge (Carex nebraskensis), Carex nigricans, and Liebur bluegrass (Poa lieburgii). Many of these species are found throughout Oregon and the entire Northern United States in wetland meadows; however, little information on the productivity, quality, or management of most of these species is available.

Virtually all beef ranchers grazing wetland meadows in Southern Oregon practice set stock grazing. The species composition of many wetland meadows has been altered due to heavy continuous grazing. Less palatable species, such as various rushes and sedges, meadow barley, mat muhly, and foxtail barley, have increased under heavy grazing pressure. This shift in species composition can adversely affect both forage production and forage quality. Forage produced in a sedge-dominated wetland meadow had N levels of 2.1 percent on May 19; yet, by mid-June forage N content had dropped to 1.4 percent, which is below the nutrient requirements for steers and lactating cows. By September forage N content from the same pasture dropped to 1.1 percent which is only marginally adequate for dry cows.

Animal performance on these meadows is also hampered by extreme variability in forage production with season and declining forage quality with age. Dry-matter production on these meadows reaches a peak in early July. Production then declines rapidly through August and September. If meadows are stocked at rates high enough to efficiently harvest the vigorous early season growth and not allow rank dead vegetation to accumulate, then slow late-season forage production results in overgrazing and poor animal performance. Animal production and the condition of desirable native meadow species both suffer under such a system. Improved grazing management to prevent the accumulation of low-quality forage and to maintain desirable species in the sward could greatly increase the productivity of these wetland meadows and provide a more ecologically sound management alternative.

1/ Assistant Professor and Experimental Biology Technician, respectively, Klamath Experiment Station.

Acknowledgements: Land and irrigation management were provided by the Rock Creek Ranch.

Intensive grazing management has improved overall productivity, efficiency, and profitability in New Zealand. The use of intensive grazing management has also allowed the maintenance of high-quality, highly palatable species in the sward, even with heavy utilization. One requirement for intensive grazing management is a knowledge of forage growth rates. Knowledge of growth rates in the spring and the time of onset of growth for different forage species is critical in strategic planning to reduce hay feeding.

Regrowth following clipping or grazing is dependent on various environmental and management parameters. The amount of forage left after grazing or clipping greatly affects regrowth. Residual dry matter (RDM) is not easily measured by the producer; however, height is closely related to RDM and is easily measured by cattlemen and ranchers.

A clipping study was initiated to determine the productivity and quality of the major forage species in two wetland meadow plant associations.

PROCEDURES

Plots were established within a livestock exclosure. Three cutting heights (2, 4, and 6 inch) were imposed on the appropriate plots. The RDM left by each cutting height was determined by clipping a 1-m^2 quadrate to ground level. Plots were harvested and forage weighed monthly throughout the growing season. Forage quality was assessed by determining N content and acid detergent fiber (ADF) content of the forage.

The relative forage production and quality of continuously grazed versus simulated rotationally grazed swards (clipped) was evaluated using exclusion cages. Accumulated forage mass was determined prior to protecting a section of continuously grazed sward with a 1-m^2 cage. After one week the cage was removed and the forage mass determined. This allowed an estimate of the pasture growth rate for that week. The cage was then moved to a previously unprotected site and the process repeated.

RESULTS

The exclusion structure was erected after cattle were turned onto the pasture in 1988. The initial harvest (July 11) reflects the spring growth of the various plant associations and the grazing preference of the animals on the pasture. The animals preferred the bluegrass/clover association as shown by the low initial yields (Table 2). This was less true of the grass/sedge association which yielded significantly higher than the bluegrass/clover association at the July 11 harvest. The sedge association was not grazed as intensively as the other two associations and had a much higher yield on the July 11 harvest than the grass-dominated associations.

Due to exclusion of grazing, the yields of the two grass associations were higher on the August 17 harvest than the initial harvest (Table 2). In contrast, the sedge association yielded less on August 17 than July 11. Cool fall temperatures resulted in low yields by the September 15 harvest.

Total forage harvested was significantly affected by cutting height. The 2-inch cutting height resulted in the highest total forage production and the highest amount of utilized or harvested forage in all three plant associations. In the bluegrass/clover and grass/sedge associations only the 2-inch cutting height resulted in a higher amount of utilized forage than set stocking. Both the 2- and 4-inch cutting heights resulted in a higher amount of utilized forage than set stocking in the sedge association.

Both grass associations had similar digestibilities, averaging 33.4 and 34.3 percent ADF across the season for the bluegrass/clover and grass/sedge associations, respectively. The sedge association had significantly higher ADF values than the grass associations, averaging 37 percent ADF across the season. Cutting height did not significantly affect forage digestibility of any plant association as estimated by percent ADF; however, the upper portions of the sward were more digestible than the lower portions.

Simulated controlled grazing (cutting) resulted in lower ADF values than continuous grazing throughout the season for all plant associations with the exception of the Bluegrass/clover association at the initial cutting. All subsequent regrowth in cut plots was of higher quality (lower percent ADF) than continuously grazed pasture. This is probably due to the removal of older less-digestible material by the uniform removal of the forage to a specific level. In contrast, selective grazing generally results in the removal of the more digestible portions of the sward and the accumulation of older, less-digestible forage.

CONCLUSIONS

Data from the first year of this experiment is encouraging but not conclusive. There appears to be adequate forage quality in the sedge association to meet the protein and energy requirements of some classes of beef cattle. Also, yield and quality responses to management indicate that improvements in both yield and quality in this forage resource are possible through grazing management.

Table 1. Total forage produced, total forage utilized, and percent utilization of three wetland meadow plant associations under continuous grazing or three different cutting heights.

Association Utilization	inch	Ht. lbs/A	Total Production lbs/A	Utilized -----%-----
Bluegrass	2	5,073	3,159	62.3
	4	3,430	1,187	34.6
	6	2,451	204	8.3
	grazed	2,351	1,625	53.7
Mixed	2	12,654	10,170	81.2
	4	8,274	4,666	56.4
	6	6,572	2,428	36.9
	grazed	6,651	4,036	62.8
Sedge	2	12,956	12,050	93.0
	4	9,054	7,457	82.4
	6	5,943	3,731	62.8
	grazed	11,230	3,743	33.0

Table 2. Effect of season, cutting height, and plant association on forage yield of wetland meadows in Klamath County.

Cutting Date	Cutting Ht. inches	Bluegrass Association	Mixed Association	Sedge Association
		------------	lbs/A	------------
7-11-88	2	329	2366	7615
	4	4	446	4077
	6	4	45	1552
8-17-88	2	2497	6681	3443
	4	830	3682	2586
	6	147	2037	1774
9-15-88	2	333	1226	992
	4	353	538	794
	6	53	346	406