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CONTENTS

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CEREAL VARIETY DESCRIPTIONS

Charles R. Rohde[1]

This article describes 52 varieties of cereals available for seeding in eastern Oregon. Varieties are grouped by type and are presented in alphabetical order within each category. Table 1 lists the varieties covered and gives the developer and the name of the organization responsible for foundation seed.

SOFT WHITE CLUB WINTER WHEATS

Barbee

Barbee is a bearded, brown-chaffed, semi-dwarf wheat released in 1976. It equals Moro in test weight and winter hardiness. Compared to Paha, Barbee is slower to emerge, about six inches shorter, and very resistant to lodging. Barbee matures about two days later than Paha; therefore, it may be too late for most of the club wheat-growing areas of northeastern Oregon. It is resistant to smut and stripe rust but susceptible to *Cercosporella* foot rot. The baking quality of its flour is very good, but milling quality is similar to that of Nugaines and not as good as that of Faro or Moro.

Faro

Faro is a soft white, beardless, brown-chaffed wheat released in 1976. It is exceptionally well adapted to the lower rainfall areas of eastern Oregon where club wheats commonly are grown and is recommended as a replacement for Moro and Paha. Compared to Moro, it is equal in test weight, superior in lodging resistance, and four to seven inches shorter. Faro is slightly shorter than Paha which it resembles in growth habit, winterhardiness, seedling emergence, and lodging resistance. Faro is earlier maturing than Paha so that it often ripens before the heat of summer. Faro is resistant to stripe rust and moderately resistant to smut, but very susceptible to leaf rust. It has good milling and baking quality.

Jacmar

Jacmar is a soft white, beardless, brown-chaffed wheat released in 1979. It is very well adapted to the lower rainfall areas of eastern Oregon where club wheats commonly are grown. Compared to Faro, it is about 1 pound lower in test weight, superior in lodging resistance, and one to three inches

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shorter. It appears to be similar to Faro in winterhardiness and seedling emergence. Jacmar matures about the same as Faro, therefore, it often ripens before the heat of summer. It has good milling and baking quality.

Moro

Moro is a beardless, brown-chaffed, medium tall wheat released in 1965. It is best adapted for growing in the lower rainfall areas of eastern Oregon where its taller straw may be desirable for erosion control. Test weight is medium low and maturity is medium early. Although seedling emergence is good, plants are somewhat susceptible to lodging. Moro is resistant to smut and stripe rust, but very susceptible to leaf rust. Milling and baking quality is good.

Tyee

Tyee is a beardless, white-chaffed wheat released in 1979. Grain test weight is about 0.2 lb/bu lighter than Faro. It grows about two inches taller than Faro and resists lodging. Tyee has satisfactory winterhardiness but has only average seedling vigor. It is resistant to common bunt and to stripe rust, but is susceptible to flag smut, leaf rust, and mildew. Tyee has tolerance to *Cercosporella* foot rot. It has good club wheat milling and baking quality.

SOFT WHITE COMMON WINTER WHEATS

Daws

Daws is a bearded, white-chaffed semi-dwarf wheat released in 1976. Grain test weight is about 2 lb/bu lower than that of Nugaines. Daws is more winterhardy than any other soft, white, winter wheat variety grown in the Pacific Northwest. Seedling emergence is poorer than that of Nugaines. Daws is resistant to lodging. Plant height and maturity date are similar to Nugaines. Daws is resistant to stripe rust and smut but susceptible to *Cercosporella* foot rot and to leaf rust. Milling and baking quality is good (similar to Nugaines).

Hyslop

Hyslop is a bearded, white-chaffed, semi-dwarf wheat released in 1970. Grain test weight is about 3 lb/bu less than that of Nugaines. It is less winterhardy than Nugaines, but no problem of winter killing has occurred in northeastern Oregon. Hyslop is slightly taller and slightly earlier to mature than Nugaines and resists lodging. Seedling emergence is slightly better than Nugaines. Hyslop is moderately resistant to stripe rust, smut, leaf rust, and *Septoria*, but moderately susceptible to *Cercosporella* foot rot. Milling and baking quality is good.

Luke

Luke is a bearded, white-chaffed, semi-dwarf wheat released in 1970. Grain test weight is about 2 lb/bu lower than Nugaines. It is as tall as Nugaines and is very resistant to lodging. It emerges more quickly and vigorously than either Hyslop or Nugaines. Luke matures about four days later than Nugaines so that it may encounter higher temperatures at the end of filling. It is resistant to stripe rust, common smut, dwarf smut, and snow mold. Because of its rapid emergence, Luke is well adapted for early seeding and is the best variety to use in areas where dwarf smut is a problem. Luke has good milling and baking quality.

McDermid

McDermid is a bearded, white-chaffed, semi-dwarf wheat released in 1974. Grain test weight is about 3 lb/bu less than Nugaines. It is more winterhardy than Hyslop. McDermid is similar in height and seedling emergence to Hyslop but is slightly earlier to mature. McDermid is resistant to lodging. It is moderately resistant to stripe rust, mildew, leaf rust, smut, and *Septoria*, but quite susceptible to *Cercosporella* foot rot. Milling and baking quality is good.

Nugaines

Nugaines is a bearded, white-chaffed, semi-dwarf wheat released in 1965. Grain test weight is high. Seedling emergence is only fair, especially when it is necessary to seed deep, but plants are quite winterhardy. Nugaines is slightly shorter than Hyslop and is resistant to lodging. It is resistant to smut, and moderately susceptible to *Cercosporella* foot rot. Milling and baking quality is good.

Sprague

Sprague is a bearded, white-chaffed, semi-dwarf wheat released in 1973. Grain test weight is only about 1 lb/bu less than Nugaines. It is about two inches taller than Nugaines, does not resist lodging as well as most other semi-dwarf varieties, and thus should not be planted where lodging may cause problems. Sprague is quite winterhardy and emerges well. It matures about the same time as Hyslop and slightly earlier than Nugaines. Sprague is resistant to smut, stripe rust, and snow mold and is the best variety to plant where snow mold is a problem. Sprague has good milling and baking quality.

Stephens

Stephens is a bearded, white-chaffed, semi-dwarf wheat released in 1977. Heads are distinctly coarse in appearance with beards which tend to flare. Grain test weight is about 3 lb/bu less than Nugaines and equals that of

Hyslop and McDermid. Winterhardiness and seedling emergence of Stephens are similar to those of Hyslop. Stephens is about 1 inch taller than Hyslop and is resistant to lodging. It matures slightly earlier than McDermid. Stephens is resistant to stripe rust, leaf rust, and smut and appears to have some tolerance to Cercosporella foot rot. It has an outstanding yield record as evidenced by its yield superiority across environmentally diverse locations for several years. Milling and baking quality is good.

HARD RED COMMON WINTER WHEATS

Hatton

Hatton is a bearded, white-chaffed, medium height wheat released in 1979. It is best adapted for growing in lower rainfall areas where conditions may be suitable for production of high protein grain. The test weight of its grain averages about 2.5 lb/bu heavier than Wanser, maturity is about 2 days later, height is about 2 inches shorter and yield is about 10 percent higher. Hatton is resistant to lodging, very winterhardy, moderately resistant to stripe rust and moderately resistant to common smut. The milling and baking quality of Hatton is good.

Wanser

Wanser is a bearded, brown-chaffed, medium tall wheat released in 1965. It is best adapted for growing in lower rainfall areas where conditions may be suitable for production of high protein wheat. Grain test weight is high, about equal to Nugaines. Wanser is winterhardy and emerges very well, nearly as well as Moro. It is about 10 inches taller than Nugaines and is quite resistant to lodging for a tall variety. It matures early, at about the same time as McDermid. Wanser is resistant to smut and moderately resistant to stripe rust. Milling and baking quality is good.

SOFT WHITE SPRING WHEATS

Dirkwin

Dirkwin is beardless, white-chaffed, semi-dwarf wheat released in 1978. It is a widely adapted variety, yielding well under both droughty and high-producing conditions. Compared to Twin, Dirkwin is similar in plant height, test weight, and heading date. Dirkwin is resistant to powdery mildew and moderately resistant to leaf rust and stripe rust. The milling and baking quality of Dirkwin is satisfactory.

Fielder

Fielder is a bearded, white-chaffed, semi-dwarf wheat released in 1974. Its grain test weight is about 2 lb/bu greater, maturity about one day earlier, and height about 1 inch taller than Twin's. Fielder appears better adapted for growing under irrigation than Twin. It is moderately resistant to powdery mildew and leaf rust and susceptible to stripe rust. Fielder has good milling and baking quality.

Fieldwin

Fieldwin is a bearded, white-chaffed, semi-dwarf wheat released in 1977. Fieldwin's grain test weight is nearly 2 lb/bu greater, maturity about 2 days earlier, and height about 1 inch taller than Twin's. Fieldwin is moderately resistant to powdery mildew and leaf rust and susceptible to stripe rust. Milling and baking quality is good.

Sterling

Sterling is a bearded, white-chaffed, semi-dwarf wheat released in 1980. In the absence of stripe rust, it is a very high yielding variety, yielding high under a broad range of environmental conditions. Grain test weight and plant height of Sterling is similar to Fielder. It heads about 3 days earlier and is about the same height as Fielder. Sterling is moderately resistant to mildew and leaf rust but very susceptible to stripe rust. Its milling and baking quality are good.

Twin

Twin is a beardless, white-chaffed, semi-dwarf wheat released in 1971. It is a widely adapted variety and yields well under both droughty and high-producing conditions. Compared to Federation, Twin is about 7 inches shorter and matures about one day later. Grain test weight usually is rather low, about 54 to 58 lb/bu. Milling quality is only fair but baking quality is good.

Urquie

Urquie is a bearded, white-chaffed, semi-dwarf, facultative wheat released in 1975. Being facultative means that Urquie can be seeded in either fall or spring. The cold tolerance of this variety makes it suitable for mid-winter to late winter seeding in fields where poor emergence and winter killing have caused poor stands. Urquie's grain test weight is about 2 lb/bu heavier, maturity about 2 days later, and height about 2 inches taller than Twin's. Urquie is moderately susceptible to stripe rust, susceptible to leaf rust, and moderately susceptible to powdery mildew and *Cercosporella* foot rot. Urquie has good milling quality and its flour has desirable baking quality for both pastry and bread.

Walladay

Walladay is a bearded, white-chaffed, semi-dwarf, facultative wheat released in 1978. The cold tolerance of this variery makes it suitable for mid-winter to late winter seeding in fields where poor emergence and winter killing have caused poor stands. In limited tests, Walladay has yielded less than Urquie, produces grain lower in test weight, is later maturing, and is 2 inches shorter in height. Walladay is moderately susceptible to stripe rust and to mildew. Its milling and baking quality is not as good as that of Urquie.

SEMI-HARD WHITE SPRING WHEATS

WS-1

WS-1 is a bearded, white-chaffed, semi-dwarf wheat released in 1972. WS-1's grain test weight is about 1 lb/bu less, maturity about 4 days earlier, and height about 2 inches taller than Twin's. WS-1 is moderately resistant to stripe rust, powdery mildew, and leaf rust. Milling and baking quality is poorer than that of Twin.

HARD RED SPRING WHEATS

Anza

Anza is a bearded, white-chaffed, semi-dwarf wheat released in 1971. It is adapted for growing under a wide range of climatic and soil conditions. Anza's grain test weight is about 4 lb/bu greater, maturity is about 5 days earlier, and height is about 3 inches shorter than Twin's. Anza is resistant to stripe rust, mildew, and leaf rust. The milling quality of Anza is good, but the quality of its flour is debatable.

Borah

Borah is a bearded, white-chaffed, semi-dwarf wheat released in 1974. Its grain test weight is about 3 lb/bu greater, maturity is 5 days earlier, and height is about 1 inch shorter than Twin's. Borah is resistant to leaf and stripe rust and has good milling and baking quality.

Fortuna

Fortuna is a beardless, white-chaffed, medium-tall, solid-stemmed wheat released in 1966. Its grain test weight is about 3 lb/bu heavier, maturity is 4 days earlier, and plant height is about 9 inches taller than Twin's. Fortuna is resistant to sawfly, leaf rust, stem rust, and stripe rust. Milling and baking quality is satisfactory.

Profit 75

Profit 75 is a bearded, white-chaffed semi-dwarf wheat released in 1974. Its grain test weight is about 3 lb/bu greater, maturity is six days earlier, and height is about equal to Twin's. Profit 75 is resistant to both stripe and leaf rust. Milling and baking quality is good.

Prospur

Prospur is a bearded, white-chaffed, semi-dwarf wheat released in 1971. Its grain test weight is about 3 lb/bu greater, maturity about 8 days earlier, and height about 3 inches taller than Twin's. Prospur is susceptible to leaf rust and moderately resistant to stripe rust. It has good milling and baking quality.

Sawtell

Sawtell is a bearded, white-chaffed, semi-dwarf wheat released in 1977. Its grain test weight is about 2 lb/bu heavier, maturity and height are about the same as Twin's. Sawtell is susceptible to mildew and moderately resistant to leaf rust and stripe rust. It has satisfactory milling and baking quality.

Wampum

Wampum is a midseason, medium tall wheat released to growers in 1978. It has stiff straw and light "tan" chaff. Wampum matures 2 to 3 days earlier and is 3 to 4 inches taller than Wared. Its test weight is about 1 lb/bu lower than Wared. Wampum is moderately susceptible to stripe rust and resistant to leaf rust. The milling and baking quality of Wampum is good.

Wared

Wared is a bearded, white-chaffed, semi-dwarf wheat released in 1974. Its grain test weight is about 2 lb/bu heavier, maturity is 2 days earlier, and height is about 2 inches taller than Twin's. Wared has shown good resistance to mildew and fair resistance to prevalent races of stripe rust. Milling and baking properties are good.

SIX-ROW WINTER BARLEYS

Boyer

Boyer is a medium short, midseason, feed grain variety released in 1975. Grain test weight is 2 lb/bu less and height is about 7 inches shorter than Kamiak. Boyer is more resistant to lodging than Kamiak and is about equal in winterhardiness. The spike is mid-dense and kernels are white.

Hesk

Hesk is a medium height, medium to mid-late, shatter resistant feed barley released in 1980. It is similar to Boyer in maturity, plant height, test weight, kernel plumpness, resistance to lodging, and resistance to barley leaf scald. Hesk is well adapted for growing in the higher yielding areas of eastern Oregon averaging 5 percent higher in yield than Boyer.

Hudson

Hudson is a medium tall, early maturing feed grain variety released in 1951. Grain test weights are heavy. Plants are winterhardy but only moderately resistant to lodging. The spike is dense and short and kernels are white or occasionally light blue.

Kamiak

Kamiak is a medium tall, early maturing, feed grain variety released in 1971. Its grain test weight is about 1 lb/bu less, maturity date and winterhardiness are about the same, height is about 3 inches shorter, and lodging resistance is greater than Hudson's.

Luther

Luther is a medium height, late maturing feed grain variety released in 1966. Its grain test weight is about 4 lb/bu less, maturity is 12 days later, height is 7 inches shorter, and winterhardiness is about equal to Hudson's. The spike is mid-dense and kernels are light blue.

Mal

Mal is a medium late, mid-tall, stiff strawed feed barley released in 1980. It produces grain with test weight similar to Boyer, heads about 2 days later, is 1 to 2 inches shorter in plant height, is similar in resistance to lodging, and similar in resistance to barley leaf scald. Mal is well adapted in Union, Wallowa, and Baker Counties and especially suited for the flood irrigated areas of Malheur County.

Schuyler

Schuyler is a medium short, medium early, feed grain variety released in 1968. Its grain test weight is about 1 lb/bu less, maturity is 5 days later, height is 9 inches shorter, and winterhardiness is slightly greater than Hudson's. The spike is mid-dense and medium long; kernels are white.

SIX-ROW SPRING BARLEYS

Advance

Advance is an early, short, stiff strawed variety released in 1979. It has averaged about 4 days earlier, 2 inches shorter and about 1.0 lb/bu heavier than Steptoe. This variety has excellent livestock feed quality and is being tested commercially for use as a malting variety. Advance does not yield well under low yielding situations but yields well under high yielding conditions.

Blazer

Blazer is a medium tall, medium maturing barley released in 1974. It is acceptable for malting and brewing. Its grain test weight is about the same, maturity is 4 days later, and height is 8 inches taller than Steptoe's. Blazer is moderately resistant to lodging. The spike is moderately dense and medium short; kernels are white.

Flynn 37

Flynn 37 is a medium height, early, feed grain variety released in 1941. Its grain test weight is about 1 lb/bu less, height is about 3 inches shorter, and straw is less resistant to lodging than Steptoe's. The spike is lax and short to mid-long. Beards are smooth. Kernels are large and white.

Gem

Gem is a medium height, early, feed grain variety released in 1947. Its grain test weight is similar, maturity is about 5 days earlier, height is slightly shorter, and straw is less resistant to lodging than Steptoe's. The spike is lax and short to midlong. Kernels are large and white.

Steptoe

Steptoe is a medium height, early, feed grain variety released in 1973. Grain test weight is quite heavy and this variety yields especially well in high yielding situations. Steptoe is resistant to lodging. It is tolerant to cold and may be fall seeded in areas where winter killing is not a serious problem. Spikes are lax and midlong. Kernels are white.

Unitan

Unitan is a medium tall, medium maturing, feed grain variety released in 1959. Its grain test weight is slightly greater, maturity is one day later, height is about 2 inches taller, and resistance to lodging is slightly less than Steptoe's. The spike is lax and long. Kernels are white.

TWO-ROW SPRING BARLEYS

Kimberly

Kimberly is a malting barley similar to Klages in agronomic characteristics released in 1977. It heads about 2 days later than Klages. Its grain test weight is about 2 lb/bu heavier than Klages. The kernels of Kimberly are white. Kimberly is quite resistant to lodging.

Klages

Klages is a medium tall, late maturing barley released in 1973. When grown under irrigation, this variety is acceptable for malting and brewing. Its grain test weight is about 2 lb/bu heavier, maturity is 8 days later, and height is the same as Steptoe's. Klages is quite resistant to lodging. The spike is lax and mid-long to long. Kernels are white.

Kombar

Kombar is a short, late maturing, feed grain variety released in 1977. Its grain test weight is about 3 lb/bu less, maturity is 7 days later, and height is about 9 inches less than Steptoe's. Kombar is very resistant to lodging and yields well under irrigation but not under dryland conditions. The spike is mid-dense and short.

Lud

Lud is a medium short, late maturing, feed grain variety released in 1975. Its grain test weight is about 3 lb/bu heavier, maturity is 9 days later, and height is 4 inches shorter than Steptoe's. Lud is quite resistant to lodging. It yields well under irrigation or when rainfall is plentiful but does not yield well under droughty conditions. The spike is mid-dense and medium short.

Summit

Summit is a medium height, late maturing barley released in 1977. Its grain test weight is about 3 lb/bu greater, maturity is 9 days later, and height is one inch shorter than Steptoe's. Summit is quite resistant to lodging. It yields well under irrigation or high rainfall but not under droughty conditions. The spike is mid-dense and medium short. According to the North American Plant Breeders, grain of Summit is acceptable for malting and brewing.

Vanguard

Vanguard is a medium tall, medium late maturing variety released to growers in 1971. Its grain test weight is about 4 lb/bu greater and plant height, maturity and lodging resistance are similar to Steptoe's. The spike is medium dense and medium long; kernels are white. Vanguard has been designated a malting barley by the Malting Barley Improvement Association.

SPRING OATS

Appaloosa

Appaloosa is a mid-tall, early, stiff-straw oat released in 1978. Kernels are yellow-gray in color and grain test weight is about equal to that of Cayuse. Appaloosa is best adapted in high yielding locations.

Cayuse

Cayuse is a short, medium early variety released in 1968. It is quite resistant to lodging. Kernels are light yellow and grain test weight is below average. Cayuse has wide adaptation and yields well under drought as well as under irrigation.

Park

Park is a medium tall, medium maturing variety released about 1953. Kernels are white. Its grain test weight is about 1 lb/bu greater, maturity is 3 days later, and height is about 4 inches taller than Cayuse. Park is quite resistant to lodging. It has been used to prevent erosion on irrigated sandy soils near Boardman. It is planted in early autumn to provide a ground cover during winter. Park freezes out during winter and does not cause a problem for spring-seeded crops.

Table 1. Cereal grain varietal developers and locations of foundation seed nurseries

Variety	Developer	Foundation seed
	Soft White Club Winter Wheats	
Barbee	C. J. Peterson Jr. and O. A. Vogel SEA-AR-USDA, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Faro	C. R. Rohde, CBARC, OSU, Pendleton, OR	Ore. Foundation Seed Project, OSU, Corvallis, OR
Jacmar	Harley D. Jacquot, Pullman, WA	Harley D. Jacquot, Pullman, WA
Moro	C. R. Rohde, CBARC, OSU, Pendleton, OR and R. J. Metzger, SEA-AR-USDA Corvallis, OR	Ore. Foundation Seed Project, OSU, Corvallis, OR
Tyee	R. E. Allen and C. J. Peterson, Jr. SEA-AR-USDA, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
	Soft White Common Winter Wheats	
Daws	C. J. Peterson Jr. and O. A. Vogel, SEA-AR-USDA, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Hyslop	W. E. Kronstad, OSU, Corvallis, OR	Ore. Foundation Seed Project, OSU, Corvallis, OR
Luke	C. J. Peterson Jr. and O. A. Vogel, SEA-AR-USDA, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
McDermid	W. E. Kronstad, OSU, Corvallis, OR	Ore. Foundation Seed Project, OSU, Corvallis, OR
Nugaines	O. A. Vogel, SEA-AR-USDA, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Sprague	G. W. Bruehl, M. Nagamitsu, and W. L. Nelson, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Stephens	W. E. Kronstad, OSU, Corvallis, OR	Ore. Foundation Seed Project, OSU, Corvallis, OR

Variety	Developer	Foundation seed
	Hard Red Common Winter Wheat	
Hatton	Ed Donaldson and M. Nagamitsu, WSU, Lind, WA	Wash. State Crop Impr. Assn., Yakima, WA
Wanser	W. L. Nelson and M. Nagamitsu, WSU, Lind, WA	Wash. State Crop Impr. Assn., Yakima, WA
	Soft White Spring Wheats	
Dirkwin	D. Sunderman, SEA-AR-USDA, Aberdeen, ID	Idaho Crop Impr. Assn., Aberdeen, ID
Fielder	D. Sunderman, SEA-AR-USDA, Aberdeen, ID	Idaho Crop Impr. Assn., Aberdeen, ID
Fieldwin	D. Sunderman, SEA-AR-USDA, Aberdeen, ID	Idaho Crop Impr. Assn., Aberdeen, ID
Sterling	D. Sunderman, SEA-AR-USDA, Aberdeen, ID	Idaho Crop Impr. Assn., Aberdeen, ID
Twin	D. Sunderman, SEA-AR-USDA, Aberdeen, ID	Idaho Crop Impr. Assn., Aberdeen, ID
Urquie	C. J. Konzak, W. L. Nelson, and M. Nagamitsu, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Walladay	C. F. Konzak, Ed Donaldson, and M. Nagamitsu, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
	Semi-Hard White Spring Wheat	
WS-1	World Seeds, Inc., Oceanside, CA	World Seeds, Inc., Oceanside, CA
	Hard Red Spring Wheats	
Anza	Mexican Govt. and International Maize and Wheat Improvement Center, Mexico	Dept. of Agronomy and Range Science, Univ. of Cal. at Davis
Borah	D. Sunderman, SEA-AR-USDA, Aberdeen, ID	Idaho Crop Impr. Assn., Aberdeen, ID

Variety	Developer	Foundation seed
Fortuna	K. L. Lebsock, W. B. Noble, and L. D. Sibbitt, SEA-AR-USDA and No. Dak. State Univ., Fargo, ND	No. Dak. Agr. Expt. Sta., Fargo, ND
Profit 75	World Seeds, Inc., Oceanside, CA	World Seeds, Inc., Oceanside, CA
Prospur	International Maize and Wheat Improvement Center, Mexico	Northrup, King and Co., Woodland, CA
Sawtell	D. Sunderman, SEA-AR-USDA, Aberdeen, ID	Idaho Crop Impr. Assn., Aberdeen, ID
Wampum	C. F. Konzak, Ed Donaldson, and M. Nagamitsu, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Wared	Developed by SEA-AR-USDA (Minnesota) Released by C. F. Konzak, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
	Six-Row Winter Barleys	
Boyer	C. E. Muir, R. A. Nilan, and A. J. Lejeune, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Hesk	M. F. Kolding, OSU, Pendleton, OR	Ore. Foundation Seed Project, OSU, Corvallis, OR
Hudson	N. F. Jensen, Cornell Univ., Ithaca, NY	Ore. Foundation Seed Project, OSU, Corvallis, OR
Kamiak	R. A. Nilan and C. E. Muir, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Luther	R. A. Nilan and C. E. Muir, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Mal	M. F. Kolding, OSU, Pendleton, OR	Ore. Foundation Seed Project, OSU, Corvallis, OR
Schuyler	N. F. Jensen, Cornell Univ., Ithaca, NY	Cornell Univ., Ithaca, NY

Variety	Developer	Foundation seed
	Six-Row Spring Barleys	
Advance	R. A. Nilan, C. L. Muir, and A. J. Lejeune, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Blazer	R. A. Nilan, C. E. Muir, and A. J. Lejeune, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Flynn	Minnesota Agr. Expt. Sta. and Moro, Sta., CBARC, Moro, OR	Ore. Foundation Seed Project, OSU, Corvallis, OR
Gem	H. K. Schultz and K. H. Klages, Univ. of Idaho, Moscow, ID	Idaho Crop Impr. Assn., Aberdeen, ID
Steptoe	C. E. Muir and R. A. Nilan, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Unitan	R. R. Eslick and E. A. Hockett, Mont. State Univ., Bozeman, MT	Montana Crop Impr. Assn., Bozeman, MT
Kimberly	SEA-AR-USDA personnel and Aberdeen Branch Expt. Sta., Aberdeen, ID	Tetonia Branch Expt. Sta., Tetonia, ID
	Two-Row Spring Barleys	
Klages	SEA-AR-USDA personnel and Aberdeen Branch Expt. Sta., Aberdeen, ID	Tetonia Branch Expt. Sta., Tetonia, ID
Kombar	Northrup, King and Co., Woodland, CA	Northrup, King and Co., Woodland, CA
Lud	North American Plant Breeders, Berthoud, CO	North American Plant Breeders, Berthoud, CO
Summit	Noeth American Plant Breeders, Berthoud, CO	North American Plant CO
Vanguard	R. A. Nilan and C. L. Muir, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
	Spring Oats	
Appaloosa	C. F. Konzak, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA

Variety	Developer	Foundation seed
Cayuse	N. F. Jensen, Cornell Univ., Ithaca, NY, and selected for release by C. F. Konzak, WSU, Pullman, WA	Wash. State Crop Impr. Assn., Yakima, WA
Park	H. Stevens and F. A. Coffman, SEA-AR-USDA and Aberdeen Branch Expt. Sta., Aberdeen, ID	Idaho Crop Impr. Assn., Aberdeen, ID

CEREAL BREEDING AND TESTING PROJECT

Charles R. Rohde and Wesley B. Locke[1]

The cereal breeding program at Pendleton has the primary objective of developing high yielding, soft, white winter wheat varieties for the lower yielding areas of eastern Oregon. Varieties adapted for lower yielding areas are often taller than semi-dwarf varieties such as 'Hyslop' and 'Nugaines" and include club varieties such as 'Moro' and 'Paha.'

Desired varietal characteristics for lower yielding areas are: (1) production of high yields of grain with excellent mil'ing and baking quality; (2) resistance to smut, stripe rust, and foot and root rots; (3) ability to establish quickly in a high residue seedbed; (4) ability to emerge when seeded deep or when soil moisture in the seeding zone is low; (5) resistance to shattering; (6) medium straw height; (7) resistance to lodging, and (7) moderate winterhardiness.

New varieties of spring and winter wheat, spring and winter barley, and spring oats, developed by public and private breeders, are compared in the variety testing program at the Columbia Basin Agricultural Research Center. Plot sites at Pendleton, Moro, and Hermiston stations and on farmers' fields that are representative of cereal-growing areas of northeastern Oregon, provide data on yield, agronomic quality, and disease characteristics for comparison to commonly grown varieties.

Climatic and soil conditions are diverse in northeastern Oregon; consequently, it is necessary to test cereal varieties at many locations and for at least three years to get reliable information as to their adaptability for various areas of northeastern Oregon. Tables 1 through 9 give yield data obtained from these trials for new and old varieties of wheat and barley. Detailed variety descriptions are included in another article in this progress report.

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Table 1. Yield data of winter wheat varieties for the years each has been tested in lower yielding areas of eastern Oregon

Variety	Moro	Pilot Rock	Echo	Lexington	Heppner	Arlington	Condon	Average
				(Bushels per acre)				
Jacmar[1]	43.7	30.4	31.5	28.9	30.3	34.5	32.1	33.1
Stephens	44.0	33.7	32.2	32.0	31.7	25.2	24.9	32.0
Faro	44.1	31.1	30.9	28.2	30.7	29.2	25.1	31.3
OR7142[2]	39.5	32.4	29.1	27.5	32.2	28.9	28.3	31.1
Sprague	40.8	32.3	27.6	29.0	32.5	27.8	26.7	31.0
OR68007[2]	41.8	36.0	30.8	27.0	29.4	25.3	26.2	30.9
Tyee	40.2	32.7	28.1	27.3	32.4	30.3	25.3	30.9
McDermid	36.1	32.6	30.1	28.1	32.8	25.8	27.0	30.4
Hyslop	37.7	31.9	30.8	29.7	32.2	26.0	23.6	30.3
Daws	38.7	35.2	30.8	26.0	29.7	23.2	25.0	29.8
Nugaines	37.4	27.4	30.6	27.8	30.5	27.1	27.4	29.7
Luke	37.2	31.3	29.2	28.2	28.9	25.9	24.6	29.3
Barbee	38.0	30.0	25.1	23.8	28.0	24.8	27.5	28.2

[1]Tested in 1980 only

[2]Potential new varieties

Table 2. Yield data of winter wheat varieties for the years each has been tested in higher yielding areas of eastern Oregon

Variety	Pendleton	Holdman	Weston	LaGrande	Enterprise	Baker	Average
				(Bushels per acre)			
Stephens	83.6	41.7	63.1	66.1	50.5	48.0	58.8
Hyslop	75.9	39.2	62.0	59.8	52.3	55.8	57.5
McDermid	74.1	35.8	63.2	61.5	54.2	55.6	57.4
Luke	74.5	38.3	59.6	59.9	50.9	58.0	56.9
Tyee	82.8	42.5	50.8	59.7	43.4	58.7	56.3
Daws	75.4	42.7	58.5	67.0	44.8	48.8	56.2
OR68007[1]	78.7	38.9	54.0	56.8	50.6	54.6	55.6
Nugaines	70.7	36.4	59.2	60.0	53.0	52.6	55.3
Jacmar[2]	78.8	45.5	53.1	60.7	34.4	----	54.5
OR7142[1]	79.4	39.3	53.9	62.4	49.0	40.0	54.0
Faro	81.4	37.6	56.3	61.1	44.5	42.1	53.8
Sprague	72.4	36.4	55.9	58.9	52.3	46.3	53.7
Barbee	69.4	41.4	49.8	51.0	43.1	46.3	50.2

[1]Potential new varieties

[2]Tested in 1980 only

Table 3. Yield data of winter wheat varieties for the years each has been tested under irrigation in eastern Oregon

Variety	Pendleton	Hermiston	Summerville	Average
		(Bushels per acre)		
OR68007[1]	94.2	63.8	92.1	83.4
Stephens	101.0	63.2	80.8	81.7
Hyslop	93.5	56.5	81.7	77.2
McDermid	88.7	55.0	75.7	73.1
Nugaines	86.0	52.0	80.0	72.7
Daws	88.1	52.8	76.1	72.3
Luke	83.9	43.2	74.9	67.3

[1]Potential new variety

Table 4. Yield data of spring wheat varieties for the years each has been tested in the lower yielding areas of eastern Oregon

Variety	Moro	Echo	Lexington	Heppner	Arlington	Condon	Average
				(Bushels per acre)			
Sterling	33.4	26.5	25.2	20.4	27.3	25.9	26.4
Dirkwin	32.6	23.5	24.6	20.1	27.9	23.8	25.4
Anza	32.4	23.1	24.0	21.0	26.0	25.5	25.3
Borah	30.5	22.5	23.3	23.3	24.2	24.2	24.7
Fieldwin	29.4	23.4	21.5	21.3	24.1	25.8	24.2
Wared	30.8	22.3	22.9	20.1	24.9	24.0	24.2
Prospur	28.8	20.7	22.2	27.6	21.2	24.3	24.1
Fielder	28.3	22.6	23.3	20.6	25.1	24.0	24.0
Walladay	32.0	24.4	22.0	17.5	25.8	21.4	23.8
Twin	30.7	23.1	22.6	19.1	24.3	23.0	23.8
Urquie	29.3	21.3	22.7	19.0	25.7	23.0	23.5
Wampum	28.6	23.0	21.7	20.3	22.7	24.5	23.5
Sawtell	30.5	20.7	22.0	20.2	25.2	20.5	23.2
Profit 75	28.6	19.7	19.4	20.5	19.0	21.9	21.5
Fortuna	24.9	21.1	20.7	19.5	21.2	20.2	21.3

Table 5. Yield data of spring wheat varieties for the years each has been tested in the higher yielding areas of eastern Oregon

Variety	Pendleton		Weston	Hermiston	LaGrande	Joseph	Baker	Average
	Irrigated	Dryland						
	(Bushels per acre)							
Dirkwin	63.2	48.8	52.4	49.0	49.2	50.6	39.3	50.4
Prospur	67.9	43.3	55.7	44.3	43.3	47.6	42.4	49.2
Borah	68.7	42.3	47.5	49.3	43.0	48.5	36.6	48.0
Wampum	62.8	43.2	49.6	43.0	43.4	52.2	36.8	47.3
Twin	65.6	43.3	42.1	40.2	45.8	45.0	44.6	46.7
Anza	67.2	45.3	46.8	45.6	40.4	41.3	39.4	46.6
Fieldwin	63.2	41.3	41.8	48.4	43.2	42.7	39.1	45.7
Fielder	60.9	39.9	43.7	50.6	41.7	38.7	37.3	44.7
Profit 75	64.8	42.8	44.8	38.3	40.7	45.3	34.3	44.4
Urquie	59.6	40.2	41.9	36.9	42.9	43.7	42.1	43.9
Sawtell	54.4	40.9	44.4	33.7	45.8	43.5	40.0	43.2
Wared	56.3	38.5	44.5	40.9	36.2	42.9	32.2	41.6
Walladay	54.9	36.6	38.5	39.1	32.6	42.5	34.1	39.8
Sterling	48.4	35.9	37.4	40.7	38.7	33.2	36.8	38.7

Table 6. Yield of winter barley varieties for the years each has been tested in lower yielding areas of eastern Oregon

Variety	Moro	Pilot Rock	Echo	Lexington	Heppner	Arlington	Condon	Average
				(Pounds per acre)				
Steptoe (fall seeded)	2074	2601	2615	2196	2059	1895	1949	2198
Wintermalt	1941	2195	2394	2277	2025	1628	1685	2021
Hesk	1883	2463	2199	2084	2106	1673	1727	2019
Kamiak	1845	2175	2267	2015	1806	1616	1776	1929
Mal	1770	2315	1854	2002	1744	1701	1780	1881
Hudson	1752	2102	2246	1764	1932	1624	1410	1833

Table 7. Yield of winter barley varieties for the years each has been tested in higher yielding areas of eastern Oregon

Variety	Pendleton	Weston	Holdman	Hermiston	LaGrande	Summerville	Enterprise	Baker	Average
					(Pounds per acre)				
Hesk	5594	4431	2082	4069	4307	4305	3216	3009	3877
Mal	5521	4187	2028	4028	4296	4639	3270	2970	3867
Schuyler	4849	4150	2460	3808	4080	4163	3444	3042	3750
Boyer	5213	4352	2180	3714	4092	4209	3087	2837	3710
Luther	4310	4130	2125	3747	3552	3785	3200	2538	3423
Kamiak	4979	3632	2110	2959	3670	3726	3113	2661	3356
Wintermalt	5194	3521	1955	3298	3540	3517	2532	3138	3337
Steptoe (fall seeded)	5164	3919	1820	2875	3058	3699	1932	1801	3034

Table 8. Yield data of spring barley varieties for the years each has been tested in the lower yielding areas of eastern Oregon

Variety	Moro	Echo	Lexington	Heppner	Arlington	Condon	Average
			(Pounds per acre)				
Steptoe	2160	2069	1742	1721	1808	2188	1948
Gem	2081	2018	1814	1656	1736	2045	1892
Lud	2265	2060	1712	1577	1690	1794	1850
Flynn 37	2008	2046	1754	1588	1651	1913	1827
Unitan	2020	1994	1759	1402	1549	1895	1770
Summit	2107	1998	1689	1308	1666	1827	1766
Stepford	1666	1806	1428	1235	1299	1221	1442

Table 9. Yield data of spring barley varieties for the years each has been tested in the higher yielding areas of eastern Oregon

Variety	Pendleton		Weston	Hermiston	LaGrande	Joseph	Baker	Average
	Dryland	Irrigated						
				(Pounds per acre)				
Steptoe	3944	4603	3762	4196	4303	4280	4046	4162
Advance	3818	4985	3657	3842	4274	3723	2854	3879
Lud	3705	4431	3746	3809	4142	3839	3420	3870
Summit	3488	4230	3503	3570	4220	3787	3329	3732
Kombar	2485	5168	3394	4006	4040	3015	3103	3602
Gem	3587	4069	3386	3374	3549	3537	2958	3494
Kimberly	3240	3693	3359	3384	3663	3453	3391	3455
Klages	3739	3713	2989	2908	3694	3666	3459	3453
Unitan	3287	3833	3014	3324	3206	3492	3080	3319
Cayuse (Oats)	2702	3940	2775	3420	3424	3239	2750	3179
Appaloosa (Oats)	2550	3640	2832	3473	3586	3149	2381	3087

PROGRESS IN THE SMALL GRAIN BREEDING PROGRAM

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Germ Plasm Bank

To make crosses directed toward specific objectives, it is necessary to accumulate and maintain a working genetic pool made up of superior winter wheat cultivars which cover a wide range of adaptability. OSU's contact with a network of institutions and agencies continues to provide a wealth of superior varieties and advanced lines through exchange of wheat genetic material. The following list includes the number of introductions and major genetic strengths from the countries sending seed to OSU during 1979 and 1980:

WHEAT GERM PLASM RECEIVED AT OSU FROM COOPERATING COUNTRIES - 1979-1980

Country	No. of Introductions	Major Genetic Strengths
Algeria	140	Septoria resistance, drought tolerance
Greece	25	Stem rust and powdery mildew resistance
Jordan	12	Drought tolerance, late frost
Syria	318 + 250 barley	Stem rust resistance, high yield potential, spring barley
Turkey, Diyarbakir	33	Yield potential, late frost
Turkey, Ankara	50	High plateau environment, winterhardiness
Turkey, Eskisehir	56	Stem rust resistance, Cercosporella tolerance

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Country	No. of Introductions	Major Genetic Strengths
Turkey, Izmir	27	Stem, leaf, stripe rust and septoria resistance
Turkey, Edirne	44	Stripe rust, powdery mildew, cercosporella and bunt resistance
Yugoslavia, Novi Sad	40	Dwarfing genes. leaf rust resistance, earliness
Yugoslavia, Zagreb	32	Stem rust resistance, yield potential
Bulgaria	17	Powdery mildew, leaf rust, fusarium resistance, yield potential
Romania	9	Powdery mildew, stem, leaf and stripe rust resistance
Hungary, Szeged	65	Powdery mildew, leaf rust, fusarium resistance
Hungary, Martonvasar	18	Dwarfing genes, winterhardiness, powdery mildew, stem rust resistance
Poland, Laski	15	Winterhardiness, dwarfness, powdery mildew, stem rust resistance
Switzerland	73	Septoria nodorum, stem and leaf rust resistance
Germany	10	Leaf and stem rust resistance
France, Clermont Ferrand	30	Cercosporella root rot, winter-hardiness
France, Versaille	46	Yield potential, stripe rust resistance
France, Pau Cedex	378	Stripe and leaf rust, powdery mildew, cercosporella resistance
France, Froissy	10	Yellow, leaf rust, powdery mildew, cercosporella resistance

Country	No. of Introductions	Major Genetic Strengths
France, Claeys-Luck	22	Cercosporella, stripe rust, powdery mildew resistance
France, Semonville, Cidex	72	Powdery mildew, stripe rust, septoria resistance
France, Le Rheu	43	Cercosporella, stripe rust, powdery mildew resistance
England, Cambridge	18	Dwarfness, yield potential, stripe rust resistance
England, Rothwell	6	Yield potential, stripe rust and cercosporella resistance
Russia, via USDA, Md.	128	Winterhardiness
China	82	Earliness, dwarfness
Sweden	12	Winterhardiness
South Africa	61	Stem rust resistance
Argentina	34	Stem, leaf rust resistance, yield potential
Ecuador	153	Stripe and leaf rust, powdery mildew resistance
Mexico, CIANO	140	Stem and leaf rust, powdery mildew resistance
Mexico, CIMMYT	354	Winter crossing block of diverse germ plasm
India	3	Barley yellow dwarf resistance
Spain	35	Stem and leaf rust, septoria resistance
Korea	11	Earliness, dwarfness
Chile	12	Stripe, leaf, stem rust resistance

Country	No. of Introductions	Major Genetic Strengths
Portugal	5	Septoria, powdery mildew resistance
Kenya	51	Stem and leaf rust resistance
Iran	31	Leaf and stem rust, septoria resistance
Ethiopia	3	Stem rust, powdery mildew resistance
Total Introductions	2724 + 250 barley	

BARLEY GERM PLASM RECEIVED AT OSU FROM COOPERATING COUNTRIES - 1979-1980

Greece	10	Mildew, helminthosporium resistance
Turkey	100	Snow mold resistance, disease resistance
France	9	Agronomic type, yield, mildew resistance
England	20	Short straw, mildew resistance
Mexico	250	Observation nursery - earliness, short straw
Netherlands	6	Agronomic type
Denmark	5	High lysine, yield
Sweden	5	High lysine
Japan	7	Short straw
Poland	2	Mildew and leaf rust resistance
Czechoslovakia	6	Mildew and leaf rust resistance
Romania	1	Mildew and leaf rust resistance

Country	No. of Introductions	Major Genetic Strengths
China	1	Earliness
Finland	5	Mildew, quality
Germany	2	Yield potential
Jordan	2	Drought tolerance
Syria	250	ICARDA observation nursery - disease resistance, leaf rust resistance

Quality Laboratory

An experiment was conducted to determine if a consistent and acceptable protein level could be obtained for hard red winter cultivars using different forms and methods of applications of nitrogen fertilizer.

Foliar applications of urea significantly increased grain protein over the control and standard topdressing treatments for most of the cultivars tested. At the Hyslop location (high rainfall) grain protein percentage increased for all nitrogen treatments with values of 11.5, 12.2, and 13.6 respectively for one of the genetically high potential protein lines. For the Kaseberg location (dryland), topdressing and the combination of topdressing plus one foliar application of urea increased the grain protein percentage to 9.3 and 10.4, respectively.

In a second study, two levels of nitrogen fertilizer were applied to five winter wheat cultivars selected for their grain yield or potential high grain protein. The experimental sites were the Kaseberg Farm (dryland) and the East Farm (high rainfall) located just east of Corvallis. The objectives of this investigation were: (1) to determine the relationship between the nitrogen percentage in the plant tissue at various stages of growth and subsequent grain protein, and (2) to evaluate the possible association between grain yield and grain protein as influenced by different cultivars, fertilizer and moisture levels.

The most significant finding in both of these studies was that higher protein levels could consistently be achieved at the higher rainfall locations. Such information will be helpful in terms of the selection and evaluation of new hard red winter varieties for Oregon.

Currently the quality laboratory is screening remnant grain samples of early generation populations (F3 and F4) which are now growing at the three major testing sites (Hyslop, Moro, and Pendleton). This, coupled with evaluating the quality pattern of frequently used parents, will result in greater overall efficiency in the breeding program.

Hard Red Winter Wheat

The objective of the hard red winter (HRW) wheat breeding program is to develop varieties adapted to the growing conditions of Oregon. Hard red winter wheat varieties are intended to complement the soft white winter wheats and provide the wheat producers of Oregon additional production and marketing options. The requirements for a HRW wheat variety are basically two-fold: (1) yield potential and stability comparable to the leading soft white varieties, and (2) acceptable milling and baking quality as demanded by the market. A quality characteristic of particular concern is protein content. This involves not only a high content (greater than 12%), but also a stable protein content between locations, and over years.

In Oregon, wheat is produced under many diverse conditions. Therefore, the question as to which area or areas of the state HRW wheats would be best adapted, and fulfill the requirements indicated above, must be answered. It was initially believed that the 16-inch or less rainfall area east of the Cascades would be the most likely area for HRW wheat varieties. However, the studies previously mentioned indicate that the higher rainfall or irrigated areas may be the best environments for combining high yield and acceptable protein content.

In Tables 1 and 2 the yield data are presented for the most promising HRW experimental wheat lines in actual yield and as percentage of Stephens and Wanser, respectively. The quality and agronomic data for the same lines are presented in Tables 3 and 4, respectively.

Small increase plots for each of these lines are now being grown. If their overall performance is acceptable this year they will be entered into regional yield trials next fall. It should be noted that these selections are the result of winter x spring crosses.

Soft White Winter Wheat

Grain yield comparisons for three selections are compared with Stephens and Daws when grown on the Hyslop Farm for the past several years (Table 5). When the average yield over years is considered, Stephens yielded 12 bushels more than Daws. Selection 1M6 and 2M6 and, for a three-year average, 72341 have exceeded the yield of Stephens. Part of this yield advantage can be explained when the disease reactions for these cultivars are viewed in Table 6. All five cultivars appear to have acceptable levels of resistance to stripe rust. For leaf rust, Daws is susceptible with the other cultivars showing resistant reaction patterns. This is especially true for Selection 72341 (10MR). The new selections also appear to have better resistance to mildew and equal or better resistance to Septoria when compared to Stephens or Daws.

Table 7 provides a similar yield comparison for the same five cultivars when grown at the Pendleton site. Stephens has had the highest average yield

Table 1. Summary of grain yields of promising hard red winter wheat selections, Wanser and Stephens at Moro, Pendleton, and Corvallis

Cultivar	Location	1978 bu/A	1979 bu/A	1980 bu/A	Average bu/A
Wanser	Moro	30	--	41	36
	Pendleton	30	64	38	44
	Corvallis	22	29	35	29
Stephens	Moro	34	--	66	50
	Pendleton	91	78	89	86
	Corvallis	57	118	79	85
SWCM 5092	Moro	43	--	70	56
	Pendleton	61	80	89	77
	Corvallis	55	103	73	77
SWD 71452A	Moro	43	--	68	56
	Pendleton	78	80	92	83
	Corvallis	60	110	81	84
SWD 71164	Moro	38	--	57	48
	Pendleton	--	84	79	82
	Corvallis	72	81	91	81

Table 2. Summary of grain yields averaged over three years for promising hard red winter wheat selections expressed as percentages of Wanser and Stephens

Cultivar	Location	% of Stephens	% of Wanser
SWCM 5092	Moro	112	155
	Pendleton	90	175
	Corvallis	91	265
SWD 71452A	Moro	112	155
	Pendleton	96	188
	Corvallis	99	289
SWD 71164	Moro	96	133
	Pendleton	95	186
	Corvallis	95	279

Table 3. Quality characteristics of hard red winter wheat selections and Wanser grown in Pendleton, Oregon in 1979

	Test weight	Flour yield	Mill score[1]	Flour ash	Flour protein	Bake mix time	Loaf volume[2]
	lb/bu	%		%	%	min.	ml
Wanser	65.0	74.2	91.3	.37	9.3	3.9	914
SWCM 5092	65.0	72.7	90.8	.35	10.6	2.9	901
SWD 71452A	62.9	71.5	85.4	.43	8.5	3.5	821
SWD 71164	64.8	73.2	89.7	.38	10.6	2.4	951

[1]Range 0-100 with 100 most desirable.

[2]Observed values corrected to 9% protein.

Table 4. Heading date and disease reactions of hard red winter wheat selections, Wanser and Stephens grown at the Hyslop Agronomy Farm

Cultivar	Stripe[1] rust	Leaf[1] rust	Septoria[2]	Heading date
Wanser	30MS	20MS	3	May 21
Stephens	10MR	30MS	8	May 20
SWCM 5092	10MR	TR	8	May 14
SWD 71452A	5M	5M	7	May 17
SWD 71164	TR	TR	4	May 6

[1]Rust data reported on Cobb Scale where TR, 5M and 10MR would be classified as resistant and 20MS and 30MS would be classified as moderately susceptible.

[2]Scale of 0-9 where 0 = resistant and 9 = susceptible.

Table 5. Four-year summary of two soft white winter wheat cultivars and three promising selections grown at Corvallis and reported in bushels per acre

	1977	1978	1979	1980	Average
	bu/A				
Stephens	81	57	111	61	78
Daws	73	57	103	32	66
2M6	88	53	123	62	82
1M6	96	55	126	55	83
72341	106	--	123	84	104[1]

[1]Three years' data

Table 6. Disease reactions of selected soft white winter wheat cultivars and promising selections when grown at the Hyslop Agronomy Farm

	Stripe[1] rust	Leaf[1] rust	Mildew[2]	Septoria[2]
Stephens	10MR	40M	5	7
Daws	10MR	60S	8	7
2M6	20MR	40M	4	5
1M6	20MR	20M	3	6
72341	10MR	10MR	3	7

[1]Rust data reported on Cobb Scale where 10MR and 20MR would be classified as resistant, 40M as moderately susceptible, and 60S as susceptible.

[2]Scale of 0-9; where 0 = resistant and 9 = susceptible.

Table 7. Four-year summary of two soft white winter wheat cultivars and three selections grown at Pendleton and reported in bushels per acre

	1977	1978	1979	1980	Average
	----------------	bu/A	----------------------		
Stephens	67.6	90.9	66.2	96.1	88.2
Daws	51.3	87.9	70.6	78.0	79.1
2M6	56.6	80.8	79.0	85.4	82.3
1M6	61.2	75.7	75.7	77.8	80.0
72341	--	89.2	68.4	105.4	88.0

being approximately nine bushels higher than Daws. Only Selection 72341 is comparable to Stephens' yield when the three selections are considered. However, it should be noted that, in 1979, all three selections outyielded Stephens and Daws. This further confirms other observations of that year in which these selections and especially 2M6 have a high level of winterhardiness.

The quality data as supplied by the Washington Regional Quality Laboratory are provided in Table 8. It can be noted that all three selections have promising quality.

Selection 2M6 is being tested in large scale plots of 5 to 15 acres by growers in the major wheat-producing areas of Oregon. Based on these trials, a decision will be made whether to release it as a new variety this fall.

Table 8. Quality patterns of soft white winter wheat cultivars and promising selections grown at Hyslop Agronomy Farm in 1979

	Test weight	Flour yield	Mill[1] score	Ash	Flour protein	Cookie diameter
	lb/bu	%		%	%	cm
Stephens	63.6	76	92.4	.41	7.8	9.27
Daws	62.0	74	87.2	.45	7.6	8.85
2M6*	64.0	77	91.4	.49	7.9	9.16
1M6**	64.4	76	88.7	.46	8.1	8.91
72341*	62.0	76	92.0	.42	7.9	9.05

[1]Range 0-100 with 100 most desirable.

Spring Wheat

Because of limited resources and priorities established, based on the total production of various types of cereal grains, only a modest effort is devoted to the breeding of spring wheat varieties. In the past, the programs at Aberdeen, Idaho, and Pullman, Washington, have been relied upon to provide spring wheat varieties for Oregon. With the development of the linkages between OSU and CIMMYT, an additional opportunity has surfaced. Each year, OSU wheat breeders evaluate and select the most promising spring wheat materials at Obregon, Mexico, in the CIMMYT nurseries. These selections represent potential spring varieties of both the soft white and hard red market classes. Last year, 1,155 such lines were screened in the Willamette Valley and at Klamath Falls. Because of limited seed supplies, these evaluations were mainly for disease resistance and agronomic type. Seventy-six lines were selected for additional testing this spring. The Ontario and Sherman Branch Experiment Station's also will be used as experimental sites this year for the selected material.

Barley Program

This year, Oregon State University is releasing a new winter barley variety. A foundation seed field is being grown near Rickereall in the Willamette Valley. A name has not been given to this variety. It is now known as OWB 70173. This line is a high yielding, stiff-strawed cultivar. It has rough beards and plump white aleurone seed.

The female parent of this line is WA 2138-68 which is a cross between Hudson and Luther. Hudson is an early winterhardy line with weak straw. Luther is a late maturing, stiff-strawed mutant of Alpine. The paternal parent is a line from Illinois. It is fairly tall and early, with good scald tolerance.

In the 1980 regional nursery, OWB 70173 was first in yield and second in straw strength. These results indicate that it might be widely adapted as the nursery was grown and harvested at eight locations in five states. Winterhardiness and stand establishment data are not yet sufficient to recommend its release for eastern Oregon. Consequently, we are at this time recommending it only for the Willamette Valley. Information on its stand establishment and winterhardiness should be available from the 1980-81 crop season and further recommendations will be made accordingly.

Tables 9 through 12 present yield and agronomic data on this line as compared to Boyer, Mal, and Hesk.

Table 9. Agronomic data for OWB70173, Boyer, Mal, and Hesk

	Test weight			Heading date			Height		Scald[2]		Lodging
	C[1]	P[1]	O[1]	C	P	O	C	P	C	P	O
	-------lb/bu-------			------May-----			----cm----		------		%
OWB70173	47.4	51.5	47	17	22	9	115	85	7	7	30
Boyer	47.4	51.7	48	17	28	13	125	95	5	7	70
Mal	46.8	50.2	48	19	29	14	115	90	4	6	75
Hesk	45.2	50.2	46	18	26	9	120	80	5	7	80

[1]C - Corvallis; P - Pendleton; O - Ontario.

[2]Scale of 0-9 with 0 being resistant.

Table 10. Four years' yield data from Corvallis for OWB 70173 and three check cultivars

	1977	1978	1979	1980	4 year average
	-------------------------T/A-------------------------				
OWB70173	2.40	1.66	2.71	2.81	2.40
Boyer	2.21	1.58	2.50	2.57	2.21
Mal	2.18	1.58	2.69	2.52	2.26
Hesk	1.92	1.73	2.47	2.45	2.14

Table 11. Two years' yield data from Madras for OWB70173 and three check cultivars

	1978	1980	Average
	-------------------------T/A-------------------------		
OWB70173	3.0	3.6	3.3
Boyer	2.7	3.6	3.1
Mal	2.3	3.0	2.7
Hesk	2.4	2.5	2.4

Table 12. Yield data at Pendleton and Ontario, Oregon, for OWB70173 Boyer, Hesk, and Mal

	1980	
	Pendleton	Ontario
	---------------T/A---------------	
OWB70173	2.73	3.08
Boyer	2.93	2.64
Mal	2.89	2.37
Hesk	2.93	3.10

A QUEST FOR CEREAL VARIETIES RESISTANT TO THE MINOR CEREAL DISEASES IN EASTERN OREGON

Mathias F. Kolding[1]

INTRODUCTION

Snowmolds, smuts, Cephalosporum stripe and frost heaving can exact their toll, individually as well as in various combinations, in winter cereal fields east of Oregon's Cascade range. Growers may not distinguish losses due to snowmolds, winter freezing or frost induced soil heaving. Cereal diseases are often not positively identified. Common bunt Tilletia caries (DC) Tul. and dwarfbunt, Tilletia conterversa, Kuhn., are similar. Cephalosporum stripe is confused with stripe rust, Puccinia striiformis, West., or Barley Yellow Dwarf Virus (BYDV). Mostly what is noticed is crop damage and loss. Some may conclude that our contemporary varieties are no better than Grandpa's so the growers are still left alone to face natures whims.

In one sense they are correct about Grandpa's varieties, because contemporary varieties are also flawed, and when disaster hits, the percentage loss may be the same, but the bushel loss is magnified. It is easier to remember harvesting 30 bushels per acre when your neighbor harvested 60 bushels than when you had 10 bushels and he had 20 bushels.

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Plant breeders are vitally concerned about both the major (more likely annual in nature) and minor (occasional, few acres or small affect to plant) plant flaws. Attention, however, is directed towards developing a high yielding variety resistant to the diseases causing the highest economic losses. The correction of minor plant flaws or introducing and finding resistance to minor diseases is more complex than the major problems since a breeder must maintain the major resistances when adding minor disease resistance.

SUMMARY

For nine consecutive years the Wulff Ranch at Flora, Oregon has provided a disease screening observation site for winter wheat, triticale and barley. Each disease did not appear each year, but snowmold, *Typhula idahoensis*, and dwarfbunt, *Tilletia controversa*, Kuhn or Cephalosporum stripe and frost heaving usually occurred in pairs. About 2950 cultivars from other locations, selections from new crosses and varieties from other breeders were observed. Presently, the selection of SM-4, SM-6, PI173438, PI178201, PI178383, and *Triticum timopheevi*, crossed to adapted wheats appear the most promising for winter wheat. At present, no satisfactory winter barleys are identified. Several winter triticale from the Kiss/193-803/358 cross are especially promising.

OBJECTIVES

The objective of evaluating winter wheat, barley, and triticale near Flora, Oregon, is to develop and discover high yielding cultivars of cereal feed grains adapted to the intermountain valleys and plateaus in eastern Oregon.

METHODS

During each of the nine autumns from 1972 through 1980, a uniform plot site of approximately 150 X 250 feet was selected at a location favorable to snow accumulation. Generally these sites had a historical problem with dwarfbunt, snowmold, and early spring soil heaving. Cultivars and bulk plant populations planted near Flora were reported to have dwarfbunt and snowmold resistance or had one or more resistant parents. To insure stand establishment and sufficient plant size for winter survival (4-8 leaves), all plots were planted during September. Selections or varieties were planted in nonreplicated, 10 to 15 foot long, four-row plots, with 12-inch row spacings. The bulk populations were grown in plots ranging from 30 to 60 feet in length.

Individual plants were selected each fall. These selections and new entries were then planted at a new Flora site. Several selections, especially from the triticale, were grown and reselected at the Hermiston site of the Columbia Basin Agricultural Research Center.

RESULTS

Nearly 2950 selections of winter wheat, triticale, and barley were evaluated. Table 1 gives examples of the winter survival of wheat and triticale grown from 1974 through 1976. Several are footnoted because they are considered the most likely to act as helpful genetic donors to improve adapted varieties. Survival ratings and disease readings for 1977, 1978, and 1979 are not summarized, since very little disease problems were in evidence in 1977. In 1978 and 1979 a major portion of the plots were destroyed by frost heaving and snowmold. Now only three winter wheat selections, and seven triticale selections (Footnote 3, Table 1 and Table 2), from the 1976 lines remain.

Twenty winter wheat populations of adapted varieties crossed to (PI178201, PI119333, PI173438, Bunt-X, PI9342, PI166910) cultivars with resistance to the minor diseases are growing in large plots for purification in 1981.

A selection of the winter triticale M76-8655 is in a breeders seed increase.

Forty-one Turkish winter barley introductions, collected by Dr. Robert Metzger, USDA-SEA-AR, Corvallis, Oregon, from areas with problems similar to eastern Oregon, are in the Flora trials.

DISCUSSION

The cropping area near Flora, Oregon, offers sites valuable for screening winter cereal selections for eastern Oregon disease problems. The nine years of screening winter cereals at the Flora sites have pointed to several challenges:

1. Cultivars resistance to common bunt are useful for dwarf smut screening since numbers are reduced, i.e. those cultivars susceptible to common smut also are susceptible to dwarfbunt, but the same is not true for resistance. The dwarfbunt races need identity.

2. The same dwarfbunt races do not appear each year. A set of differentials to identify races is needed for Flora area. Existing differentials may die from other diseases.

3. Dwarfbunt resistance without snowmold resistance is meaningless when screening on sites. More snowmold resistance is needed for both research lines and growers.

4. Lines resistant to frost heaving are rare but needed since damage which occurs is often disguised by regrowth and tillering. What are the losses?

5. Cephalosporum stripe has been confused with dwarfbunt in evaluation. Resistance to both is needed.

6. Levels of dwarfbunt resistance sought by export requirements are meaningless to a grower harvesting grain in September and October whether he has had rains and will probably sell his grain for feed or if he had a nice crop and only has to raise his header to cut down the amount of smut in his wheat. Does the grower need more wheat varieties or alternate crops?

7. Growers will try the most popular wheats on fields thought to be low in dwarfbunt innoculum. Stephens wheat this year gave superior yields, but what if that "virulent type?" had appeared and infected the crop? Or, is a good wheat year a poor smut year? We need to know more about raising smut races. Do all released wheat varieties need dwarfbunt resistance?

8. Triticale is providing some answers, but the romance of growing wheat is hard to overcome.

9. Lines selected at Flora are usually very susceptible to leaf rust.

Table 1. Percent Winter Survival of Winter Wheat and triticale at Flora, Oregon, 1974 through 1976

Selection	Identity[1] number	Percent winter survival 1974	1975	1976
		Winter Wheats from different sources		
Introduction	CI 9342[2]	95	95	95
Introduction	CI 12595	0		
Introduction	CI 14106[2]	95	95	60
Idaho source	CI 17302			20
Idaho source	CI 17304			10
It/159/2/Mcc/WA476S	CI 17308			70
Idaho source	CI 17309			40
Idaho source	CI 17311			20
Introduction	PI 94433	0		
R75-1216	PI 119333			90
FW741279F	PI 119333[2]	90	95	50
Introduction	PI 166910		80	20
M74-1831	PI 166910		95	40
Einkorn	PI 167556		0	0
Introduction	PI 167822	60	95	75
M74-15	PI 173438[2]		100	90
Introduction	PI 178192	30		
Introduction	PI 178201[2]		95	50
FW741282F	PI 178201[2]	Reselect 95	90	90
Introduction	PI 178210		30	10
Introduction	PI 178383[2]		90	80
Introduction	PI 191100		5	0
Introduction	PI 221421		5	
Introduction	PI 225275		80	10
Introduction	PI 245579		100	10
Introduction	PI 245622	10		
Introduction	PI 253958	0		
Introduction	PI 255416	0		
Introduction	PI 264255	0		
Introduction	Bunt-X[2]	100		
Sprague	CI 15376		95	10
Thule III	FW741283F[2]	100	60	100
Hansel	UT755204		95	30
Franklin	CI 15317		100	90
Gns/Burt//Itana	WA7002		100	50
Bnk 1205/Burt//14/53-1	WA5985		100	90
1709, WKP 4/1081D	FW741331			60
1712, WKP 4/1011D	FW741334			80
1714, WKP 4/1011D	FW741336			80

Table 1. (continued)

Selection	Identity[1] number	Percent winter survival 1974	1975	1976
		Winter Wheats selected at Flora		
Hyslop (control)	CI 14564	20	100	10
Nugaines (control)	CI 13968	20	100	10
Luke (control)	CI 14586	35	80	40
Daws (control)	R75-1382			60
YY/2* 63112-604	FW73522F		100	30
YY/2 63112-604	FW73522F221		100	50
Rb/Moro/2/FW71001/Yh	FW74682F		80	10
2*Yh/Yy/2/Yh/Cama	FW741267F	40	50	60
2*Yh/Yy/2/Yh/Cama	FW741269[3]	40	40	50
69-230/63130-702	FW741276F	20	40	30
Yh/Hys/2/Hys/Yy	FW741240F	80	80	90
Yh/Hys/2/Hys/Yy	FW741255F	50	80	90
M73-710-4	FW741296F[3]	90	60	20
M73-720-11	FW741304F	95	30	80
PI178383/om/2/CI13438	FW75536F[2]			90
Yy/Hys/2/Hys/Yy	FW75533F			50
P-101/Luke	FW75537F			60
P-101/Luke	FW75540			60
PI173438/Elgin	M74-1832[3]			95
Yy/2* 63112-604	R72-1602P05			70
Yy/2* 63112-604	R72-1602P01			70
	Winter Triticale			
Elt-9	M75-6530			90
Elt-1, hardy	M75-7149			90
6TA 386A	M75-7206			10
Tcl	M75-8064			80
Tcl	M75-8551			70
Tcl	M75-8655[3]			90

[1]Identity number lines prefixed by PI, R, or M were furnished by Dr. Robert Metzger, USDA, SEA, AR, Corvallis, Oregon

[2]Most likely helpful for the feed grains breeding project

[3]Long term selections still grown at Flora

Table 2. 1980 Flora screening trials, Cephalosporum stripe, dwarfbunt, *Tilletia controversa*, snowmold, *Typhula idahoensis*, root rot, *Cercosporella herpotrichoides*, and agronomic ratings for winter wheat and triticale selections kept for 1981

Entry[1]	Pedigree	Cephalo-sporum stripe	Dwarf smut	Snow mold	Root rot	Plot[2] rating
		Percent infected plants	Percent infected	Percent stand survival	Percent lodged	
	Winter Wheat					
CI 17596	Stephens (control)	70	0	80	trace	4
CI 17419	Daws (control)	70	0	80	20	4
CI 14565	McDermid (control)	80	0	90	40	3
CI 13968	Nugaines (control)	80	0	80	40	4
French	Promesse	20	0	90	10	5
Thule III	(control)	0	0	90	90	1
PI 119333	(control)	0	0	30	90	2
PI 178201	(control)	0	0	20	90	1
PI 178383	(control)	0	0	30	90	2
PI 173438	(control)	0	0	90	90	3
England	Triticum Lumpton	50	5	90	trace	6
FW75361F902	Yh/Yy/2/WA64-249/FW-378 /3/Yh/Hys/2/Hys/Yy	20	0	80	0	5
FW74697-07	Hys/Rb/2/FW71001/Yh	20	trace	90	0	5
FW75361F910	Yh/Yy/2/WA64-249/FW-378 /3/Yh/Hys/2/Hys/Yy	70	0	90	0	4
FW741051F-06	FW72002/3/Yy/Yh/3/Rb/Yh	10	0	80	0	6
FW741051F07	FW72002/3/Yy/Yh/2/Rb/Yh	30	0	90	0	3-4
FW741269F	2*Yh/Yy/3/Yh/Cama[3]	50	0	80	60	3
FW741296F	M73-710-4[3]	?	0	90	90	2
M74-1832	PI173438/Elgin[3]	50	0	70	90	1
FW76152F902	JJG/Paha/2/Bunt-X	20	5	90	0	5
FW76257F911	WKP 1701/4/109/2/Suwon/ Riedel	60	0	90	0	5
FW79567	*Triticum timopheevi*/2* P-101	40	0	90	0	6
FW79568	*Triticum timopheevi*/2* P-101	40	0	90	0	6
FW79569	*Triticum timopheevi*/2* P-101	40	0	90	0	6
FW79570	*Triticum timopheevi*/2* P-101	40	0	90	0	6
M76-473	Stephens/SM-4	10	0	70	40	3
M76-473	Stephens/SM-4	0	0	80	90	4
M76-456	Daws/SM-4	10	0	80	trace	5

Table 2. (continued)

Entry[1]	Pedigree	Cephalo-sporum stripe	Dwarf smut	Snow mold	Root rot	Plot[2] rating
		Percent infected plants	Percent infected	Percent stand survival	Percent lodged	
	Triticale					
M75-8655	Kiss/3/193-803//358	50	0	90	0	6
M76-6288	Tcl	20	0	80	0	5
M76-6252	Kiss/Elliott	60	0	90	0	4
M75-8589	Head selection	60	0	80	0	4
M75-8655-50	Kiss//193-803/358[3]	30	0	80	0	5
M75-8655-55	Kiss//193-803/358[3]	40	0	80	0	4
M76-6881	AM2147	80	0	70	0	3
M75-8655-48	Kiss//193-803/358[3]	20	0	90	0	6
M75-8655-51	Kiss//193-803/358[3]	20	0	90	0	5
M75-8655-53	Kiss//193-803/358[3]	20	0	90	0	5
M75-8655-68	Kiss//193-803/358[3]	20	0	90	0	3
TA76-96-72	Kiss//193-803/358[3]	40	0	80	0	3
R79-965	BT-2	20	0	90	trace	4
R79-998	Flora	10	0	90	0	5
R79-1007	Flora	10	0	90	0	5
R79-1011	Flora	20	0	90	0	5
R79-1029	Flora	50	0	90	0	5
R79-1047	Flora	10	0	90	0	5
FT79435	6TAB72//6TB163/Elt-3/3/6TAB76A	10	0	80	0	5
FT79437	6TAB72//6TB163/Elt-3/3/6TAB76A	20	0	80	0	4
FT79442	M75-6576-2//6TB219/6TAB76	10	0	80	0	5
FT79448	6TB163/6TA386A//6TAB75	10	0	80	0	5
FT79451	6TB163/6TA386A//6TAB75	10	0	90	0	4
FT79453	6TB163/6TB164//6TAB76	10	0	90	0	4
FT79458	6TB163/6TB219//M75-6600	10	0	90	0	5
FT79475	Bulk selection	10	0	80	0	Seg[4]
FT79477	Bulk selection	30	0	70	0	4

[1]Entry numbers prefixed PI, M, and R were provided by Dr. Robert Metzger, USDA, SEA, AR, Corvallis, Oregon

[2]Plot rating: 0 to 9 scale where 0-3 unacceptable; 4-6 probably acceptable; 8-9 ideal

[3]Long-term selections

[4]Segregating population - no rating

BEST MANAGEMENT PRACTICES (BMP) DEMONSTRATION AND EVALUATION PROJECT FIVE-COUNTY NORTH CENTRAL OREGON AREA 1978-1981

Gerald O. George[1]

This project began in February 1978 after state funds were appropriated and personnel hired. The original project was to document and evaluate terrace effects on water pollution caused by sediment from soil erosion. In 1979, the program was expanded to evaluate recognized Best Management Practices (BMP's) and demonstrate their impacts on water quality.

Climatic Conditions

Climatic conditions have been about the same each winter. Freezing weather and snow have occurred each month from November to March. The main difference has been in the length of the freezing period and the length of time and depth of snow cover. Each year has had one major thaw and runoff period that produced 70 to 80 percent of the soil movement. This runoff period occurred in December 1977, February 1979 and 1980, and in December 1980.

METHODS

Each year, fields for erosion measurement were selected to represent typical tillage and management practices for the area, and erosion was measured with a rill meter. In 1979, 1980, and 1981, runoff samples were taken with recording samples and by grab sample each time runoff left a field or terrace. These samples were allowed to settle and sediment volume determined. The samples were then used to determine the amount of sediment in the water leaving a field. Rainfall volume and intensity, and soil temperatures were recorded.

RESULTS

One runoff period each year produced 60 percent or more of the annual sediment loss.

Level storage type terraces that don't breach are 100 percent effective in reducing water pollution from sediment. Level terraces that breach or have a designed outlet are 80 + percent effective in sediment removal. Graded terraces are 60 to 80 percent effective if the outfall grade is less than one percent.

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All terraces were effective in reducing erosion by breaking up the length of slope in a field. Within limits, the closer the spacing the more effective the erosion control and sediment reduction. Terraces did not stop erosion from initiating, but they did reduce rill size and the amount of sediment available for water pollution.

Stubble mulch and conservation tillage systems were evaluated and found to be more effective than terraces in keeping erosion from initiating. These BMP's improved water quality as long as there was a low runoff volume. Once runoff started, the stubble did little to remove any sediment that was picked up in the water.

Observations of grassed waterways and buffer strips indicated they were effective in carrying runoff water and sediment from fields without generating additional soil sediments for stream pollution. These practices had no impact on in-field erosion, but they did reduce the total volume of sediment delivered to a stream.

Samples of outflow from graded terraces indicated 50 to 150 ml/l of sediments in the water. Samples from stubble mulched fields indicated about the same concentration of sediments when there was runoff. Samples taken from rills entering a terrace or from a non-terraced area had 250-400 ml/l of sediments.

CONCLUSIONS

All terraces will reduce erosion and sediment and improve water quality, but may not bring soil losses within tolerance limits.

Stubble mulch and conservation tillage will reduce water pollution by keeping erosion from initiating during low rainfall or runoff conditions. Conservation practices are more effective in keeping soil losses within established tolerance limits than terraces. They are not as effective in removing sediment pollutants at the terrace once sediment is picked up by the runoff water.

Grassed waterways and stream buffer strips reduce sediment delivery to streams, but have little or no impact on in-field erosion.

Where combinations of practices were utilized and measurements were made there was decidedly less erosion and, therefore, less sediment for water pollution.

RESIDUAL RUSSIAN THISTLE CONTROL IN FALL STUBBLE

D. J. Rydrych[1]

Russian thistle is one of the most troublesome of 40 common broadleaf weeds that are found in eastern Oregon, which are resistant to one or more of our commonly used herbicides. It is a member of the Goosefoot family and commonly escapes fall weed control programs. This plant is a summer annual that emerges in the spring to escape fall applied herbicides. It poses little problem in the winter wheat crop itself but becomes established after the crop has been harvested. Russian thistle grows to enormous size in the stubble right after harvest and causes mechanical difficulty when tillage or fallow is resumed in late winter or early spring. This research is an attempt to isolate herbicides which would help suppress or control Russian thistle in wheat or barley stubble after harvest so the weed could not become established in the fall fallow season.

EXPERIMENTAL PROCEDURE

Experimental plots were established on outlying locations in eastern Oregon for the selective control of broadleaf and grass weeds in winter wheat. Each site contained potential Russian thistle volunteer plants although the seedlings had not emerged before treatment. The herbicides trifluralin, diclofop, and DPX 4189 were preplant, soil incorporated. Bromoxynil, terbutryn, metribuzin, and 2,4-D were applied postemergence to other emerged weeds in the wheat.

Preplant, soil-incorporated herbicides were applied in September 1978 and postemergence treatments were applied April 1979. Crop yield and weed control evaluations were completed in July 1979. Residual Russian thistle control was evaluated in stubble for each treatment in November 1979, and again in February 1980, during the noncrop phase of winter fallow.

A randomized block design with three replications was used in all experiments. Stand counts were made of Russian thistle that remained in the treated areas.

RESULTS AND DISCUSSION

Table 1 gives the summarized evaluations for the sites at Ione and Holdman, Oregon. Russian thistle control values are listed as percent of a

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nonweeded control. Several herbicides were effective in the residual suppression of Russian thistle and may have some value as an indirect method of weed control. Trifluralin in any combination with bromoxynil, terbutryn, or 2,4-D showed 80 to 100 percent control of thistle as compared with 52 percent for trifluralin alone. Diclofop (hoelon) was very weak, alone or in combination with other herbicides, on Russian thistle. DPX 4189 is a new experimental broadleaf herbicide that gave only 50 percent thistle control when applied PPI but rose to 96 percent when applied postemergence on the original weed plots. Metribuzin was also effective (85 to 99 percent) in the residual control of Russian thistle as a separate treatment or when combined with bromoxynil or terbutryn. The chemical treatments were more efficient in the suppression of volunteer Russian thistle than the handweeded (mechanical) plots.

CONCLUSIONS

The preliminary data are very encouraging and indirect control of Russian thistle may be possible. Trifluralin, DPX 4189, and metribuzin effectively controlled Russian thistle even though the materials were applied several months before thistle germination. Past experience has shown that herbicides in the urea family, such as diuron, linuron, and chlorbromuron, are weak on Russian thistle.

Further experimentation is needed to establish a strategy that will produce significant Russian thistle control after harvest. Problem sites are being sampled to confirm the usefulness of herbicides such as trifluralin, DPX 4189, and metribuzin.

Table 1. Residual control of Russian thistle in wheat stubble after the use of fall and spring applied herbicides in the crop in eastern Oregon

Treatment[1]	Rate (lb/A)	Application time	Russian thistle control (%)	
			Ione	Holdman
Trifluralin	0.75	(PPI)	52	54
Trifluralin + bromoxynil	0.75 + 0.25	(PPI)+(Post)	80	91
Trifluralin + terbutryn	0.75 + 0.25	(PPI)+(Post)	94	100
Trifluralin + 2,4-D	0.75 + 1.00	(PPI)+(Post)	90	80
Diclofop + bromoxynil	1.00 + 0.25	(PPI)+(Post)	40	59
Diclofop + terbutryn	1.00 + 0.80	(PPI)+(Post)	40	66
Diclofop + 2,4-D	1.00 + 1.00	(PPI)+(Post)	70	30
DPX 4189	0.06	(PPI)	50	50
DPX 4189	0.06	(Post)	96	85
Metribuzin	0.33	(Post)	85	95
Metribuzin + bromoxynil	0.33 + 0.25	(Post)	90	96
Metribuzin + terbutryn	0.33 + 0.80	(Post)	90	99
Metribuzin + 2,4-D	0.33 + 0.25	(Post)	50	70
Handweeded (mechanical)	-----------	----	75	65
Control	-----------	----	0	0

Residual Russian thistle readings taken February 12, 1980, in stubble from treatments applied in the crop (1978-79).

[1]Trifluralin and diclofop applied preplant incorporated (PPI) only.

PRECIPITATION VARIATION EFFECTS ON SOIL NITROGEN AND NITROGEN REQUIREMENTS OF WINTER WHEAT

D. M. Glenn and F. E. Bolton[1]

During the last three years, research and historical data have been gathered in the Sherman County area to develop a comprehensive nitrogen fertilizer management program for wheat growers in the 10 to 14 inch precipitation zone of eastern Oregon. This management program utilizes precipitation probabilities for the area in association with a yield estimation formula (Table 1) based on monthly precipitation levels in the fallow and crop seasons. The anticipated yield level is adjusted downward when crop emergence is delayed (Figure 1). The effect of fallow and crop season precipitation levels on soil nitrogen mineralization also is considered. In 1980, field trials were conducted in Sherman and Wasco Counties to verify the accuracy of the yield-estimating formula on a commercial field basis and to examine the effect of straw incorporation on nitrogen mineralization in the fallow and crop season.

Table 1. Yield estimation formula

Potential grain yield (bu/A) =

Productivity index
X

-6.08 (Aug + Sept + Oct) + 4.87 (Nov + Dec + Jan) + 5.59 (Feb + Mar + April) + 7.37 (Sept)	Fallow season precipitation (in)
+ 2.80 (Nov + Dec + Jan) + 1.21 (Feb + Mar + April)	Crop season precipitation (in)
- 9.45	

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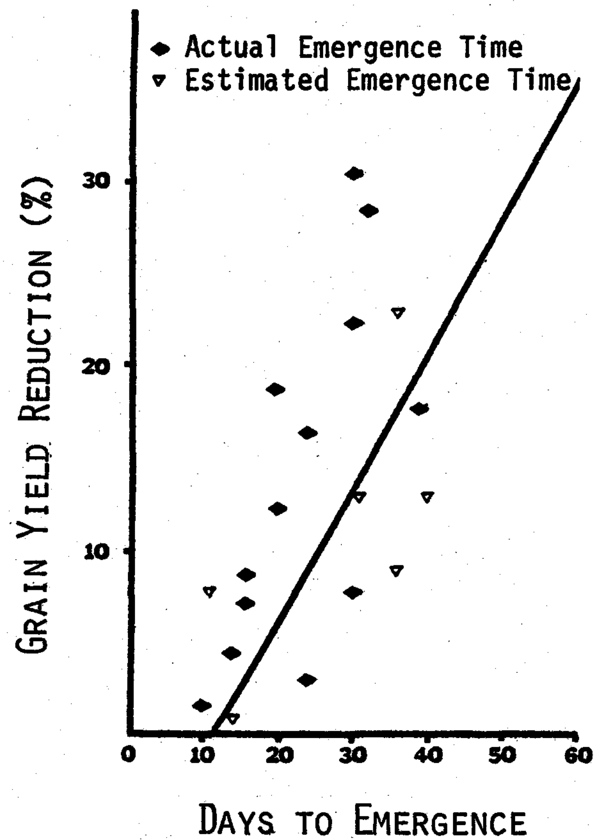

Figure 1. The effect of delayed emergence on percentage grain yield reduction (Moro, Oregon).

EXPERIMENTAL PROCEDURE

Five, fallow-crop soil moisture treatments simulating a dry fallow-normal crop (DFNC), normal fallow-dry crop (NFDC), normal fallow-normal crop (NFNC), normal fallow-wet crop (NFWC), and wet fallow-normal crop (WFNC) were established on a commercial farm near Moro, Oregon. These treatments were created by covering plots to exclude rain or by adding water as required during the 1978-80 season. Treatment levels were based on the long-term patterns. Soil profile nitrate-N was measured at the beginning of the fallow (August), and May, August, and September of the fallow period. Crop mineralization of nitrate-N was estimated indirectly using the fertilizer trials. Each treatment received six levels of nitrogen fertilizer (0, 13, 40, 54, 67, 94 #N/A) before Stephens wheat was planted. The crop was harvested in July 1980.

Crop season nitrogen fertilizer trials (0, 10, 20, 30 #N/A) were established on nine farms in Sherman and Wasco County to further verify the yield estimation formula on a commercial field scale.

RESULTS

In 1980, the yield estimations (Table 2) were generally below the actual production levels primarily because of the relatively cool, moist conditions

Table 2. A comparison of actual and predicted yields in Sherman and Wasco Counties

Productivity Index	Field production level (bu/A)	Predicted potential yield (bu/A)	Deviations (bu/A)	(%)
1.17	56.1	52.5	- 3.6	- 6.4
1.02	49.1	40.6	- 8.5	-17.3
0.49	26.0	21.3	- 4.7	-18.1
1.10	57.8	49.1	- 8.7	-15.1
1.10	41.9	46.1	4.2	10.0
0.81	47.0	32.3	-14.7	-31.0
1.02	45.1	40.6	- 4.5	-10.0
0.57	12.1	21.0	8.9	73.5
1.00	55.0	39.9	-15.1	-27.5

in May, June, and July. The yield estimation formula does not consider precipitation and temperature conditions beyond April of the crop year since nitrogen fertilizer cannot be applied effectively beyond this point. Despite this limitation, this method of estimating yield clearly indicated that in the spring of the crop year, above-normal yields were to be expected and growers who fertilized for normal yield levels should have considered additional top-dress applications. The amount of nitrogen required is equal to:

$$\underset{(bu/A)}{\text{Potential yield}} \times 2.4\ \frac{\text{lbs N}}{\text{bu}} - \text{amount of N mineralized in the fallow and crop season.}$$

The amount of nitrogen that is mineralized in the soil is related to the native fertility of the soil, the soil temperature, and the soil moisture content. A method of estimating soil mineralization amounts was tested by simulating five levels of fallow-crop season precipitation. Actual and estimated amounts of mineralized nitrogen at the end of the fallow period closely agreed at the 1 to 6 foot depths (Table 3). The upper foot of soil indicated that the amount of straw incorporated in the fallow could immobilize more nitrogen than the soil could mineralize under the existing conditions. For this reason, low levels of nitrogen were found in the upper foot at the end of the fallow period.

The amount of crop-season mineralization for all treatments was calculated to be -13 pounds N/A. This deficit of crop season mineralization further emphasized the immobilizing effect the incorporated straw had upon net nitrogen mineralization. These results stress the need for adequate nitrogen soil testing in both the fallow and crop season to estimate most accurately nitrogen needs of the crop.

Table 3. Fallow season mineralization (1979)

Fallow Condition	Predicted Total (lbs N/A)	Straw immobilization requirement (lbs N/A)	Predicted net (lbs N/A)	Actual (lbs N/A)
		0-1 foot		
Dry	52	118	-66	13
Normal	48	118	-70	13
Wet	52	118	-66	8
		1-6 foot		
Dry	54	-	54	41
Normal	58	-	58	41
Wet	61	-	61	40

DEEP FURROW OPENER FOR PLACEMENT OF FERTILIZER

D. E. Wilkins, G. A. Muilenburg, B. L. Klepper, and P. E. Rasmussen[1]

Banded fertilizer can accelerate fall and early spring growth of winter wheat, especially in tillage systems that leave crop residue on the surface. Placement of banded fertilizer is critical because germination and emergence can be depressed if the concentration of fertilizer is too high close to the developing seedling. This toxic effect of fertilizer is greatest for hot and dry seedbeds such as encountered in early fall planting in summer fallowed systems.

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Two modified deep furrow openers were compared in a fallow seedbed. These openers delivered seed and fertilizer with the same opener but did not allow intimate contact in the opener. The distribution of seed and fertilizer in the seedbed were measured to evaluate their separation. Wheat germination, emergence, and early growth responses also were measured to evaluate the significance of keeping seed and fertilizer separated in the seedbed.

EXPERIMENTAL PROCEDURES

The Johnson and USDA modified HZ openers (Figure 1), were designed to deliver both seed and fertilizer in the same opener and then to place fertilizer below the seed. These two openers were evaluated on a Walla Walla silt loam at the Pendleton Experiment Station in 1980. Stephens winter wheat was planted in 41-cm (16-inch) rows on October 30, 1980. The soil moisture content at planting was 20 percent. Ammonium polyphosphate, (10-34-0), was used as the starter fertilizer at the rate of 90 kg ofN (nitrogen) per hectare (80 lbs of N per acre). Soil samples were taken in 1-cm depth increments within each row 11 days after planting to determine the distribution of starter fertilizer at emergence. Seedlings from 0.5-m of row were excavated at emergence (12 days after planting), and the root and coleoptile lengths measured. Stand counts were made daily. As a measure of plant development, on December 30 the main-stem leaf number was measured on the plants in a 24-cm length of row.

RESULTS AND DISCUSSION

The mean depth of seeding for the Johnson and USDA openers were, respectively, 4 and 3 cm. The Johnson opener placed seed adjacent to high concentration of ammonium nitrogen fertilizer (Table 1), but the USDA opener provided a good separation between seeds and areas of high fertilizer concentration. Small changes in design produced this dramatic difference in opener performance.

Poor separation between seed and fertilizer had a significant impact on seedling root development and early growth (Table 2). Fertilization with the Johnson opener produced toxicity to both early root development and seedling growth because of insufficient separation between seed and fertilizer. Fifty percent emergence was delayed seven days and final stand reduced 20 percent by fertilizer applied with the Johnson opener (Figure 2). The USDA opener delayed 50 percent emergence only two days and did not reduce stand.

The modified USDA opener gave a good separation of fertilizer and seed, while the Johnson opener did not. The small differences of design in these two modified openers gave a big difference in performance. This comparison shows that openers can be designed to deliver seed and fertilizer with the same opener and yet achieve separation in the seedbed. Furthermore, this study showed that wheat germination and emergence are sensitive to separation of seed and fertilizer band. Preliminary information in related studies at Pendleton also shows that fertilizer banding may be necessary to develop conservation tillage systems that retain crop residues on the surface.

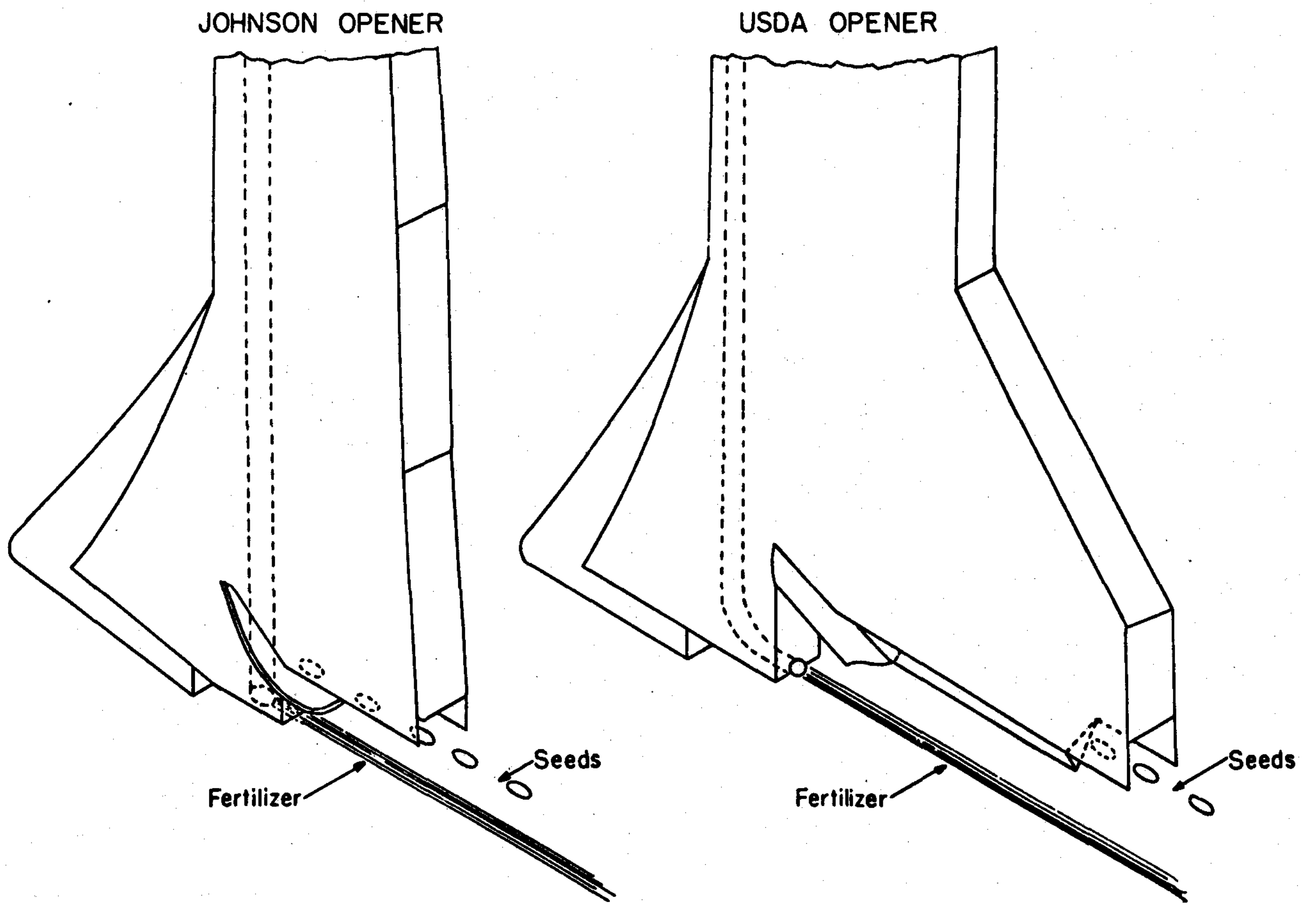

Figure 1. Typical seed and fertilizer band separation with the Johnson and USDA modified openers.

Table 1. Ammonium-nitrogen concentration and seed placement profiles in the seedbed as affected by grain drill opener design

Depth from surface of seedbed	NH_4^+ concentration in soil receiving no banded fertilizer	Johnson modified opener		USDA modified opener	
		NH_4^+ concentration	Seed location[1]	NH_4^+ concentration	Seed location[1]
cm	*ppm*	*ppm*	*percent*	*ppm*	*percent*
0-1	9	6	0	4	2
1-2	7	5	0	3	9
2-3	4	20	7	2	41
3-4	2	304	32	6	30
4-5	2	4207	52	80	18
5-6	1	1552	9	487	0
6-7	1	1109	0	1372	0
7-8	1	675	0	2133	0
8-9	1	150	0	1744	0
9-10	1	43	0	926	0

[1] If 100 seeds were planted the percent values would indicate the number of seeds to be found at that depth in the seedbed.

Table 2. Fertilizer placement effects on early wheat seeding growth at the time of emergence

Modified opener	Fertilizer added	Length of main root at time of emergence (mm)	Number of main-stem leaves 60 days after planting
Johnson or USDA	no	58	2.0
Johnson	yes	10	1.7
USDA	yes	44	2.0

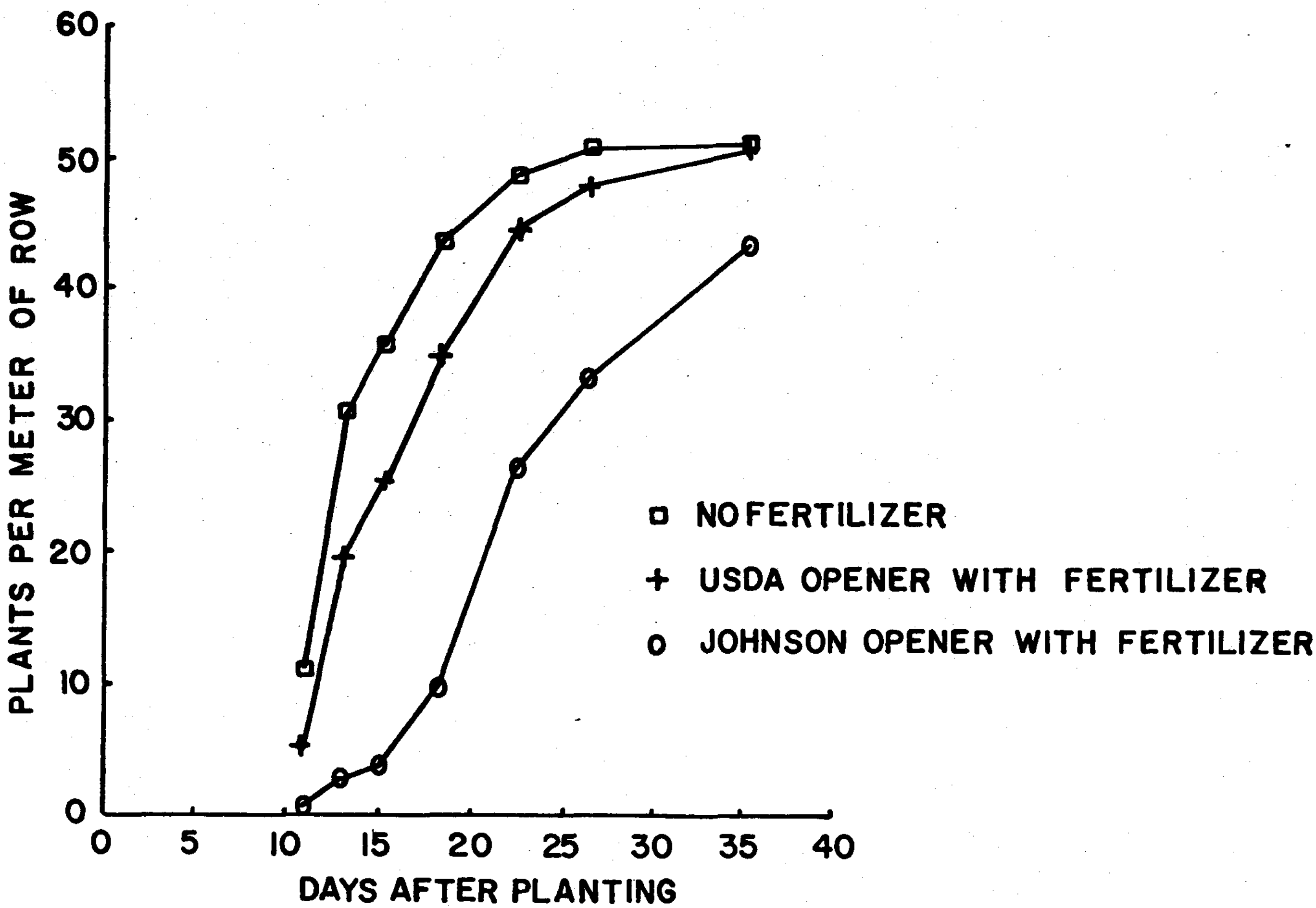

Figure 2. Fertilizer placement effect on emergence of Stephens winter wheat.

TILLAGE, SOIL MOISTURE, AND YIELD IN GREEN PEA PRODUCTION

R. E. Ramig and L. G. Ekin[1]

Dryland pea production in the Blue Mountain region of Oregon and Washington is often limited by deficiency of water, disease, or both. Tillage and treatment of stubble after wheat harvest can significantly affect soil water storage and subsequent green pea yields. There is large year-to-year variation in soil water storage and in the pea utilization of the stored soil water. This report summarizes 13 years (1968-1980) of field measurements to evaluate the water conservation by tillage (and associated stubble handling) treatments after wheat harvest. Subsequent responses by peas are evaluated in a wheat-pea rotation on a Walla Walla silt loam on the Pendleton Agricultural Experiment Station, where annual precipitation is 15.8 inches.

PROCEDURES

Four tillages of winter wheat stubble were compared:

1. Rototilling 4 to 5 inches deep in August after wheat harvest to completely mix the soil and stubble before the overwinter recharge period.

2. Moldboard plowing in August after harvest to bury the stubble before the overwinter recharge period.

3. Moldboard plowing in March to bury the stubble before pea planting.

4. No-tillage, where stubble is left on the surface.

Treatments 1 and 4 were sprayed with glyphosate in March to kill volunteer wheat and weeds. Weeds and volunteer wheat were controlled in moldboard plowed plots by spring-tooth cultivation in the spring. Dark Skin Perfection peas were seeded at a rate of 200 pounds per acre about April 1 with a 7-inch hoe drill. Soil moisture was measured with a neutron soil moisture meter.

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RESULTS

Precipitation over the period from wheat harvest until pea seeding about April 1 ranged from 8.1 to 21.7 inches and averaged 13.1 inches for the 13-year period (Table 1). Water storage in the fall-rototill and fall-plow treatments was no different and averaged 7.9 inches in an 8-foot soil profile. The two treatments with stubble standing overwinter stored 9.4 inches of water, which was 1.5 inches more than when the stubble was buried before winter. Consequently, fall tillage provided a storage of only 60 percent of the winter precipitation, storage efficiency in the standing stubble was 72 percent.

Table 1. Tillage and associated wheat-stubble management influences on water conservation and soil storage for use by peas, 1968-1980, Pendleton, Oregon

Tillage after wheat harvest	Inches of water stored during first winter[1]		
	Maximum	Mean	Minimum
Fall rototill	17.5	7.8	2.5
Fall plow	16.5	7.9	2.4
Spring plow	16.5	9.4	3.2
No tillage	17.1	9.5	4.2

[1]Precipitation ranged from 8.1 to 21.7 inches and averaged 13.1 inches.

Water storage did not begin on the fall tilled treatments until after 3.5 inches of precipitation had occurred but storage started after only 2.8 inches of precipitation where the stubble remained standing until spring (Figure 1). Standing stubble produced a microenvironment which reduced evaporation as compared to the greater evaporation demand where the stubble had been tilled after harvest. A combination of reduced radiation and dry air movement next to the soil surface may be involved in the greater water storage efficiency of the standing stubble. In 8 of 13 years, overwinter standing stubble stored from 1.2 to 4.7 more inches of water than where stubble was tilled and buried. These were years with average or less winter precipitation. In 5 of 13 years, when winter precipitation was above average, there was no difference in water storage.

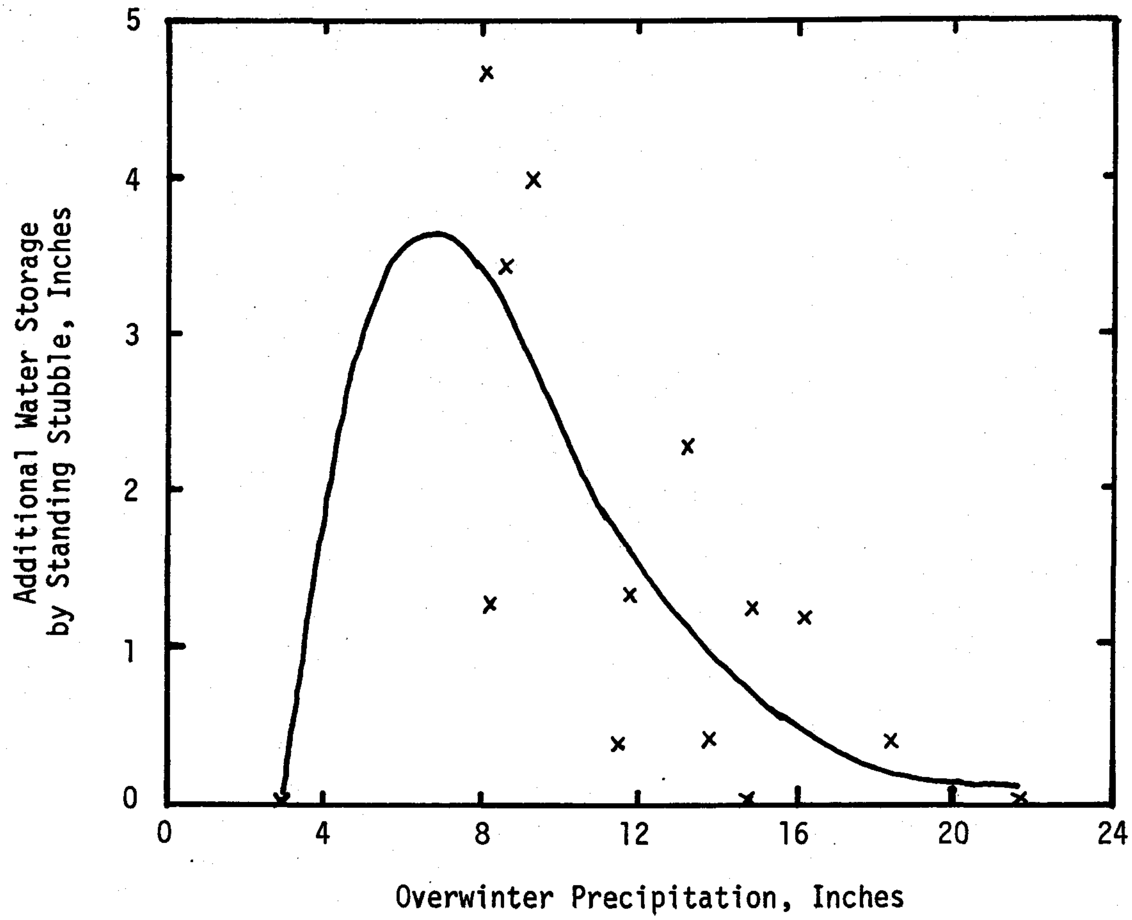

Figure 1. Additional water stored by leaving wheat stubble stand overwinter compared to plowing the wheat stubble in the fall. Pendleton, OR 1968-80.

The green pea crop removed an average of 5.0 inches of water from the five foot soil profile where stubble had been tilled in the fall and 5.8 inches where the stubble had remained standing overwinter (Table 2). Precipitation during the pea growing season, from seeding until harvest, averaged 2.8 inches.

Pea production in the conventional fall-plowed treatment was 2450 pounds per acre and, where non-tilled, 2650 pounds per acre (Table 3). In 7 of the 13 years there was no significant difference in yield between the spring-plowed and non-tilled treatments. When there was a significant difference between the spring-plow and no-till treatments, the spring-plow outyielded the no-till treatment four times and the no-till outyielded the spring-plow treatments two times. Average yield was 315 pounds per acre more where the stubble remained standing overwinter than where the stubble was fall tilled. The range of this yield difference was from 1350 to zero pounds per acre.

As an average of the four tillage methods for the 13-year period (1968-1980), three inches of water were required to grow the Dark Skin Perfection pea plant to where yield begins. Thereafter each inch of stored water plus growing season precipitation produced approximately 490 pounds of peas.

Table 2. Extraction of stored soil water by peas as influenced by different tillage treatments after wheat in a wheat-pea rotation, 1968-1980, Pendleton, Oregon

Tillage after wheat harvest	Inches of stored water extracted[1]		
	Maximum	Mean	Minimum
Fall rototill	9.4	5.0	1.4
Fall plow	8.5	5.0	1.6
Spring plow	9.1	5.8	2.2
No tillage	8.6	5.8	2.5

[1]Growing season precipitation ranged from 0.7 to 6.4 inches, and averaged 2.8 inches.

Table 3. Yields of green peas (for processing) as influenced by tillage of wheat stubble, 1968-1980, Pendleton, Oregon

Tillage after wheat harvest	Green pea yields (lb/A)		
	Maximum	Mean	Minimum
Fall rototill	5670	2500	320
Fall plow	5050	2450	360
Spring plow	5630	2790	1060
No tillage	5460	2650	1040

CONCLUSIONS

Standing wheat stubble increased overwinter water conservation and storage an average of 1.5 inches when compared to fall tilled wheat stubble at Pendleton, Oregon. This additional water was extracted by the pea crop and increased production of green peas for processing, 315 pounds per acre. Wheat stubble standing overwinter also controlled soil erosion.

At Pendleton, approximately 3 inches of precipitation is required after wheat harvest before water storage in the soil profile begins. Late summer and early fall rains wet the air-dry surface soil or evaporate because of high temperatures and low relative humidity.

Three inches of stored water are required to grow the pea plant to the production stage and each inch of water thereafter produces 500 pounds of peas to the acre.

THE EFFECT OF WATER INJECTION AND STARTER FERTILIZER ON STAND ESTABLISHMENT AND COMPONENTS OF YIELD

Fariborz Noori-Fard and F. E. Bolton[1]

The establishment of a vigorous stand of winter wheat at the optimum time is necessary to protect against erosion and make the most efficient use of available moisture and nutrients. In many years, the level of seed-zone moisture is inadequate to promote rapid germination and emergence at the optimum date of planting. Reduced and no-tillage systems often have a drier seedbed than stubble mulch systems. Dry seedbed conditions result in delayed emergence, spotty stands, weed problems, poor plant development, and reduced yields. The injection of water and starter fertilizer with the seed was investigated in a no-till system to determine the effect on emergence, yield components, and final grain yield of Stephens and Faro winter wheat.

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MATERIALS AND METHODS

In September 1979, Stephens and Faro winter wheat were seeded into a dry seedbed (7.5 percent moisture) on land chemically fallowed at the Sherman Branch Experiment Station. Water injection and starter fertilizer treatments (Table 1) were applied with the seed as an aid to stand establishment. The water and starter fertilizer treatments were combined directly with the seed at planting using a rotary-strip tiller to prepare the seedbed, plant the seed, and inject water and starter fertilizer. The starter fertilizer was composed of a liquid combination of Solution 32 (32-0-0) and liquid ammonium phosphate (10-34-0) diluted with water. Approximately 18 seeds/ft. of row were planted (70 pounds seed/A). The plots received a uniform application of 60 pounds N/A.

RESULTS

Laboratory experiments conducted the previous year indicated that rates up to 20 pounds N/A and 40 pounds P/A could be applied with the seed at planting without reducing germination and stand populations. In the field experiment, the water injection and starter fertilizer treatments significantly increased the percentage of plants that emerged in both cultivars. The emergence response was primarily caused by the additional water in the dry seedbed rather than the enhanced nutrient availability. The number of tillers, heads, and 1,000 seed weight were unaffected by the water injection and starter fertilizer treatments. Hand harvested yield (grams of grain/meter of row) and total plot yield (bu/A) did show a slight increase from both water injection and starter fertilizers.

SUMMARY

Laboratory and field studies indicate that up to 20 pounds N/A and 40 pounds P/A can be applied with the seed without reducing stands. The application of water into a dry seedbed with the seed does stimulate emergence and provides enhanced fall growth and erosion control. Additional studies are underway to determine the effect of sulfur sources in conjunction with nitrogen and phosphorous starter fertilizers and water injection.

Table 1. The effect of water injection and starter fertilizer on stand establishment and components of yield

Treatment	Emergence %		Tillers/meter		Heads/meter		1000 seed wt. (grams)		Yield bushels/acre	
	Faro	Stephens	Faro	Stephens	Faro	Stephens	Faro	Stephens	Faro	Stephens
CONTROL	59	53	6	4	136	118	38	58	52	48
WATER INJECTION (120 gal/A)	86	78	5	4	158	126	38	59	64	48
1 N-P (120 gal. water/A + 10# N + 20# P/A)	76	74	5	4	149	147	39	62	54	47
2 N-P (120 gal. water/A + 20# N + 40# P/A)	69	84	5	5	140	134	38	61	52	51

HESSIAN FLY IN NORTHEAST OREGON

R. W. Rickman, B. Klepper, P. Rasmussen, Dale Wilkins, and K. Pike[1]

Historically, Hessian fly has not been a pest of wheat in northeastern Oregon but that no longer may be the case. Although it has been a pest of western Oregon since the late 1800s, it was not found in eastern Oregon until 1979. There have been recent changes in farming practices, such as no-till, trashy fallow management, and irrigation of wheat. These practices are enhancing survival of the pest and increasing the potential that Hessian fly will become an important pest in the dryland wheat production of the Pacific Northwest.

Yield losses caused by the insect were recorded from spring wheat plots east of Pendleton in both 1979 and 1980. Field conditions that led to the worst damage were late seedings of spring wheat into heavy straw mulch with low nitrogen availability at the seed depth. Table 1 reports tiller survival and yield from the spring wheat plots. Where nitrogen was available at the seed depth to spring wheat seedlings because of banding application of the fertilizer, fly damage to the crop did not depress yield below that expected for spring wheat in this area. Adequate nitrogen fertility seems to be a key factor allowing wheat to produce enough tillers to produce a normal yield, despite the losses of some tillers from Hessian fly. No yield loss in winter wheat from Hessian fly has been observed.

Control methods for Hessian fly vary depending on the crop (winter vs. spring wheat), farm location, and farm practices required for a given area. Winter wheat generally is less susceptible to fly damage than spring wheat. For fall planted wheat, October 15 and later constitutes a fly-free period because cooler seasonal temperatures after October 15 prevent fly activity. Clean or conventional tillage, dryland winter wheat farming, and rotation to a non-host crop all aid in prevention of Hessian fly. With spring wheat, particularly wheat grown under irrigation, reduced tillage, or both, a granular systemic insecticide may have to be used. The Pacific Northwest Insect Control Handbook reports only one registered material, Thimet R 15G. If the material is needed, then the handbook indicates it should be applied in the seed furrow at planting at a rate of 1.6 ounces per 1,000 feet of row for any row spacing down to a minimum of 8 inches. Do not feed or graze foliage within 45 days of treatment, or make insecticide applications after the treatment at planting time.

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In the midwestern and eastern United States, Hessian fly is controlled mainly by resistant varieties. Unfortunately, no such resistance is available in wheats grown in the Pacific Northwest. However, Washington State University, in collaboration with Hessian fly specialists in Kansas, are working to establish fly resistance in wheats in the Pacific Northwest.

Table 1. Tiller survival on June 20, 1980, and final yield of Twin spring wheat infested by Hessian fly

Surface residue treatment	Nitrogen[2] available at seed depth	Head producing[1] tillers	Living tillers	Fly-killed tillers	Grain yield
		Tillers/m^2	%	%	bu/A
Clean tilled	yes	776	82	10	68
Clean tilled	no	634	90	5	43
Straw mulch	yes	720	80	7	76
Straw mulch	no	507	70	16	21

[1]Main stem of plant included as a tiller.

[2]Nitrogen available at seed depth was banded near the seed at planting. Nitrogen not available at seed depth was broadcast on the surface at planting.

"TWINNING" IN WINTER WHEAT

Betty Klepper, R. W. Rickman, and Curt M. Peterson[1]

INTRODUCTION

The wheat plant produces most of its tillers at crown level, but one tiller is conspicuous because it appears at the level of the seed. This seed tiller is called the coleoptilar tiller. Kernels which produce plants with large seed tillers (Figure 1) appear to have made two plants from one kernel - hence, the name "twinning."

In the field, it is hard to distinguish a seed tiller from a late-emerging independent seedling without digging up the seedling. Two clues can be used to help make this distinction. The seed tiller usually appears relatively early in plant development when the main stem has less than four leaves. It is generally found on the same side of the plant as the second leaf of the main stem. Figure 2 shows both of these features.

METHODS

Several field and growth chamber experiments contributed to reveal the reasons for seed tiller success or failure. Growth chamber experiments reported here showed the major results. Chambers were kept at a constant 18°C with 12-hour light-dark cycles. One experiment compared growth and tiller development from three sizes of whole and halved seeds. The other had three light intensities with varied plant spacing utilizing one intermediate seed size. Regular watering with a complete nutrient solution and deionized water prevented any nutrient or water stress.

RESULTS

The seed tiller does not develop when seedbed conditions have been poor. Nor does it appear on plants produced from small or damaged kernels. Table 1 shows several combinations of kernel conditions along with the percent of the plants which produced a seed tiller. Notice that intact large kernels are most likely to show "twinning."

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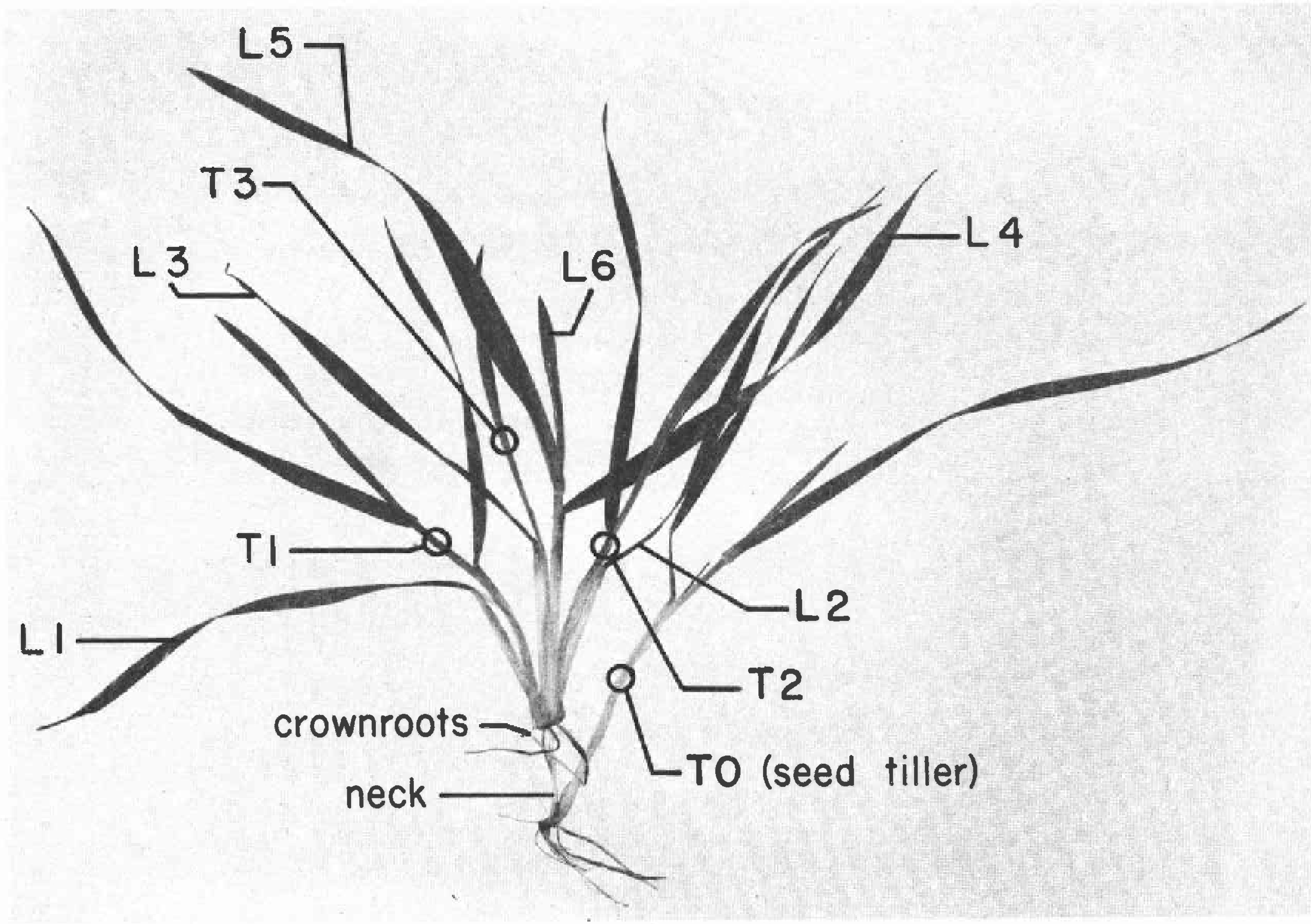
[1]Plant physiologist and soil scientist, Columbia Plateau Conservation Research Center, Pendleton, Oregon 97801; associate professor of botany, Department of Botany, Plant Pathology and Microbiology, Auburn University, Auburn, Alabama 36830. C. M. Peterson was on sabbatical leave from Auburn University and was supported in part by a post doctoral fellowship.


L5
T3
L3
L6
L4
T1
L2
L1
T2
crownroots
T0 (seed tiller)
neck

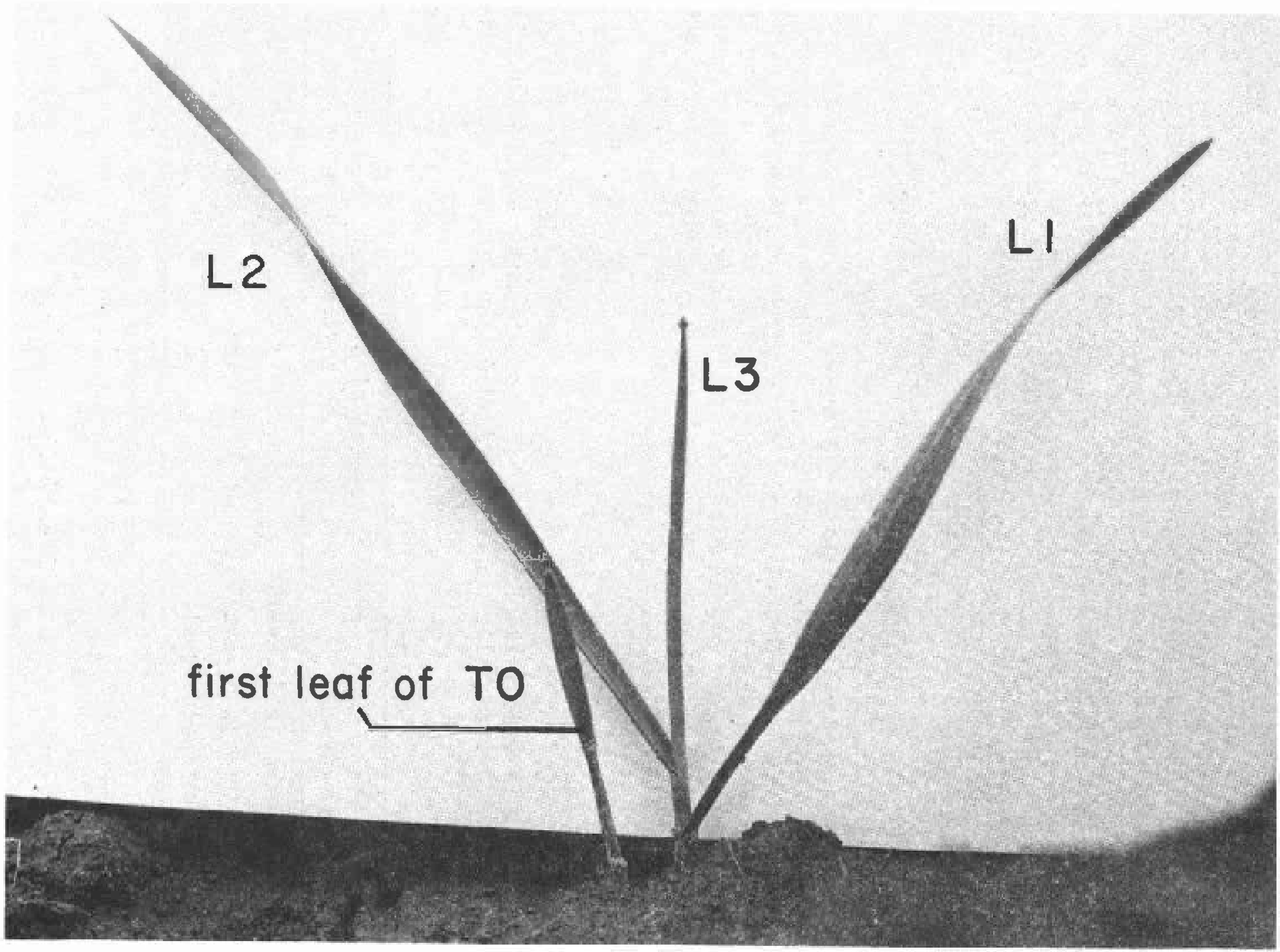

L2
L3
L1
first leaf of TO

Table 1. Effect of kernel size and condition on presence of the seed tiller in a bright growth chamber

Kernel size	Percent of plants with seed tillers	
	Intact seed	Halved seed
Large	88	0
Medium	43	0
Small	25	0

Table 2 shows effects of light and planting density on production of seed tillers. Field conditions at Pendleton in late autumn would correspond to the intermediate light levels (about 300 $\mu E \ M^{-2} S^{-1}$). Uncrowded plants in bright light are most likely to develop these tillers. Field studies have shown a low percentage of plants with seed tillers when exposed to poor seedbed conditions such as compacted subsoils, hot, dry seedbeds, and deep planting.

Table 2. Effects of light levels in a growth chamber on production of seed tillers under uncrowded (one per pot) and crowded (three per pot) conditions

Light level	Percent of plants with seed tillers	
	Uncrowded	Crowded
Bright (twice field level)	73	64
Intermediate (field level)	42	17
Dim (half of field level)	0	0

CONCLUSION

Our studies have not yet shown whether this seed tiller contributes significantly to yield. Since it has a crown set deeper in the soil than the main stem, it may escape frost damage during certain types of winter conditions. What is certain is that the presence of these seed tillers on a significant fraction of seedlings indicates that the seed was sound and that the seedbed was favorable.

17 Year Precipitation Summary
Sherman Station - Moro, Oregon

(Crop year basis, ie; September 1 through August 31 of following year.)

Crop Yr.	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
70 Year Average	.59	.92	1.68	1.67	1.69	1.16	.94	.75	.79	.69	.20	.29	11.37
1963-64	1.63	.50	1.56	1.36	.60	.25	.60	.15	.08	1.30	.04	.18	8.25
1964-65	.16	.60	1.69	6.11	1.65	.16	.63	.72	.32	.59	.17	1.04	13.84
1965-66	.08	.36	2.07	.51	2.45	.54	.78	.06	.02	.13	1.31	0	8.31
1966-67	.47	.74	3.14	1.84	.91	.03	.55	1.47	.39	.32	0	0	9.86
1967-68	.26	.74	.84	.54	.97	1.04	.16	.10	.74	.10	.15	1.52	7.16
1968-69	.33	1.04	2.67	2.09	1.93	.44	.63	.84	.84	1.99	0	0	12.80
1969-70	.52	.76	.53	2.00	3.96	1.27	.88	.38	.33	.22	0	0	10.85
1970-71	.13	.68	2.36	1.21	1.63	.12	1.28	.84	.93	.81	.20	.09	10.28
1971-72	1.36	.45	1.50	1.03	2.25	.26	1.44	.40	.45	1.70	.07	.55	11.46
1972-73	.57	.43	.83	1.62	1.09	.34	.40	.21	.34	.25	0	.07	6.15
1973-74	.90	.85	3.70	3.99	1.29	.97	1.30	1.18	.38	.02	.41	0	14.99
1974-75	0	.37	1.02	1.39	2.01	1.47	1.25	.46	.53	.84	.40	1.26	11.00
1975-76	0	1.17	1.34	1.26	1.25	.93	.95	1.06	.14	.06	.79	1.17	10.12
1976-77	.04	.10	.43	.20	.18	.63	.50	.08	2.70	.28	.37	.90	6.41
1977-78	.88	.22	2.00	3.22	2.80	1.31	.74	1.42	.43	.44	.59	1.32	15.37
1978-79	.33	.01	.79	.69	1.59	1.54	.99	1.06	.28	.10	.07	1.05	8.50
1979-80	.53	2.59	2.23	.65	3.41	1.83	.94	.89	1.27	1.37	.16	.11	15.98
*1980-81	.42	.79	1.73	2.95	1.52	1.22	.65						
16 Year Average	.48	.68	1.69	1.74	1.76	.77	.82	.67	.60	.62	.28	.54	10.65

*Not included in 17 year average figures.

16 Year Precipitation Summary
Pendleton Station - Pendleton, Oregon

(Crop year basis, ie; September 1 through August 31 of following year.)

Crop Yr.	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
52 Year Average	.71	1.37	1.86	2.14	1.94	1.44	1.59	1.48	1.33	1.27	.32	.45	15.92
1964-65	.61	1.24	1.81	4.43	3.84	.47	.21	1.16	1.03	1.37	.75	1.33	18.25
1965-66	.20	.51	2.28	.45	2.35	.71	1.72	.51	.43	.99	1.14	.17	11.46
1966-67	.46	1.10	2.30	2.86	2.80	.32	1.51	1.60	.95	.55	.04	0	14.49
1967-68	.56	1.17	1.30	.76	.74	2.39	1.04	.21	.65	1.11	.34	.77	11.04
1968-69	.83	1.36	2.71	2.65	2.62	.78	.43	2.31	1.26	.75	.06	0	15.76
1969-70	.65	1.41	.44	2.39	5.23	1.50	1.87	1.05	.62	.85	.11	.05	16.17
1970-71	1.02	1.40	2.22	1.02	1.44	.77	1.28	1.65	1.66	3.14	.63	.33	16.56
1971-72	1.42	1.72	3.14	3.93	1.15	1.70	2.11	1.35	1.50	.91	.76	.35	20.04
1972-73	.49	.66	1.14	2.47	.89	.89	1.27	.58	1.03	.12	0	.09	9.63
1973-74	1.77	1.24	5.86	4.40	1.29	2.00	1.50	3.64	.38	.33	1.30	0	23.71
1974-75	.02	.35	1.56	1.76	3.73	1.68	.97	1.72	.68	.69	.05	1.38	14.59
1975-76	0	2.16	1.47	3.40	2.13	1.09	1.69	1.65	1.21	.58	.04	2.58	18.00
1976-77	.44	.53	.47	.59	.90	.57	1.72	.46	1.70	.31	.12	2.21	10.02
1977-78	1.54	.69	1.79	3.19	2.27	1.71	1.40	3.50	.81	1.27	.59	1.37	20.13
1978-79	1.61	0	1.68	2.28	1.31	1.54	1.74	1.82	1.15	.18	.12	2.08	15.51
1979-80	.17	2.56	2.31	1.05	2.85	1.55	2.12	1.20	2.45	1.42	.23	.18	18.09
1980-81	1.24	2.96	1.81	1.99	1.26	2.31	2.30						
16 Year Average	.74	1.13	2.03	2.35	2.22	1.23	1.41	1.53	1.09	.91	.39	.81	15.84