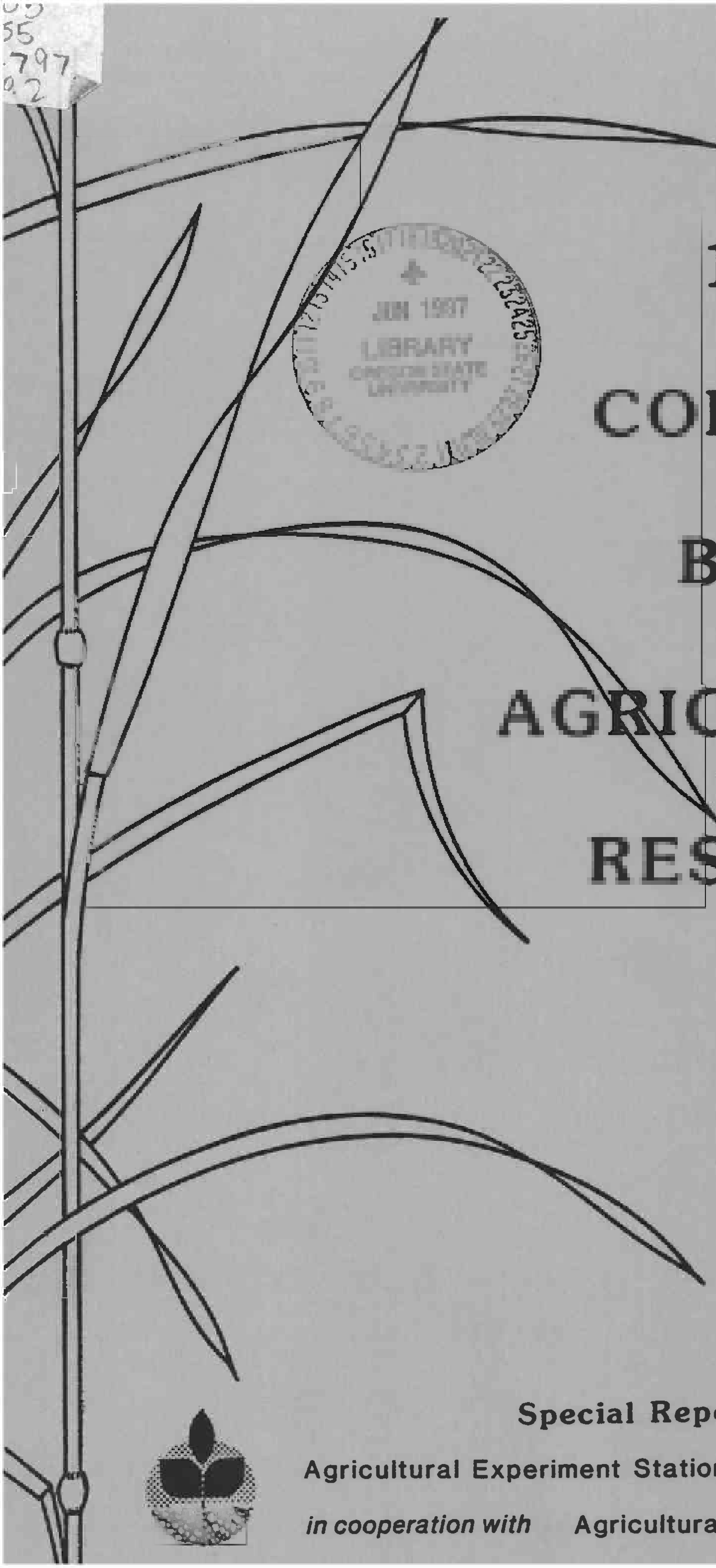
JUN 1987
LIBRARY
OREGON STATE UNIVERSITY



1987 COLUMBIA BASIN AGRICULTURAL RESEARCH

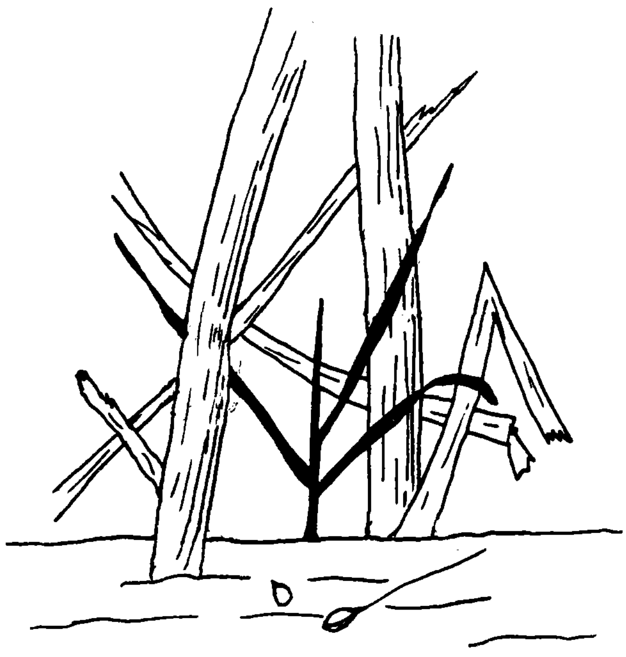
Special Report 797

Agricultural Experiment Station • Oregon State University

in cooperation with Agricultural Research Service • USDA

COLUMBIA BASIN AGRICULTURAL RESEARCH

SPECIAL REPORT 797 JUNE, 1987



Editorial Committee

Clyde Douglas, Jr., chairman

Ron Rickman

Julie Biddle

Acknowledgement is made to Carol Brehaut and Gloria Eidam, for typing, and to Gordon Fischbacher, for graphic preparation.

Contents

DISCLAIMER: These papers report research only. Mention of a specific proprietary product does not constitute a recommendation by the U. S. Department of Agriculture or Oregon State University, and does not imply their approval to the exclusion of other suitable products.

Introduction

The staffs of the Columbia Basin Agricultural Research Center (CBARC-Oregon State University) and the Columbia Plateau Conservation Research Center (USDA-Agricultural Research Service) are again proud to present results of their research in this bulletin. The past year has seen significant changes at the research center, in staffing, new projects undertaken, and facilities improvement. This introduction summarizes most of the exciting challenges and changes that occurred during the past year.

New Projects and Releases

A new soft white winter wheat variety, named "Oveson", was released during 1986. This variety was developed by Chuck Rohde and others, and is given special credit elsewhere in this report. Eight new field trials were established in Union, Umatilla and Sherman Counties by the new plant pathology program. Emphasis of the program is initially focused upon the newly recognized problems with Rhizoctonia root rot and cereal cyst nematode, and upon the continuing losses from strawbreaker foot rot. Several new projects have been initiated by the USDA staff. One of these is being done by John Zuzel to provide Oregon farmers with the ability to use personal computers and historical data from official weather stations to generate dry, average, and wet season scenarios for any given farm location in the wheat-producing areas of the state. A major new thrust in the crop modelling program has come through the U.S. Department of Energy (DOE) who has supported Ron Rickman to lead research into the development of a CO_2-sensitive wheat growth model. This model is expected to be finished in 1992 and can be used by DOE to assess the impacts of changes in global CO_2 levels associated with the use of fossil fuels (coal, oil, gasoline).

Facilities

State-owned facilities continue to suffer from the lack of funding for maintenance and improvement. The only maintenance expenditure at CBARC this year was an emergency allocation of funds for materials needed to repair a rupture in our old water pipes. Improvements included completion of a plant pathology research lab in the USDA building, partial renovation of a greenhouse, and transfer of the USDA library to the basement of the State's Old Office Building. The 1987-1988 fiscal year will bring additional challenges to the OSU programs at CBARC; it will be the first year that salaries will exceed recurring funds. Research grants and product sales will become the only support for all farming operations and the maintenance of facilities, equipment and vehicles, and for some staff salary. Our program of replacing old equipment will continue so that our research programs will be conducted with contemporary equipment. In spite of these fiscal difficulties in State programs, research progress is keen, and staff morale continues to strengthen. The USDA facilities have been improved by the addition of a new storage building behind the existing USDA garage building, by a complete remodelling of the shop building, and by the refurbishing of a large equipment room into four laboratory areas for improved facilities for research into soil physics, plant growth, soil erosion mechanics, and soil microbiology. In addition substantial relandscaping and improvements in land drainage have been performed to improve efficiency of grounds upkeep.

Liaison Committee

The Sherman Station Liaison Committee was formalized during early 1987. It succeeds the Moro Station Advisory Committee which was formed during the mid-1970's. This Committee now complements the structure and function of the communications system established through formation of the Pendleton Station Liaison Committee during 1985. Each of the committees has region-wide representation, and serves to provide guidance in decisions on staffing, programming and facilities and equipment improvement at the Stations. Membership is by appointment by the Director of the Oregon Agricultural Experiment Station and also, at Pendleton, by the Director of the Northwestern Area, USDA-ARS. Larry Coppock (Adams: 503-566-3776) serves as chairman at the Pendleton Station. Paul Alley (Moro: 503-442-5278) serves as interim chairman of the Sherman Station committee, until a continuing chairman is elected in June.

Staff Changes

Julie Biddle, research associate, and Sandy Ott, experimental biology aide, each joined the new plant pathology research program in 1986. Julie is a recent graduate of the doctoral program in seed pathology at Iowa State University, and has experience with legumes and corn. Her expertise considerably broadens the capabilities of this new program. Sandy has worked with many agricultural crops, and brings with her the in-depth training in experimental technique that was acquired during her work at the Hermiston Agricultural Research and Extension Center. Doris Long retired from her position as clerical assistant on September 1, 1986 and Susan Colwell, weed control specialist for the wheat-pea integrated pest management (IPM) program, moved her research activities from Pendleton to Prosser, WA late in 1986. Jeff Rains joined the IPM program in July to serve as general manager of the plot sites. New USDA staff members include Gail Smead (Federal Junior Fellow), who works with Dale Wilkins on the wheat-pea integrated pest management project; Ralph Perry (Machinist), who operates the machine shop on a temporary half-time appointment in lieu of a full-time agricultural engineering position which was abandoned under budget reduction pressures; and Grace Freeman (Clerk-Typist), who replaced Jennifer Fallgren in the office staff.

Promotions and Awards

Kathleen Van Wagoner has been enrolled in graduate courses at Corvallis during the winter and spring, in partial fulfillment of the Master of Science degree in Plant Pathology. The research component of her studies will be at Pendleton. Richard Smiley was appointed the Editor-in-Chief of APS Press, the book publishing division of The American Phytopathological Society. This publishing house, based in St. Paul, MN, releases 5 to 10 new books annually, such as the Compendium of Wheat Diseases, 2nd Ed. (new in May, 1987). Awards for exceptional performance of duties have gone to Sharron Wart (Cash Award) and to Rich Greenwalt and Sue Waldman (Quality Step Salary Increase). Dale Wilkins received a USDA Invention Cash Award for his innovative design of equipment for placement of fertilizer below seed with minimum soil disturbance. Promotions have been made for Clyde Douglas (Soil Scientist), David Steele (Administrative Technician), Julie McClendon (Computer Assistant), and Maralyn Horn (Biological Technician).

Visitors

Distinquished visitors hosted by staff at the Center included John Byrne (President of Oregon State University), George Keller (Vice President for Research and Graduate Studies, OSU), Mike Burke (Acting Dean, College of Agricultural Sciences, OSU), Steve Davis (Acting Director, Oregon Agricultural Experiment Station), Kelvin Koong (Associate Director, OAES), Van Volk and Lloyd Martin (Acting Directors, OAES), Bob Buchanan (Director of the Oregon Department of Agriculture), Bruce Andrews (Deputy Director of the Oregon Department of Agriculture), Mary Carter (Associate Administrator of the Agricultural Research Service, USDA), David Grunes (Soil Scientist, USDA-ARS-Plant, Soil and Nutrition Lab, Ithaca, NY), Fred Crowe (Superintendent, Central Oregon Experiment Station, Redmond), Dick Amerman, Ralph Nave and Jim Elgin (Natonal Program Staff, USDA-ARS, Beltsville, MD). Other visitors included faculty and staff from several OSU programs at Corvallis and at LaGrande, and representatives or administrators of equipment and chemical companies. Visiting scientists from nearby states included Jim Cook, Larry O'Keefe, Lloyd Elliott, John Kraft, Don McCool, Alex Ogg, Gail Lee, Ken Morrison, Alan Busacca, Gaylon Campbell, Tom Hodges, Dave Miller, and John Hammel. Scientists from Australia (Albert Rovira), France (C. Luquet), Canada (Robert Sheard), Peru (Lucrecia Aguirre), and Germany (Maria Finchk and Jorg Schneider) also visited the Centers. We hosted wheat trade teams from Egypt and Japan, and tours of agronomists from the Bureau of Indian Affairs (from northwestern USA reservations), the Adams Ladies Club, and a high school basketball team from Portland.

Seminars

The seminar series at the Center was coordinated by Don Wysocki. Seminars included the following speakers and subjects: Steve Simmons (University of Minnesota; sterile tillers in barley), Ron Rickman (roots and soil fertility), Paul Rasmussen (long-term tillage and fertilization), Bob Ramig (annual cropping practices), Betty Klepper (root growth modelling), Bob Stevens (WSU, Prosser; reforestation of Mt. St. Helens), Mary Coombs (Saturday Academy; the program and our potential role in it), John Zuzel (expert systems), Richard Smiley (Rhizoctonia root rot), Dale Wilkins (paraplowing), Russ Karow (production of hard red wheats), Julie Biddle (Goss's wilt of corn), John Hart (tissue testing in hard red wheat), Lloyd Elliot (USDA-ARS, Pullman, WA; plant root-microbe relationships), Herb Huddleston (use of soils information in land use planning), Alan Busacca (WSU, Pullman; geologic history and soils of the Palouse), Floyd Bolton (climate, yield and nitrogen model for wheat), John Hammel (UI, Moscow; tillage effects of water use by wheat), Gaylon Campbell (WSU, Pullman; wheat growth models), and Albert Rovira (CSIRO, Australia; soilborne pathogens of cereals).

Expressions of Appreciation

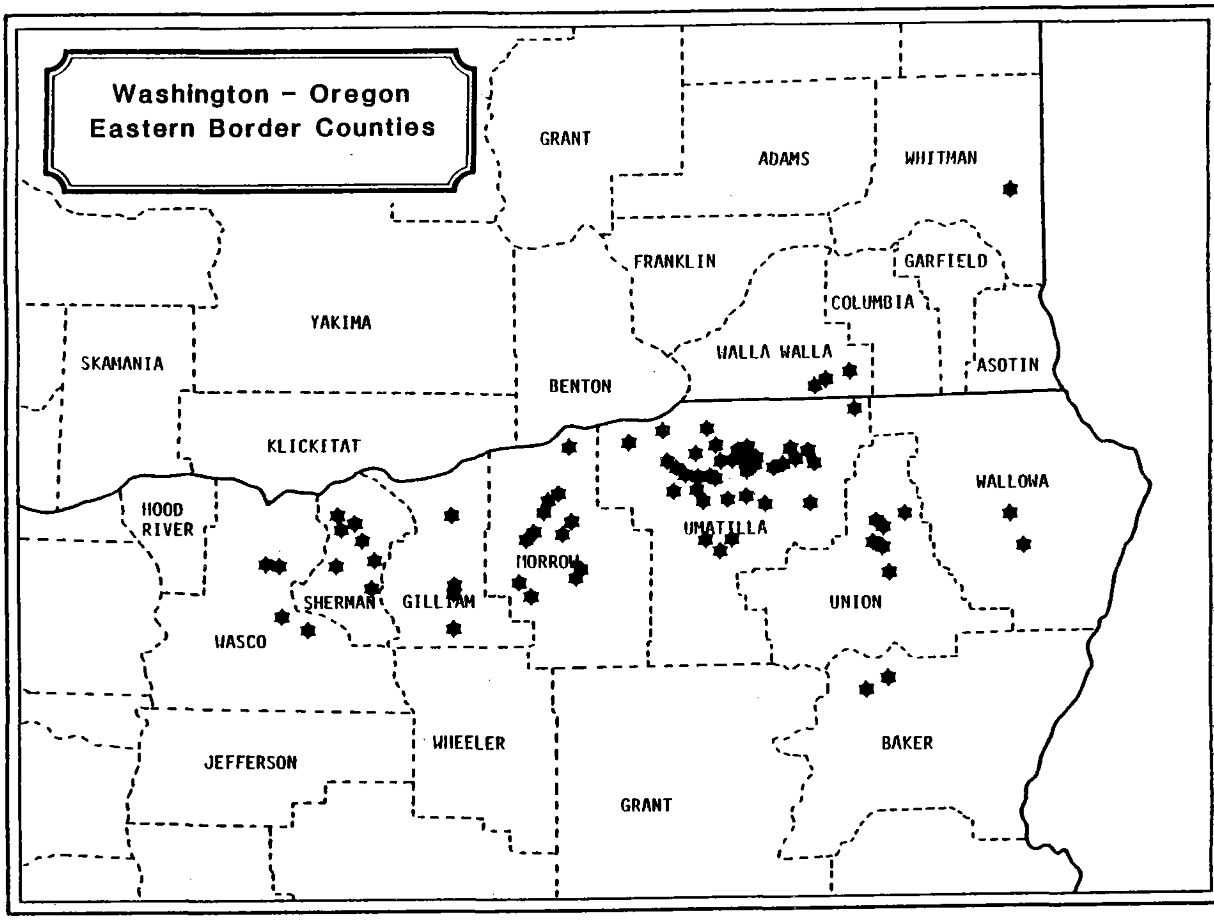
The staff wishes to express their appreciation to individuals, associations, and corporations who have given special assistance for the operation of experimental plot area on or associated with the Center during 1986-1987. The Oregon Wheat Commission continues to provide the critical support upon which many of the Center's projects are founded. Thanks are also given to those who donated funds and/or chemicals (Ciba-Geigy, Dupont, Gustafson, Lesco, Midco Grain Growers, Mallinckrodt, Merck, Mobay, Monsanto, Nor-Am, Ortho, Pendleton

Grain Growers, and Union Carbide), donated seed (Asgrow, Western Plant Breeders, Consolidated Commodities, Perfection, Pendleton Grain Growers, Pureline, Dana Herron and Paul and John Proudfoot), loaned equipment or facilities (Frank Tubbs, Tom Darnell, D & K Foods, and Green Giant), constructed equipment (John Rea), and provided laboratory measurements (US Army Corps of Engineers, Cold Regions Research and Engineering Lab). We also acknowledge those who donated labor, supplies, equipment, or funding for the Pendleton Field Day (Umatilla County Ag Lender's Assoc., Wheatland Insurance, Pendleton Grain Growers, Frank Tubbs, and Larry Coppock) and the Moro Field Day (Monsanto Agr. Products Co., Condon Grain Growers, Midco Grain Growers, Sherman Cooperative Grain Growers, PureGro, Sherman Farm Chemicals, Grass Valley Rebekah Lodge, and Sherman County Schools). Cooperative research plots at the Center are operated by R. E. Allan, Floyd Bolton, Warren Kronstad, Chris Mundt, Ron Welty, and the Soil Conservation Service. We also thank the SCS District Conservationists in Oregon and Washington for their assistance. Additionally, we are very thankful for the ever-present assistance from the Extension Service personnel in all counties of the region, and especially from Umatilla, Union, Sherman, Morrow, Gilliam, Wallowa, and Wasco Counties and from Columbia and Walla Walla Counties in Washington. We also wish to thank the many farmers who have allowed us to work on their property and who have often gone the extra mile by performing field operations, loaning equipment, donating chemicals, and adjusting their practices to accommodate our plots. The locations of these outlying sites are shown on the map that follows.

We truly appreciate the support and encouragement of growers, organizations, and businesses with a mission common to ours; to serve in the best manner possible the crop production needs of the region. We welcome your suggestions on how we may continue to improve our attempts to reach this goal.

Richard Smiley
Superintendent
OSU-CBARC

Betty Klepper
Research Leader
USDA-ARS-CPCRC



Off-Station Research Plot Locations

WALLOWA, OREGON
Stu Coleman
Jim Dawson

BAKER, OREGON
Jim Blatchford
Daryl Leggett

UNION, OREGON
John Cuthbert
Dale Eisiminger
Kent Hug
Shaw-DeLint-Rudd
Don Starr
Larry Starr
Stan Weishaar
Gil Witherspoon

UMATILLA, OREGON
Dutch Clark
Larry Coppock
Bill Etter
Mike Etter
Dean Friedly
Dick Goodwin
Doug Harper
Herm. Agr. Res. Ctr.
Bob Johns
Maury Johns
Harold Kirk
Sheldon Kirk
K. C. Loiland
John Martin
Bob Newtson

UMATILLA, OREGON
Larry Newtson
Al Peters
Clinton Reeder
Leon Reese
Sherman Reese
Larry Rew
Bob Schmidtgall
Carl Schuening
Mack Temple
Gerald Terjeson
Gunder Terjeson
Ralph Terjeson
Glen Thorne
Mike Thorne
Ken Thompson
Stan Timmermann
Frank Tubbs
Alan Wernsing
Dwight Wolfe

MORROW, OREGON
Charlie Anderson
Eric Anderson
Frank Anderson
Montee Crum
Ralph Crum
Tom Martin
Mark Miller
Tad Miller
Chuck Nelson
Don Peterson
Ken Peck
Ken Smouse

MORROW, OREGON
Jim Swanson
Keith Rea

GILLIAM, OREGON
Frank Dyer
Bill Jaeger
Bob Maley
Louis Rucker
Marion Weatherford

SHERMAN, OREGON
Steve Burnet
Larry Kaseberg
Terry Kaseberg
Leroy Martin
Bill Peters
Dave Pinkerton
Sherman Exp. Stn.
Bill Todd

WASCO, OREGON
Bud Hammel
Leland Mayhew
Fred Schrieber
Ted Von Borstel

WHITMAN, WASHINGTON
Harvey Lehmitz

WALLA WALLA, WASHINGTON
James F. Ferrell
Donald Meiners
Pat Meiners

Publications - 1986

The following list consists of publications by personnel of the USDA-ARS, Columbia Plateau Conservation Research Center and Oregon State University Columbia Basin Agricultural Research Center in 1986.

Allmaras, R. R., J. L. Pikul Jr., J. M. Kraft Jr., and D. E. Wilkins. 1986. Measuring incorporated crop-residue and associated soil properties. 1986 Agronomy Abstracts, p. 239.

Belford, R. K., R. W. Rickman, Betty Klepper, and R. R. Allmaras. 1986. Studies of intact shoot-root systems of field-grown winter wheat. I. Sampling techniques. Agronomy Journal 78:757-760.

Grunes, D. L., R. W. Rickman, and B. Klepper. 1986. Future needs to promote efficient growth of, and nutrient and water uptake by, plants. 1986 Agronomy Abstracts, p. 201.

Hyde, G. M., D. E. Wilkins, K. Saxton, J. Hammel, G. Swanson, R. Hermanson, E. Dowding, J. Simpson and C. Peterson. 1986. Reduced tillage seeding equipment development. In Proceedings National STEEP Symposium 20-21 May 1986.

Karow, Russ, and F. Vance Pumphrey. 1986. Growing rapeseed in Oregon's drylands. 4 p. Department of Crop Science Ext/CRS 63, Oregon State University.

Karow, Russ, and F. Vance Pumphrey. 1986. Potentials and problems of rapeseed production in Oregon. 4 p. Department of Crop Science Ext/CRS 64, Oregon State University.

Klepper, Betty. 1986. Long term career goals for women in agriculture. Journal of Agronomic Education 15:29-33.

Klepper, Betty. 1986. Origin, branching and distribution of root systems. pp. 103-125. In (J. V. Lake, D. A. Rose, and P. J. Gregory, eds.) Root Development and Function - Effects of the Physical Environment. Cambridge University Press.

Klepper, Betty, F. V. Pumphrey and T. R. Toll. 1986. Root development in legume plants. pp. 35-36. In 1986 Columbia Basin Agricultural Research, Oregon Agricultural Experiment Station Special Report 776.

Klepper, Betty and Ron W. Rickman. 1986. Concepts for modelling cereal root exploration of soils. 1986 Agronomy Abstracts, p. 16.

McMaster, G., W. Wilhelm, B. Klepper, R. Rickman, and W. Willis. 1986. SHOOTGRO 1.0: Aboveground vegetative development and growth of unstressed wheat. 1986 Agronomy Abstracts, p. 17.

Pikul, J. L. Jr., and R. R. Allmaras. 1986. Physical and chemical properties of a Haploxeroll after 50 years of residue management. Soil Science Society America Journal 50:214-219.

Pikul, J. L. Jr., J. F. Zuzel, and R. N. Greenwalt. 1986. Formation of soil frost as influenced by tillage and residue management. Journal of Soil and Water Conservation 41:196-199.

Porter, J. R., Betty Klepper, and R. K. Belford. 1986. A model (WHTROOT) which synchronizes root growth and development with shoot development for winter wheat. Plant and Soil 92:133-145.

Pumphrey, F. V. 1986. Nitrogen fertilization, soils nitrate, and plant nitrate for irrigated hard red winter wheat. Pacific Division, American Association for the Advancement of Science, Proceedings, Vancouver, B.C. 5:43.

Pumphrey, F. V., M. Kolding, and S. Broich. 1986. Nitrogen management, soil tests, and tissue tests with irrigated hard red winter wheat production. pp. 10-12. In Irrigated Fertilizer Conference Proceedings, Pasco, Washington.

Pumphrey, F. V., and R. E. Ramig. 1986. Pea yield response to high temperatures during blooming and pod filling. pp. 31-34. In 1986 Columbia Basin Agricultural Research, Oregon Agricultural Experiment Station Special Report 776.

Ramig, Robert E. 1986. Fall residue management for water storage. pp. 24-26. In Proceedings of 5th Annual Inland Empire Conservation Tillage Conference, Pullman, WA. Published by Inland Empire Chapter, Soil Conservation Society of America, University of Idaho, Moscow, ID.

Ramig. R. E. 1986. Fallow systems for the semiarid Pacific Northwest. 1986 Agronomy Abstracts, p. 251.

Ramig, Robert E. and L. G. Ekin. 1986. Influence of type and placement of fertilizer on tillering, components of yield, and yield of recropped winter wheat. pp. 43-47. In 1986 Columbia Basin Agricultural Research, Oregon Agricultural Experiment Station Special Report 776.

Rasmussen, Paul E. 1986. Wheat response to fertilizer. pp. 35-36. In Proceedings of Dryland Fertilizer Dealers' Conference, 7 Jan. 1986, Pendleton, OR.

Rasmussen, P. E. and R. R. Allmaras. 1986. Sulfur fertilization effects on winter wheat yield and extractable sulfur in semiarid soils. Agronomy Journal 78:421-425.

Rasmussen, Paul E. and Paul O. Kresge. 1986. Plant response to sulfur in the Western United States. pp. 357-374. In (M. A. Tabatabai, ed.). Sulfur in Agriculture. ASA Monograph, No. 27, American Society Agronomy, Madison, WI.

Rasmussen, P. E., R. W. Rickman, and C. L. Douglas Jr. 1986. Air and soil temperatures during spring burning of standing wheat stubble. Agronomy Journal 78:261-263.

Rasmussen, Paul E. and C. R. Rohde. 1986. Nitrogen fertilization, stubble burning, and benomyl effects on Cercosporella foot rot in winter wheat. 4 pp. In Proceedings 37th Northwest Fertilizer Conference, 7-9 July 1986, Boise, ID.

Rohde, Charles R. 1986. Description of cereal grain varieties commonly grown in northeastern Oregon. pp. 8-15. In 1986 Columbia Basin Agricultural Research, Oregon Agricultural Experiment Station Special Report 776.

Rohde, Charles R. and Kathleen Van Wagoner. 1986. Performance of cereal varieties in northeastern Oregon. pp. 16-19. In 1986 Columbia Basin Agricultural Research, Oregon Agricultural Experiment Station Special Report 776.

Rush, C. M., R. E. Ramig, and J. M. Kraft. 1986. Effects of wheat chaff and tillage on inoculum density of *Pythium ultimum* in the Pacific Northwest. Phytopathology 76:1330-1332.

Smiley, R. W. and M. C. Fowler. 1986. Turfgrass thatch components and decomposition rates in long-term fungicide plots. Agronomy Journal 78:633-636.

Smiley, R. W., M. C. Fowler, and K. L. Reynolds. 1986. Temperature effects on take-all of cereals, caused by *Phialophora graminicola* and *Gaeumannomyces graminis*. Phytopathology 76:923-931.

Smiley, R. W. and D. E. Giblin. 1986. Root cortical death in relation to infection of Kentucky bluegrass by *Phialophora graminicola*. Phytopathology 76:917-922.

Smiley, R. W., P. A. Taylor, R. G. Clarke, and F. C. Greenhalgh. 1986. Simulated soil and plant management effects on root rots of subterranean clover growing in cores of intact soils from pastures. Australian Journal of Agricultural Research 37:633-644.

Snobar, B. A., D. E. Wilkins, A. Hadjichristodoulou, and N. I. Haddad. 1986. Stand establishment in pulse crops. In Proceedings International Food Legume Research Conference, Spokane, WA, 6-11 July 1986.

Wilhelm, W., G. McMaster, R. Rickman, B. Klepper, and W. Willis. 1986. SHOOTGRO 2.0: Aboveground vegetative development and growth of winter wheat with N and water stress. 1986 Agronomy Abstracts, p. 21.

Wilkins, D. E. 1986. Method and apparatus for placement of fertilizer below seed with minimum soil disturbance. U.S. Patent #SN 6-876,047 (patent pending), June 1986.

Wilkins, D. E., E. A. Dowding, G. M. Hyde, C. L. Peterson and G. J. Swanson. 1986. Conservation tillage equipment for seeding. In Proceedings National STEEP Symposium, 20-21 May 1986.

Wilkins, D. E., P. E. Rasmussen and J. M. Kraft. 1986. Effect of paraplowing on winter wheat growth. pp. 40-42. In 1986 Columbia Basin Agricultural Research, Oregon Agricultural Experiment Station Special Report 776.

Wilkins, D. E., P. E. Rasmussen and J. M. Kraft. 1986. Effect of paraplowing on wheat and fresh pea yields. Paper No. 86-1516. American Society of Agricultural Engineers, Chicago, IL, December 1986.

Zuzel, J. F. 1986. Probability distributions of rain on seasonally frozen soils. pp. 237-244. In Proceedings Cold Regions Hydrology Symposium. American Water Resources Association, Fairbanks, AK.

Zuzel, J. F., J. L. Pikul Jr., and R. N. Greenwalt. 1986. Point probability distributions of frozen soil. Journal of Climate and Applied Meteorology 25:1681-1686.

"Oveson"

Charles R. Rohde[1]

The name 'Oveson', OR7996, is given to the soft, white winter wheat W-1980, Hyslop/Yayla//WA4995/3/Cerco, in memory and honor of Merrill M. Oveson.

Mr. Oveson spent his entire professional career as an agronomist and soil scientist in eastern Oregon. He began his career at the Sherman Branch Experiment Station at Moro as a soil scientist and eventually became superintendent. He concluded his career as superintendent of the Columbia Basin Agricultural Research Center at Pendleton. He devoted his energy to solving the soil management and fertility problems of the dryland wheat farmers of eastern Oregon. Mr. Oveson was recognized by the dryland wheat farmers as the leading authority on the culture of wheat in eastern Oregon.

Oveson is a bearded, soft white common type winter wheat cultivar. It is a semi-dwarf, moderately stiff-strawed cultivar with moderate winterhardiness. Oveson is resistant to stripe rust and moderately tolerant to Cephalosporium stripe. This cultivar is well adapted for growing in the higher rainfall areas of eastern Oregon.

---

[1] Professor of agronomy, Columbia Basin Agricultural Research Center, Oregon State University, Pendleton, Oregon 97801.

Description of Cereal Grain Varieties Commonly Grown in Northeastern Oregon

Charles R. Rohde[1]

The selection of a cereal variety depends on the particular problems that commonly occur in the area where the variety is to be grown. For example, if winterkilling is a common problem, the grower should select a variety with a high level of winterhardiness. If Cephalosporium stripe is a disease that occurs frequently, then the grower should select a variety that is most tolerant to this disease. Another factor to consider is the seeding date. Early fall seedings, for example, favor most diseases that occur in northeastern Oregon, therefore, it would be important to choose a variety that is resistant to most of these diseases and be prepared to apply fungicides or insecticides to control those diseases to which the selected variety may be susceptible.

Tables 1 through 4 give summaries of several agronomic and disease reaction characteristics of a number of winter and spring wheat and winter and spring barley varieties adapted for growing in northeastern Oregon.

Table 1. Agronomic and disease reaction characteristics of several soft white winter wheat varieties

Variety	Emergence index[1]	Winter hardiness 1/	Maturity	Test weight 1/	Plant height 2/	Foot rot 3/	Common bunt 3/	Dwarf bunt 3/	Stripe rust 3/	Leaf rust 3/	Cephalosporium stripe 3/
Malcolm	5	3	early	6	SD-M	R	R	S	R	MS	MS
Stephens	5	3	early	6	SD-M	R	R	S	R	MS	S
Dusty	5	5	med-late	8	SD-M	S	R	S	MR	MS	MS
Lewjain	6	6	med-late	8	SD	MR	R	R	R	MS	MR
Daws	4	8	medium	7	SD-M	MS	R	S	MR	MS	MS
Oveson	5	3	med-late	6	M	MR	R	S	MR	MS	MR
Hill 81	5	5	medium	7	M	S	R	S	MR	MR	MR
CLUB VARIETIES											
Crew	6	6	medium	6	SD-M	S	R	S	MR	MR	MS
Tres	6	5	medium	7	M	MS	MR	S	MR	MR	MS
Tyee	5	5	medium	5	SD-M	MR	MR	S	MS	S	MS

1/ 1 = poor, 10 = excellent

2/ SD = semidwarf, M = medium

3/ R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible

---

[1] Professor of agronomy, Oregon State University, Columbia Basin Agricultural Research Center, Pendleton, Oregon 97801.

Table 2. Agronomic and disease reaction characteristics of several spring wheat varieties

Variety	Maturity	Test weight1/	Plant height2/	Stripe rust3/	Leaf rust3/
		SOFT WHITE			
Twin	med-late	4	SD-M	R	S
WS-1	medium	5	SD-M	R	S
Penawawa	medium	5	SD	MR	R
Dirkwin	medium	3	SD-M	R	S
Crestone	medium	4	SD-M	R	S
Owens	medium	8	SD-M	R	S
Waverly	med-late	5	SD-M	MR	R-MR
Edwall	medium	4	SD-M	MR	R
		HARD RED			
Wared	med-late	5	M	MR	MR
Borah	early	8	SD	MR	MR
McKay	medium	8	SD-M	R	R
Wampum	medium	5	M	R	R

1/ 1 = poor, 10 = excellent

2/ SD = semidwarf, M = medium

3/ R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible

Table 3. Agronomic characteristics of several winter barley varieties

Variety	Winter hardiness1/	Maturity	Test weight1/	Plant height	Barley scald2/
Mal	5	medium	5	med-short	MS
Hesk	6	medium	5	med-short	MS
Scio	5	medium	6	med-short	MR
Steptoe	4	med-early	6	tall	MR
Kamiak	5	early	8	medium	MR
Wintermalt	6	early	7	med-short	MR
Hudson	5	early	9	medium	MR
Ersin	6	med-early	8	medium	MS
Showin	5	med-early	4	short	MR
Boyer	4	medium	5	med-short	MS

1/ 1 = poor, 10 = excellent

2/ MS = moderately susceptible, MR = moderately resistant

Table 4. Agronomic characteristics of several spring barley varieties

Variety	Maturity	Test weight[1]	Plant height	Quality[2]
Steptoe	medium	5	med-tall	F
Lindy	medium	5	med-tall	F
Gem	early	6	med-tall	F
Flynn 37	early	3	medium	F
Klages	med-late	8	tall	M
Andre	med-late	8	med-tall	M
Micah	med-late	4	short	F
Advance	med-early	7	med-tall	M or F

1/ 1 = poor, 10 = excellent

2/ F = feed, M = malting

A brief description of varieties commonly grown in northeastern Oregon follows.

WINTER WHEAT

Stephens

Stephens is a bearded, white-chaffed, semi-dwarf wheat released by Oregon State University (OSU) in 1977. Heads are distinctly coarse in appearance with beards that tend to flare. Stephens has only a minimal level of winter-hardiness and is susceptible to Cephalosporium stripe. This variety is resistant to stripe rust and has some resistance to leaf rust. Stephens has very wide adaptation and yields well in low rainfall areas, high rainfall areas, and under irrigation.

Oveson

Oveson is a bearded, white chaffed, medium height variety released by OSU in 1986. Its winterhardiness is similar to that of Stephens. Oveson is resistant to stripe rust and possesses greater tolerance to Cephalosporium stripe than does Stephens. This variety is best adapted to the higher rainfall areas of eastern Oregon. Limited quantities of foundation seed are available from the Foundation Seed Project at OSU.

Malcolm

Malcolm is a bearded, white chaffed, semi-dwarf wheat released by OSU in 1985. Its winterhardiness is similar to that of Stephens. Malcolm is resistant to stripe rust. It has heads slightly less coarse than Stephens, however, it produces slightly more tillers than does Stephens. Malcolm has wide adaptation, similar to that of Stephens. Limited quantities of foundation seed are available from the Foundation Seed Project at OSU.

Hill 81

Hill 81 is a bearded, white-chaffed medium height variety released by OSU in 1981. It is more winterhardy than Stephens and is recommended for those areas where the winterhardiness of Stephens has not been adequate. Hill 81 is more tolerant to Cephalosporium stripe than Stephens, therefore, it is recommended in those areas where this disease is a problem.

Lewjain

Lewjain is a bearded, white-chaffed, semi-dwarf variety released by Washington State University (WSU) in 1982. It is a late season variety with very good winterhardiness. This variety is resistant to dwarf bunt, tolerant to Cephalosporium stripe, and is recommended especially in those areas where dwarf bunt is a problem. In most areas its yield potential is not equal to that of Stephens.

Daws

Daws is a bearded, white-chaffed, semi-dwarf variety released by WSU in 1976. This variety is very winterhardy and is recommended in areas where winterkilling commonly occurs. Emergence is only adequate, therefore, it is not recommended where it is necessary to seed deep to get the seed into moist soil.

Dusty

Dusty is a bearded, white-chaffed, semi-dwarf variety released by WSU in 1985. This variety has good winterhardiness, is later in maturity than Stephens, but has yielded well at many locations in northeastern Oregon.

Crew

Crew is a multiline club variety released by WSU in 1983. This variety was developed to lessen the vulnerability of the region's club wheat to stripe rust. It is made up of 10 separate lines, each of which possesses different genetic resistance to stripe rust. Crew is mid-season in maturity, has a mixture of brown and white chaff colors, and exhibits irregular plant height. Yield potential of Crew in traditional club wheat areas is good.

Tyee

Tyee is a beardless, semi-dwarf, white-chaffed club variety released by WSU in 1979. It is taller than Faro but has good resistance to lodging. Tyee is moderately susceptible to stripe rust so a grower must watch the variety closely and be prepared to apply a fungicide when stripe rust begins to appear. In the absence of stripe rust, Tyee yields quite well.

Tres

Tres is a beardless, semi-dwarf, white-chaffed club variety released by WSU in 1984. Its name means three, signifying its resistance to three foliar diseases - stripe and leaf rust, and powdery mildew. Tres is one of the 10 components of Crew. It appears to have a similar yield potential to Crew, but has none of the heterogeneities found in Crew.

SPRING WHEAT

Dirkwin

Dirkwin is a beardless, white-chaffed, soft white, semi-dwarf variety released by the University of Idaho (U of I) in 1978. It is a very widely adapted variety, yielding well under both droughty and high-producing conditions. The test weight of Dirkwin tends to be somewhat low. This variety is resistant to stripe rust, but is susceptible to leaf rust.

Twin

Twin is a beardless, white-chaffed, soft white, semi-dwarf variety released by the U of I in 1971. It is very similar to Dirkwin in plant height, test weight, heading date, and resistance to stripe rust. This variety is also susceptible to leaf rust.

Waverly

Waverly is a bearded, semi-dwarf, white-chaffed, soft white variety released by Washington State University (WSU) in 1981. This variety is moderately resistant to stripe rust and leaf rust. Its test weight is superior to that of Dirkwin, however, it usually does not yield as high as Dirkwin.

Owens

Owens is a bearded, semi-dwarf, white-chaffed, soft white variety released by the U of I in 1981. It is resistant to stripe rust and moderately resistant to leaf rust. The test weight of Owens is significantly higher than Dirkwin, however, it usually does not yield as high as Dirkwin.

WS-1

WS-1 is a bearded, semi-dwarf, white-chaffed, soft white variety released by World Seeds, Inc. in 1972. This variety is resistant to stripe rust and to leaf rust. The test weight of WS-1 is heavier than that of Dirkwin.

Edwall

Edwall is a bearded, semi-dwarf, white-chaffed, soft white variety released by WSU in 1984. This variety is moderately resistant to stripe rust and resistant to leaf rust. The test weight of Edwall is heavier than that of Dirkwin. In most tests it has not yielded as high as Dirkwin.

Penawawa

Penawawa is a bearded, semi-dwarf, white-chaffed, soft white variety released by WSU in 1985. This variety is moderately resistant to stripe rust and resistant to leaf rust. The test weight of Penawawa is heavier than that of Dirkwin.

Crestone

Crestone is a beardless, white-chaffed, soft white variety released by Colorado State University (CSU). It is slightly shorter in height than Dirkwin, but similar to Dirkwin in test weight, heading date, and resistance to stripe and leaf rust.

Borah

Borah is a bearded, semi-dwarf, white-chaffed, hard red variety released by the U of I in 1974. It is moderately resistant to stripe rust and resistant to leaf rust. The test weight of its grain is quite high and the protein content of its grain is usually higher than other hard red spring varieties adapted in northeastern Oregon. It is early maturing and yields well in most areas of northeastern Oregon.

Wared

Wared is a bearded, semi-dwarf, white-chaffed, hard red variety released by WSU in 1974. It is moderately resistant to both stripe and leaf rust. The test weight of Wared is high. Wared appears to be best adapted to lower yielding areas of northeastern Oregon.

Wampum

Wampum is a bearded, mid-tall, white-chaffed, hard red variety released by WSU in 1978. This variety is resistant to stripe rust and moderately resistant to leaf rust. It is best adapted to the higher yielding areas of northeastern Oregon. Wampum has a special quality of being able to grow as a seedling when soil temperatures are quite low.

McKay

McKay is a bearded, semi-dwarf, white-chaffed, hard red variety released by the U of I in 1981. This variety is resistant to both stripe and leaf rust. The test weight of its grain is usually very high.

WINTER BARLEY

Hesk

Hesk is a 6-row, feed barley variety released by OSU in 1980. It is medium in height, medium to mid-late in maturity, resistant to lodging, and has adequate test weight. Hesk has fairly good winterhardiness. This variety is well adapted for growing in the higher yielding areas of northeastern Oregon.

Mal

Mal is a 6-row, feed barley variety released by OSU in 1980. This variety is medium late in maturity, mid-height, with good resistance to lodging. It is fairly winterhardy and produces grain with adequate test weight. Mal is well adapted in Union, Wallowa, and Baker counties, and is especially well suited for the flood irrigated areas of Malheur county.

Scio

Scio is a 6-row, feed barley variety released by OSU in 1981. It is medium short, midseason in maturity, and has fairly good winterhardiness. This variety is very stiff-strawed and well adapted to high rainfall and irrigated areas.

Kamiak

Kamiak is a 6-row, feed barley variety released by WSU in 1971. This variety is early maturing, has good winterhardiness, produces grain with high test weight, and is best adapted in the lower rainfall areas of northeastern Oregon.

Hudson

Hudson is a 6-row, feed barley variety released by Cornell University, New York, in 1951. This variety is early maturing, produces grain with high test weight, has good winterhardiness, but is moderately susceptible to lodging. It is best adapted in the lower rainfall areas of northeastern Oregon.

Boyer

Boyer is a 6-row, feed barley variety released by WSU in 1975. It is medium in height, medium to mid-late in maturity, resistant to lodging, and has fairly good winterhardiness. The test weight of its grain is adequate. This variety is best adapted to the higher rainfall areas of northeastern Oregon.

Wintermalt

Wintermalt is a 6-row, malting variety developed at Cornell University. It is medium in height, early in maturity, with only fair lodging resistance. This variety has good winterhardiness and produces grain that has a fairly high test weight. To produce grain suitable for malting purposes, it should be grown in areas that have a high probability of producing large plump kernels.

Showin

Showin is a 6-row, feed barley variety released by WSU in 1984. It is quite short and resists lodging. This variety has a very prostrate growth habit providing excellent ground cover until jointing stage. The winter-hardiness of Showin is nearly equal to that of Kamiak.

Klages

Klages is a 2-row, malting barley variety released by the U of I in 1972. This variety produces grain with a high test weight, and its height is mid-tall, but it is quite resistant to lodging. It is best adapted to irrigation or the higher rainfall areas of northeastern Oregon. The malting quality of Klages is excellent.

Kimberly

Kimberly is a 2-row, malting barley variety released by the U of I in 1977. Grain test weight is high and malting quality is very good. This variety is mid-tall, and medium in maturity, being slightly earlier than Klages. It is best adapted for irrigated areas or areas of higher rainfall.

Morex

Morex is a 6-row, malting barley variety released by North Dakota State University about 1978. This variety is mid-tall in height and mid-season in maturity. Its straw has only adequate resistance to lodging. The test weight of its grain is fairly high, however, it shatters from the head rather easily and should be harvested as soon as it is ripe. The variety has excellent malting quality, and is best adapted in the higher rainfall areas of northeastern Oregon.

Performance of Cereal Varieties in Northeastern Oregon

Charles R. Rohde and Kathleen Van Wagoner[1]

The selection of the best cereal variety to grow depends on the adaptability of the variety to the area in which it is to be grown. To determine the adaptability of different varieties, they are tested in areas which represent climatic and soil types that occur in northeastern Oregon. Summaries of the yield data obtained from these tests are presented in Tables 1 through 8.

Table 1. Summary of yield data of winter wheat varieties tested in the lower yielding areas of northeastern Oregon, 1982-86

Variety	Moro	Arlington	Condon[1/]	Lexington	Heppner	Pilot Rock	Echo[2/]	Average
	bu/A							
Malcolm[3/]	55.2	39.8	34.6	52.7	46.4	43.4	47.0	45.6
Stephens	54.9	40.6	30.8	54.9	46.5	44.9	44.6	45.3
Dusty[4/]	56.4	37.2	32.7	50.3	43.0	44.5	42.3	43.8
Lewjain[1/]	49.0	39.3	29.6	50.4	38.9	46.9	38.5	41.8
Daws	53.1	39.6	28.8	49.0	40.2	40.2	39.9	41.5
Oveson	49.5	35.7	26.7	50.3	39.6	43.3	42.1	41.0
Hill 81	51.4	38.9	28.0	48.6	38.8	40.7	40.6	41.0
CLUB VARIETIES								
Crew	51.2	40.6	29.0	49.3	39.5	43.2	43.8	42.4
Tres[3/]	51.1	40.8	26.6	49.3	37.1	40.3	42.5	41.1
Tyee	53.4	37.9	26.5	46.4	40.0	41.0	39.5	40.7

[1/] No tests in 1985
[2/] No test in 1986
[3/] Not tested in 1982
[4/] Not tested in 1982 and 1983

[1] Professor and research assistant, Oregon State University, Columbia Basin Agricultural Research Center, Pendleton, Oregon 97801.

Table 2. Summary of yield data of winter wheat varieties tested in the higher yielding areas of northeastern Oregon, 1982-86

Variety	Pendleton	Holdman	Weston	LaGrande	Summerville[1]	Flora[1]	Average
	bu/A						
Malcolm[2]	83.8	57.0	102.3	79.0	74.9	47.0	74.0
Oveson	85.3	55.7	96.1	76.8	73.5	42.1	71.6
Dusty[3]	87.8	52.6	102.6	74.8	68.8	42.3	71.5
Stephens	84.4	54.9	97.9	73.2	71.0	44.6	71.0
Hill 81	85.0	52.2	93.8	79.8	74.0	40.6	70.9
Daws	80.0	53.2	90.5	77.1	69.3	39.9	68.3
Lewjain[2]	76.7	53.8	89.8	69.9	65.3	38.5	65.7
CLUB VARIETIES							
Tyee[4]	82.9	61.4	94.8	76.2	62.9	49.2	71.2
Crew	81.5	57.7	95.5	75.0	61.3	52.6	70.6
Tres[5]	82.3	52.6	96.6	83.4	55.0	48.9	69.8

[1] No tests in 1985
[2] Not tested in 1982
[3] Not tested in 1982 and 1983
[4] Not tested in 1984
[5] Not tested in 1982 and 1984

Table 3. Summary of yield data of spring wheat varieties tested in the lower yielding areas of northeastern Oregon, 1982-86

Variety	Moro	Echo[1]	Lexington	Heppner[2]	Arlington	Condon[3]	Average
	bu/A						
Twin	38.2	25.2	39.6	38.9	28.9	22.3	30.8
Crestone[4]	38.1	23.3	38.7	----	28.3	18.8	29.4
Dirkwin	36.0	23.8	36.9	40.3	28.0	21.7	29.3
Waverly[5]	34.9	25.0	33.2	----	25.6	19.2	27.6
Edwall[4]	35.9	23.0	33.2	----	26.5	19.0	27.5
Owens	34.3	22.2	32.0	31.5	27.5	20.3	27.3
HARD RED VARIETIES							
Wared	34.5	27.7	35.3	32.5	26.0	20.9	28.9
Borah	34.8	21.5	33.6	38.6	26.5	21.4	27.6
McKay	35.9	20.6	30.4	34.1	23.9	19.5	26.1
Wampum	30.6	22.1	30.5	34.9	23.8	22.6	25.9

[1] No tests in 1984 and 1985
[2] Tested in 1982 only
[3] No test in 1985
[4] Not tested in 1982 and 1983
[5] Not tested in 1982

Table 4. Summary yield data of spring wheat varieties tested in the higher yielding areas of northeastern Oregon, 1982-86

Variety	Pendleton	Weston[1/]	Holdman-Helix[2/]	Imbler-LaGrande	Joseph[3/]	Baker[4/]	Average
	bu/A						
Twin	43.3	55.3	29.5	59.3	67.2	21.6	50.9
WS-1[6/]	48.5	62.7	31.8	61.4	49.3	13.7	50.7
Penawawa[5/]	42.3	60.5	24.8	59.3	65.7	29.0	50.5
Dirkwin	43.1	55.1	31.2	57.8	63.6	11.1	50.2
Crestone	44.2	56.0	29.9	61.1	59.2	25.7	50.1
Owens	40.7	58.0	30.0	59.2	59.2	25.1	49.4
Waverly[6/]	38.8	53.2	31.2	57.4	60.0	34.2	48.1
Edwall[5/]	39.3	55.6	28.8	54.8	60.9	27.6	47.9
HARD RED VARIETIES							
Wampum	38.1	51.6	28.4	54.5	66.4	34.3	47.8
Borah	42.8	51.2	29.1	50.5	60.7	36.8	46.9
McKay	38.0	52.3	27.8	51.8	51.3	25.8	44.2
Wared	35.5	48.2	26.8	44.4	54.8	----	41.9

1/No tests in 1983 and 1984
2/No test in 1982
3/No test in 1984
4/Tested in 1986 only
5/Tested in 1985 and 1986 only
6/Not tested in 1982

Table 5. Summary of yield data of winter barley varieties tested in lower yielding areas of northeastern Oregon, 1982-86

Variety	Moro	Arlington[1/]	Condon[2/]	Lexington	Heppner	Pilot Rock	Echo[3/]	Average
	lbs/A							
Scio	3360	2638	1642	3502	2739	3076	3089	3341
Hesk	3334	2685	1608	3574	2736	2947	3006	3315
Mal[4/]	3301	2383	1819	3614	2700	2812	3048	3280
Kamiak[5/]	2967	2551	1802	3222	2697	3312	2911	3244
Steptoe[6/]	2761	2666	1584	3228	2627	2884	2878	3105
Wintermalt	2500	2641	1589	3285	2711	2937	2936	3100
Ersin[7/]	3050	2407	1552	3237	2452	2667	2956	3054
Hudson[8/]	2595	2477	1345	3104	2623	2420	2772	2889

1/No test in 1984
2/No tests in 1982 and 1985
3/No test in 1986
4/Not tested in 1983 and 1985
5/Not tested in 1984 and 1985
6/Not tested in 1983
7/Not tested in 1985
8/Not tested in 1983, 1984, and 1985

Table 6. Summary of yield data of winter barley varieties tested in the higher yielding areas of northeastern Oregon, 1982-86

Variety	Pendleton	Holdman	Weston	LaGrande	Summerville	Flora	Average
	-----	-----	-----	lbs/A	-----	-----	-----
Scio	5539	4052	5789	5172	4828	2981	4727
Mal	5252	3981	5759	5250	4370	2833	4574
Hesk	5417	4057	5521	5010	4224	2350	4430
Ersin	5215	3759	5253	4957	3967	2537	4281
Boyer	5371	3485	5170	4887	3890	2591	4232
Kamiak	4959	3831	4572	4132	3610	3195	4050
Wintermalt	4862	3282	4682	4253	3729	3055	3977
Steptoe	4879	3897	4695	3920	3360	2739	3915

Table 7. Summary of yield data of spring barley varieties tested in the lower yielding areas of northeastern Oregon, 1982-86

Variety	Moro	Echo[1/]	Lexington	Heppner[1/]	Arlington	Condon[2/]	Average
	-----	-----	-----	lbs/A	-----	-----	-----
Lindy[3/]	2554	1972	3143	1915	2370	1881	2306
Steptoe	2590	1937	3068	2130	2255	1721	2284
Gem	2306	1519	2920	1872	2147	1631	2066
Flynn37[4/]	2256	1570	2882	1690	2233	1464	2016

[1/] No tests in 1984 and 1985
[2/] No test in 1985
[3/] Not tested in 1982 and 1983
[4/] Not tested in 1982

Table 8. Summary of yield data of spring barley varieties tested in the higher yielding areas of northeastern Oregon, 1982-86

Variety	Pendleton	Weston[1/]	Holdman-Helix	Imbler-LaGrande	Joseph[1/]	Baker[2/]	Average
	-----	-----	-----	lbs/A	-----	-----	-----
Steptoe	4267	4205	2177	4634	5336	4732	4225
Lindy[3/]	4608	4189	1966	4717	5470	3664	4102
Klages	3909	3776	1985	3907	4692	4760	3838
Andre[4/]	4011	3469	2203	3646	4701	4384	3736
Micah[4/]	3518	3340	1550	4112	5269	4334	3687
Advance	3811	3404	1960	4096	5102	3711	3681

[1/] No test in 1984
[2/] Tested only in 1982 and 1986
[3/] Tested only in 1985 and 1986
[4/] Not tested in 1982

Cereal Varietal Development: Pendleton, 1986

S. L. Broich, P. M. Hayes, M. Verhoeven, C. S. Love, A. E. Corey,

N. Scott, M. D. Moore, R. Knight and W. E. Kronstad[1]

INTRODUCTION

The goal of the Oregon State University Cereals Breeding Programs is the development of high yielding, disease-resistant winter wheat and spring wheat and barley varieties adapted to the wide range of climatic conditions found in Oregon. The OSU Cereals Project maintains major experimental sites at three locations: Hyslop Farm in the Willamette Valley, Sherman Branch Experiment Station near Moro, and Barnett-Rugg Ranch east of Pendleton. The purpose of this report is to describe the results of yield trials and breeding research observed on the Barnett-Rugg Ranch near Pendleton, Oregon, during the 1985-86 crop year.

MATERIALS AND METHODS

Breeding nurseries were planted on land following fresh cannery green peas. Soil tests were used to determine fertilizer requirements and fall applications of anhydrous ammonia and Nitrosol were made at rates equivalent to 75 lbs. of nitrogen and 15 lbs. sulfur per acre. No additional spring fertilizer applications were made. Spring applied herbicides included Bromoxynil (1 pint/a) and Dicamba (2 ozs./a).

The meterological station at the Columbia Basin Agricultural Research Center, about 5 miles west of this site, reported a total precipitation of 17.76 inches for the 1985-86 crop year which is very close to the 19 year average of 17.14 inches.

Although there were traces of leaf rust in some plots, in general, diseases were not a problem during this crop year.

A total of 15.6 acres of experimental trials were planted this crop year on the Barnett-Rugg site (Table 1); this is an increase of 2.8 acres over the 1984-85 crop year. More than one-half (ca. 58%) of the acreage was planted to segregating populations which included 1650 F5 and 5700 F3 plant rows. From these populations 340 bulks were cut and advanced into preliminary yield trials and heads were pulled and advanced into 1100 F4 populations. The remaining 6.6 (42% of the field) acres were planted to yield trials; results from these trials are discussed below by market class.

[1]Research associate, assistant professor, instructor, research assistant, senior research assistant, senior instructor, research assistant, senior research assistant and professor, Crop Science Department, Oregon State University, Corvallis, Oregon 97331.

Table 1. Acreage covered by various components of the OSU cereal breeding program at Pendleton during the 1985-86 crop year

	Total Acreage	Percentage of yield trials	Percentage of total field
Yield trials			
Soft white winter	2.4	36.8	
Hard red winter	1.3	19.2	
Winter barley	0.4	5.5	
International	1.1	16.9	
Spring grains	0.8	11.6	
Special studies	0.7	10.0	
Yield trial total	6.6	100.0	42.1
Segregating populations	9.0		57.9
Total acreage	15.6		100.0

Table 2. Mean yields for selected lines from the 1986 soft white winte wheat elite yield trial grown at Pendleton, Oregon

Selection	1986 yield	Long-term yield at Pendleton	Years tested
	bu/A		
Stephens	101.3	92.5	13
Hill 81	102.7	94.1	13
Dusty	85.0	83.5	2
Malcolm	96.5	89.2	10
Tres	84.7	84.7	1
OR CW 8314	97.5	96.2	8
OR CW 8519	98.7	100.0	5
OR CW 8521	109.5	98.6	5
OR CW 8522	117.5	109.1	5
OR CW 8625	91.8	97.3	4
OR CW 8626	94.7	97.6	4
OR CW 8627	103.5	104.3	4
OR CW 8628	97.8	97.8	4
OR CW 8629	106.3	105.4	4
OR CW 8630	101.0	102.2	4
OR CW 8631	98.4	103.2	4
OR CW 8632	106.1	106.9	4
OR CW 8633	92.7	97.7	4
OR CW 8634	97.3	102.3	4
OR CW 8635	98.4	101.3	4
OR CW 8637	101.6	98.2	4
Means	99.2	98.2	
lsd .05	10.8		

RESULTS AND DISCUSSION

Soft White Winter Wheat (SWW)

A little over one-third (36.8%) of the yield trial acreage was planted to soft white winter wheats. This included a series of four separate yield trials containing 308 selections. Results from the Soft White Winter Wheat Elite Yield Trial are presented in Table 2. The 1986 yields of 'Stephens' and 'Hill 81' were 101.3 and 102.7 bu/a, respectively; the overall mean of the trial was 99.2 bu/a. The long-term average in our trials near Pendleton is 98.2 bu/a. A number of the newer selections have achieved equal or higher yields, both in the 1986 harvest and over a longer period of time. These data indicate that there are several very promising SWW selections in the advanced stages of yield testing.

Hard Red Winter Wheat (HRW)

Almost 20% of the yield trial acreage was planted to Hard Red Winter Wheat. There were also four separate HRW yield trials containing a total of 197 breeding selections. Results of the Hard Red Winter Wheat Elite Yield Trial are presented in Table 3. Yields of 'Wanser', 'Hatton', and 'Bantum' were 70.4, 63.0 and 83.7 bu/a, respectively, as compared to 'Stephens' at 100.6 bu/a in this trial. Data in Table 3 show that there are a number of unreleased HRW selections with yield potentials equal to 'Stephens' SWW wheat. Equally important, data in Table 3 show that, even with rather modest fertilization rates, most selections achieved grain protein contents of 12.0% or better during this crop year. Grain samples of these selections are now undergoing complete milling and baking tests at the Western Wheat Quality Laboratory in Pullman, Washington. We are confident that the quality characteristics of several of these selections will prove to be comparable to 'Wanser' and 'Hatton'.

Table 3. Mean yields and percent grain protein content for selected lines from the 1986 hard red elite yield trial grown at Pendleton, Oregon

Selection	1986 grain protein	Crop yield	Long-term yield at Pendleton	Years tested
	%	bu/A	bu/A	
Wanser	10.9	70.4	50.0	9
Stephens	11.9	100.6	93.3	13
Centura	11.4	65.3	60.3	3
Hatton	11.5	63.0	58.5	6
Bantum	12.0	83.7	83.7	1
OR CR 8313	12.2	100.7	89.6	8
OR CR 8414	12.8	101.2	85.2	6
TSN-B2	12.0	102.9	93.0	3
OR CR 8511	13.0	89.7	92.0	5
OR CR 8512	10.6	101.6	87.6	5
OR CR 8601	12.8	96.2	98.7	5
OR CR 8602	12.2	103.7	113.2	4
OR CR 8603	12.2	103.9	104.8	4
OR CR 8604	12.5	97.2	102.0	4
OR CR 8608	12.2	101.9	104.5	4
Means	12.0	92.1	87.8	
lsd .05		10.3		

Spring Wheat Trials

With increasing interest in spring sown grains the Cereals project has initiated yield testing of both Hard Red Spring (HRS) and Durum wheats in the Pendleton area. This year, 11.6% of the acreage at the Burnett-Rugg site was planted to spring wheats (Table 4).

The Spring Hard Red Elite Yield Trial, consisting of check varieties and selections obtained through our international cooperation with CIMMYT in Mexico, has been grown at Pendleton for the past two years. Seven of the 11 lines advanced over these two years have out-performed 'McKay', 'Westbred 906R', and 'Borah'. One, ORS 8508, shows promising HRS quality. A Hard White Spring (HWS) selection, ORS 8413, also shows good bread baking characteristics and has outyielded 'McKay' by 6% over this two-year period.

The Western Regional Durum Nursery has also been grown at Pendleton for two years. During this time, two of our selections, also originating from the CIMMYT program in Mexico, have yielded 103% of the check variety, 'Modoc' (Table 5).

Table 4. Yields of hard red spring wheat lines harvested at Pendleton in 1986

Variety or selection	1986 yield	Two-year yield average at Pendleton
	- - - bu/A - - -	
McKay	64.3	57.4
Shasta	63.7	59.0
Borah	63.4	57.3
NK000751	50.8	51.2
Westbred 906	57.7	54.4
Wampum	61.7	57.3
ORS 8508	64.6	57.8
ORS 8509	69.0	61.8
ORS 8510	62.3	56.3
ORS 8511	71.3	62.2
ORS 8512	67.2	58.1
ORS 8514	67.6	58.4
ORS 8518	68.5	59.9
ORS 8519	56.3	52.9
ORS 8520	62.9	54.7
ORS 8415	60.2	57.8
ORS 8417	65.0	54.3
ORS 8418	67.9	59.5
ORS 8422	62.8	56.1
ORS 8425	60.1	55.7
ORS 8413	72.3	60.7
ORS 8416	64.3	55.6
Means	63.8	57.2
lsd 0.5	8.7	

Table 5. Yields of spring sown Durum wheat lines grown at Pendleton in 1986

Variety or selection	1986 yield	Two-year yield average at Pendleton
	- - - - bu/A - - - -	
Modoc	60.1	53.5
Irradur	58.8	49.6
Wald	59.8	51.8
Lloyd	57.7	50.8
Durox	59.4	52.3
Signadur	49.8	46.0
WPB 881-4	57.2	49.8
D0072209	56.7	51.7
CM979-126M OH	55.5	51.0
CD 22344-8M OH	61.4	54.8
CD 24831-E3Y OH	63.5	54.9
T8300136	56.6	51.9
T8300135	55.4	49.7
T8300140	61.8	51.8
T8300147	60.4	55.5
T8300175	55.8	48.7
T8300179	53.5	47.3
Means	57.8	51.2
lsd 0.5	9.1	

Winter Barley

Two winter barley nurseries - the Winter Barley Quality Trial (WBQT) and the Winter Barley Elite Line Trial (WBELT) - were grown at Pendleton in 1986; these trials occupied about 5 percent of the total yield trial acreage. Yields in the WBQT ranged from 4109 to 6250 lbs/acre. ORWM 8407 is consistently the highest yielding entry (Table 6), and this line has the best malting quality of any 6-row winter barley that we have evaluated. ORWM 8412, although somewhat low in extract, has a quality profile similar to 'Klages'. This promising 2-row selection is not as high yielding as ORWM 8406, a consistently high performing 2-row with high enzyme activity but low extract. Overall, the yields of malting quality and feed lines are comparable (Tables 6 and 7).

Yields in the WBELT ranged from 3965 to 5917 lbs/acre. For both 1986 and the three-year average, yields of feed barley lines shown in Table 7 meet or exceed those of 'Kamiak', 'Boyer', 'Scio', and 'Hesk'. 'Hesk' yielded 4290 lbs/acre in the 1986 WBELT. We are continuing our evaluation of these selected winter malting and feed barley lines in both local and regional trials.

Table 6. Yields of selected winter barley malting quality lines grown at Pendleton in 1986

Line	Type	Yield 1986	Yield 3 year ave.
		lbs/A	lbs/A
Scio	6-row	5024	5382
Wintermalt	6-row	4532	4486
ORWM 8406	2-row	5231	5031
ORWM 8407	6-row	6250	5567
ORWM 8412	2-row	4542	4291
ORWM 8417	6-row	5200	4428

Table 7. Yields of selected winter feed lines grown at Pendleton in 1986

Line	Type	Yield 1986	Yield 3 year ave.
		lbs/A	lbs/A
Kamiak	6-row	3972	4040
Boyer	6-row	4937	4727
ORWF 8410	6-row	5583	5737
ORWF 8411	6-row	5917	5431
ORWF 8413	6-row	4887	4793
ORWM 8411	2-row	5769	5919

International Nurseries

About 17% of the total yield trial acreage was planted to winter wheat selections derived from the International Spring X Winter Wheat Crossing Program and developed at Oregon State under contract with U.S.A.I.D. Five nurseries were grown: two International Yield Trials, the 14th International Winter Wheat Screening Nursery and preliminary yield trials for Soft Red Winter wheats and Hard White Winter wheats. A total of about 410 selections were evaluated in these trials. While many of these selections are of market classes not now appropriate for release in the Pacific Northwest, they provide a source of genetic material for the project crossing blocks. Ultimately, the valuable genes identified in these selections find their way into new SWW and HRW cultivars that can be released for production in Oregon.

Special Studies

Ten percent of the yield trial acreage was planted to special studies; this included thesis research plots for three students.

Ms. Judy Holmer-Habernicht, an M.S. student, conducted an experiment to investigate the relationships among harvest index, nitrogen harvest index, and grain protein content in a genetically diverse collection of 25 winter wheat cultivars originating from North America and Europe. She also investigated the use of hill plots for research on these traits. It is hoped that understanding nitrogen allocation within winter wheat plants will aid in development higher yielding, high grain protein HRW wheat cultivars.

Mr. Noor-Ul-Islam Kahn, a Ph.D. student, explored alternative experimental analyses for data from field trials grown on sites with heterogeneous soils. This research was conducted to develop more efficient and effective ways of analyzing both yield trials and special studies to determine the breeding potential of a given line and to make selection decisions within the breeding program.

Mr. Ruben Verges, an M.S. student, conducted a study to compare the yield stability of F1 hybrid winter wheat lines, the parents of these F1 hybrids, and composites of each pair of parents. In the event that commercial F1 hybrid wheat varieties become available, results from this study should aid the producer in making the decision between growing traditional inbred wheat lines or to shift to F1 hybrids.

The Cereals Breeding Program wishes to acknowledge Quinten Rugg and his people and Dr. Richard Smiley and the staff of the Columbia Basin Agricultural Research Center for their excellent cooperation.

Relation Between Seedling Vigor and Yield of Peas

D. E. Wilkins and J. M. Kraft[1]

Uniform maturation is important in pea (Pisum sativum L.) production because both pea quality and yield are dependent on pea size and tenderness (Mansour et al., 1984). Consumer demand is for small tender peas (sieve size range of 9/32 to 5/16 inches and 95 to 100 tenderometer). To maximize yield of small tender peas within a field, plants must mature uniformly. Poor seedbeds, weeds, insects, and diseases may stress peas sufficiently to cause nonuniform maturation (Pumphrey et al., 1979, and Mansour et al., 1984).

Field emergence and early development of pea plants are typically nonuniform because of poor seed-soil contact, marginal soil water, low soil temperature, weak seed and soilborne diseases. Some plants get off to a poor start and often appear stunted. A critical concern is how much do these stunted and less vigorous plants contribute to fresh pea yield? Do these plants overcome their poor start and mature at the same time as the stronger more vigorous plants? This research was conducted to evaluate the effect of low seedling vigor on plant growth.

MATERIALS AND METHODS

Peas (variety OSU-605 treated with Captan and Lindane and had a 90% germination test) were seeded in rows 7 inches apart on May 1, 1986, at 200 lbs/A in an Athena silt-loam soil in northeast Oregon. Thirty days after planting, 82 consecutive plants in two adjacent rows were categorized as healthy or weak. Weak plants were defined as plants that were less than 1/4 the size of a normal plant. Twenty of the 164 plants were classified as weak and 144 as healthy. The weak plants were tagged so that they could be identified at harvest. Plants were harvested on July 1, 1986, and plant height, pods per plant, peas per plant, pea dry weight, and plant dry weight (peas not included) were measured. From the same field, 20 plants classified as weak were destructively sampled on May 15, 1986, and examined for presence of hollow heart. Hollow heart is a physiological disorder of the seed. It is characterized by a cavity in the cotyledons during seedling development. Seeds with hollow heart are highly susceptible to rot. Isolations were not made to determine the specific diseases present in the cotyledons.

RESULTS AND DISCUSSION

Table 1 shows the results of the plant characteristics measured at harvest. The weak plants never caught up to the plants that had good early vigor. The vigorous plants were over twice as tall, had 4 times as many pods, 6 times as many peas, 14 times the weight of peas, and 4 times as much plant material on a dry weight basis as the weak plants.

---

[1] Agricultural engineer, USDA-ARS, Columbia Plateau Conservation Research Center, Pendleton, OR 97801; and plant pathologist, USDA-ARS, Irrigated Agricultural Research and Extension Center, Prosser, WA 99350.

Table 1. Plant characteristics at harvest from weak and vigorous seedlings

Plant characteristics	Vigorous plants-		Weak plants-	
	mean	std. dev.	mean	std. dev.
Plant height - inches	12.4	1.46	5.5	3.60
Pods per plant	2.5	0.66	0.6	0.75
Number of peas per plant	9.6	3.60	1.5	1.80
Pea dry weight per plant-grams	0.9	0.39	0.1	0.11
Plant dry weight[1/] per plant-grams	2.4	0.85	0.6	0.55

[1/] Peas not included in plant dry weight.

Plants from the same field as those reported in Table 1 were destructively sampled when they were in the seedling stage. Of these plants, more than 95 percent of those in the weak category had hollow heart and disease-infected cotyledons. Hollow heart, a soilborne disease, poor seedbed, weak seed, and combinations of these may have caused the plants to be small. Whatever the cause, small seedlings remained small throughout the growing season and contributed very little toward yield. For uniform maturation and maximum yield of fresh peas, seedlings should be healthy and vigorous.

REFERENCES

1. Mansour, N. S., W. Anderson, and T. J. Darnell. 1984. Producing processing peas in the Pacific Northwest. PNW Publication 243. 12 pp.

2. Pumphrey, F. V., R. E. Ramig, and R. R. Allmaras. 1979. Field response of peas (Pisum sativum L.) to precipitation and excess heat. Journal of the American Society of Horticultural Science 104(4):548-550.

Winter Wheat Response to Lime in a Wheat-Pea Rotation

Paul E. Rasmussen and D. E. Wilkins[1]

INTRODUCTION

Soils in the Pacific Northwest are gradually being acidified by the use of ammonium-based nitrogen fertilizer. In annual precipitation zones above 16 inches, nitrogen fertilization over the last 30 years has lowered the soil pH below 6.0. When the pH drops below 5.5, crop yield, especially that of legumes, may be substantially reduced. In 1984, more than 45% of the soils in northern Idaho had a soil pH less than 5.6, and crops are responding to lime application (Mahler and McDole, 1984; 1985).

The soil pH in southeastern Washington and northeastern Oregon is not as low as in northern Idaho, but it is approaching 5.5 in many soils. To investigate acidity effects in this area, winter wheat response to lime was determined in 1986 at two of the three Integrated Pest Management sites for wheat/pea production (Wilkins et al., 1985). Lime response by peas in the wheat pea rotation will be measured in 1987.

MATERIALS AND METHODS

The experimental design was a 2 x 2 factorial with 4 replications, and included 2 rates of lime (0 and 1.5 tons/acre) and 2 rates of nitrogen (0 and 100 lbs N/acre). Ag-lime (-100 mesh) was applied at both locations in August 1985. 'Hill 81' winter wheat was seeded on October 10, 1985 at 90 lbs seed/acre. Nitrogen was applied as ammonium nitrate-sulfate on February 27, 1986.

Soil pH was determined before lime application and at seeding in a 1:2 soil/water solution. Vegetative growth, water use, straw production, and grain yield were determined.

RESULTS AND DISCUSSION

Surface soil (0-8 inches) at both sites had a pH near 5.8. Liming increased the pH at both sites to above 6.3 (Table 1). Lime addition did not increase grain yield, alter straw production, or affect water use (Table 2). There were no visual differences between limed and unlimed plots throughout the growing season. The results agree with those of Mahler and McDole (1984), who found that wheat yield was not reduced until the pH dropped below 5.3.

---

[1] Soil scientist and agricultural engineer, USDA-ARS, Columbia Plateau Conservation Research Center, Pendleton, Oregon, 97801.

Table 1. Effect of liming on soil pH at two locations

Soil depth	Ferrel		Meiners	
	unlimed	limed	unlimed	limed
(inches)	pH[1/]			
0-4	5.9	7.1	5.7	6.4
4-8	5.8	6.3	5.7	5.9
8-12	6.8	6.8	6.3	6.3
12-24	7.2	7.2	6.7	6.7

1/ Measured in a 1:2 soil/water ratio.

Nitrogen fertilization increased grain yield at both sites (Table 2). Grain yield in the absence of N application was quite high, 80 bu/acre, reflecting either substantial N fixation by peas or residual N from previous years. The nitrogen response suggests that less than 100 lbs N/acre was needed for maximum yield. The amount of straw produced per bushel of grain was somewhat less than normal (85-90 lbs. vs. the norm of 100), primarily because of high grain yield.

Table 2. Effects of lime and nitrogen on grain yield, straw production, and water use of winter wheat

Lime applied	Nitrogen applied	Grain yield	Straw production	Water use[1/]
(tons/acre)	(lbs/acre)	(bu/acre)	(lbs/bu of grain)	(inches)
		Ferrel Site		
0	0	78 b[2/]	75 b	19.4 b
1.5	0	80 b	72 b	19.4 b
0	100	99 a	89 a	21.0 a
1.5	100	96 a	86 a	21.3 a
		Meiners Site		
0	0	82 b	76 c	19.4 b
1.5	0	80 b	73 c	19.2 b
0	100	89 a	87 a	20.7 a
1.5	100	87 a	83 b	20.6 a

1/ Water use = stored soil water depletion plus precipitation from March 1, 1986, to July 31, 1986.

2/ Means within a column for each site followed by the same letter are not statistically different at a probability of P = 0.05 by Duncans MRT.

REFERENCES

1. Mahler, R. L. and R. E. McDole. 1984. Cereal and pulse crop responses to lime application in northern Idaho. p 133-138. Proceedings 35th Northwest Fertilizer Conference, Northwest Plant Food Association, Portland, OR.

2. Mahler, R. L. and R. E. McDole. 1985. The influence of lime and phosphorus on crop production in northern Idaho. Communications in Soil Science Plant Analysis 16:485-499.

3. Wilkins, D. E., L. L. Baarstad, and J. M. Kraft. 1985. Integrated pest management research for pea production. p 50-54. Special Report 738, Oregon State University Agricultural Experiment Station, Corvallis.

Fallow Systems for Semiarid Eastern Oregon and Washington

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

Water conservation is most important for plant production in dryland agriculture. The main approaches to water conservation are a) uniform distribution of snow over the land area, b) infiltration of precipitation or snowmelt into the soil where it occurs, c) sufficient soil depth of silt loam or finer texture to store the water, and d) reduction of evaporation losses after the water is stored in the soil.

Seldom in dry farmed regions of eastern Oregon and Washington is precipitation sufficient or adequately distributed during the growing season for economical crop production. It is usually necessary to have stored soil water available to supplement the limited growing season rainfall. Land is usually fallowed to store water, control weeds, and allow mineralization of organic matter and release of available nitrogen. Today we control weeds with herbicides and apply needed fertilizers as commercial fertilizer; so the main function of fallow is water conservation. Fallow land is kept free of weeds with herbicides, tillage, or both. Good water conservation results in increased crop yield, stability of production, and water use efficiency.

OBJECTIVES

The objectives of this research were to determine: 1) the effect of fall tillage in a wheat-fallow cropping sequence on water conservation and storage, 2) the value of tillage herbicides on weed control and amount of tillage required for fallow, and 3) possible erosion control on highly erodible lands.

METHODS

The research was conducted on Ritzville silt loam soil on the Leon Reese farm, 12 miles west of Pendleton, Oregon. Ritzville silt loam occurs on 1.5 million acres in eastern Oregon and Washington (See Figure 1). Average annual precipitation varies from 9 to 12 inches, and the soil is found from 750 to 2250 feet above sea level. Ritzville silt loam holds about 10.5 inches of available water per six foot of soil depth.

Six combinations of tillage, tillage-aid herbicide for fallow (Table 1), and three rates of nitrogen fertilization were studied in a split plot experimental design with three replications for five years. The six tillage-herbicide combinations for fallow were:

---

[1] Soil scientist and agricultural research technician, USDA-ARS, Columbia Plateau Conservation Research Center, Pendleton, Oregon, 97801.

Table 1. Six combinations of tillage and herbicide treatments used in a fallow-wheat sequence and number of secondary tillage operations required to keep the fallow free of weeds

Primary tillage for fallow (type)	(ave. date)	Tillage aid herbicide[1/]	Number of secondary tillages on[2/]	Herbicide applied on wheat crop[3/]
1) Moldboard plow[4/]	March 28	- -	4 to 5	- -
2) Chisel[5/]	Sept. 28	Roundup	0 to 1	- -
3) Disk[6/]	Sept. 28	Roundup	0 to 1	- -
4) Sweeprod[7/]	May 17	Roundup	0 to 1	Sencor or Lexone
5) Sweeprod[7/]	March 28	- -	4 to 5	Sencor or Lexone
6) Sweeprod[7/]	May 17	Roundup	0 to 1	- -

[1/] Applied at 16 oz/acre in 20 gpa of water on an average date of March 15; [2/] Spring tooth, field cultivate, or rodweed; [3/] Applied at 0.3 lb. (ai) per acre by March 1; [4/] Plowing depth was 6 to 7 inches; [5/] Chisel depth was 14 to 15 inches, chisels spaced 24 inches; [6/] Disking depth was 4 to 5 inches; [7/] Sweep tilled to depth of 4 to 5 inches; rodweeder attachment on rear shanks of sweep operated at depth of 3 to 4 inches.

1) Moldboard plow standing wheat stubble in March to a depth of six to seven inches to bury all residues and weed growth; spring tooth and rodweed as necessary four to five times to keep free of subsequent summer weed growth; 2) Chisel wheat stubble in September after harvest to a depth of 14 to 15 inches with a chisel spacing of 24 inches. Spray with Roundup in March to kill all weed growth. Sweeprod to a depth of 4 to 5 inches in mid May to kill all summer weed species that had emerged after spraying with Roundup in March, and to break capillary continuity with the moist subsoil layers; 3) Disk wheat stubble in September after harvest to a depth of four to five inches. Spray with Roundup in March to kill all weed growth. Sweeprod in mid-May to a depth of four to five inches to kill all summer weed species that had emerged after the spraying with Roundup in March, and to break capillary continuity with the moist subsoil layers; 4) Spray wheat stubble with Roundup in March to kill all weed growth. Sweeprod to a depth of four to five inches in mid May to kill all summer weed species that had emerged after spraying with Roundup in March, and to break capillary continuity with the moist subsoil layers. Spray seeded wheat with Sencor or Lexone in spring of crop year to selectively control downy brome in the growing wheat crop; 5) Sweeprod wheat stubble to a depth of four to five inches in March to kill weeds. Field cultivate and rodweed as necessary (four to five times) to keep fallow free of summer weed growth. Spray

seeded wheat with Sencor or Lexone in spring of crop year to selectively control downy brome in the growing wheat crop; 6) Spray wheat stubble with Roundup in March to kill all weed growth. Sweeprod to a depth of four to five inches in mid May to kill all summer weed species that had emerged after spraying with Roundup in March, and to break capillary continuity with the moist subsoil layers.

Spraying with Roundup in March killed all weed growth before seed set and delayed tillage until mid May after summer weed species had emerged. The topsoil was drier so there was less danger of soil compaction and greater success of weed kill when tilling the drier soil. Tillage treatment 1 required several secondary tillages to firm the plowed soil and kill weeds that had not been buried. Tillage treatment 5 required several secondary tillages to kill weeds that continued growth after the moist soil was sweeprod tilled in March. Tillage treatments 4 and 5 were sprayed with Sencor or Lexone in March, after wheat had been seeded in the fallow the previous October, to selectively control any downy bromegrass that had not been controlled by the Roundup spray in Tillage 4 or the early cultivation in Tillage 5.

Tillage treatments were major plots and were 40 by 120 feet. Three rates of nitrogen fertilizer (25, 50, and 75 pounds per acre) were the subplots and were 40 by 40 feet. Fertilizer was broadcast, as dry ammonium nitrate, on the soil surface the day before seeding the wheat in mid-October.

Wheat was seeded with a John Deere HZ split presswheel deep furrow drill with row spacing of 16 inches. Seeding rate was 60 pounds per acre. Hyslop soft white winter wheat was grown two years; Fielder soft white spring wheat the third year after Hyslop winter killed 30 to 40 percent on the plowed fallow treatment. Stephens soft white winter wheat was grown the last two years.

Broadleaf weeds in the wheat crop were controlled by spraying with a mixture of 24-D Amine and Banvel D in late March or early April.

Precipitation was measured with a standard U.S. Weather Bureau rain gauge at the plot site. During freezing weather, the funnel and catch cylinder were removed, and the large outer can partially filled with an ethylene glycol mixture to melt falling snow and prevent freezing. A thin layer of light mineral oil was placed in the rain gauge can or cylinder to prevent evaporation. Changes in glycol solution volume were measured volumetrically and converted to inches of precipitation.

Soil water was measured by neutron moderation. Neutron gauge access tubes were placed in each plot to bedrock at 6 to 9 feet. Measurements were made after wheat harvest, near March 1 the following spring, near November 1 after the wheat had been seeded, near March 1 in the wheat crop year, and again after wheat harvest. Extensions of the access tubes were removed and the tubes capped at the one-foot depth before tillage for fallow. The extensions were replaced after the wheat had been seeded in October and approximately 0.3 to 0.5-inch precipitation had firmed the loose topsoil. This prevented burial of emerged wheat plants with loose, dry topsoil while the tube extensions were replaced.

RESULTS AND DISCUSSION

Water Storage:

The average precipitation for the 19-month fallow season from wheat harvest until February 28 of the crop year for the five years of this study was 18.0 inches. The percentage of fallow season precipitation that was stored is presented in Table 2. Differences in water storage among the six fallow systems were not significant. Water storage for the 19-month period was lowest in the fall chiseled or fall disked treatment in every one of the five years (data not presented). Greatest water storage occurred once in five years in the fall chiseled treatment because runoff water from the frozen soil surface ran into the chisel grooves and infiltrated the soil from the non-frozen lower chisel grooves. This has been observed only once in 10 years in Oregon, but could occur more frequently at higher elevations and/or northern latitudes in Washington where the soil is frozen more often and for longer periods than at this site in Oregon. In the other four years, greatest water storage for the 19-month fallow season occurred where wheat stubble remained standing overwinter and was plowed (one year) or sprayed with Roundup in March and sweeprod tilled in mid-May (data not presented.)

Table 2. Percentage precipitation stored during the fallow season, wheat[1/] yield, test weight per bushel, and crude protein content of the wheat crop, as affected by fallow system

Fallow system	Fallow season precipitation stored (%)	Yield (bu/A)	Test weight (lbs/bu)	Crude protein (%)
1) Spring plowed	34	45 ab[4/]	59.6 b	11.0 a
2) Fall chiseled + spring Roundup + spring sweeprod	33	43 b	60.1 a	10.3 b
3) Fall disked + spring Roundup + spring sweeprod	31	41 b	59.7 b	11.0 a
4) Spring Roundup + spring sweeprod + Sencor on wheat	33	47 a	60.1 a	10.8 a
5) Spring sweeprod + Sencor on wheat	33	43 b	59.6 b	10.3 b
6) Spring Roundup + spring sweeprod	34	43 b	59.7 b	10.9 a

[1/] Numbers in table are 5-year averages; [2/] Fallow season is from harvest in July to Feb. 28, 19 months later; [3/] Crude protein on 14% grain moisture basis; [4/] Figures in a column followed by the same letter or letters are not significantly different at the 5% level of probability according to the Duncan Multiple Range Test.

Yields:

Average yields, test weights per bushel, and crude protein percentage of the grain, averaged for the three nitrogen rates over the five years, are also presented in Table 2. Differences between nitrogen rates were not significant. Growing season (March 1 to harvest in July) precipitation for the five years ranged from 1.85 inches to 5.35 inches and averaged 3.68 inches; nearly the same as the 30-year average for the April-July period of 3.64 inches. Highest yields occurred where the wheat stubble remained standing overwinter and was sprayed with Roundup in March, sweeprod tilled in mid-May and the wheat crops sprayed with Sencor or Lexone to selectively control downy bromegrass in the wheat crop. Second highest yield occurred where the stubble was spring plowed. Lowest yield was on the fall disked wheat stubble. This treatment had no standing stubble to trap snow or slow evaporative winds at the soil surface during the winter. Yields of the remaining fallow treatments were intermediate to those above.

Observations revealed that spring-applied Roundup killed all emerged vegetation. However, some downy bromegrass seed on the soil surface failed to germinate during the winter even though it was wet. Consequently, it was not killed by the Roundup spray. Sweeprod tillage in mid-May incorporated the viable seed in the soil, and it emerged with the seeded wheat the following winter. Application of Sencor or Lexone in early March selectively controlled the downy bromegrass in the wheat crop, reducing weed competition for water and nutrients (Treatment 4) with resultant higher yield than where no Sencor or Lexone was used (Treatment 6). Treatment 5 (no Roundup) required one to five secondary tillage operations to kill downy bromegrass in the fallow. Sufficient plants survived the tillage operations when the soil was moist, to produce viable seed. These also emerged with the seeded wheat crop. The downy bromegrass population was so great, application of Sencor or Lexone failed to give adequate weed control, and yield of wheat was reduced.

Test weights per bushel were highest when competition for water from downy bromegrass was lowest (Treatments 2 and 4). Crude protein percentage averaged highest where stubble was plowed and organic matter mineralized (Treatment 1), or where water stress reduced yield and test weight (Treatment 3); or where weed competition caused water stress and lower yield and test weight (Treatment 6).

Water use:

Data are presented for three years only (Table 3). Data for the drought year 1977 were omitted because only 2.8 inches of water had been stored by fallowing and the wheat averaged 16 bushels per acre. Similarly, data for 1979, when the winter-killed wheat was reseeded to spring wheat, were also omitted because the spring wheat yielded 23 bushels per acre; much less than winter wheat that survived. Average water storage for all six fallow systems was 6.6 inches in the 6-foot soil profile (data not presented). The winter wheat crops removed from 6.2 to 6.7 inches or all the stored water from the soil profile (Table 3). Differences in water removed or used by the wheat crops grown on the different methods of fallow were not significant.

Table 3. Fallow system effect on water use, wheat yield, and water use[1/] efficiency

Fallow system	Soil water removed from six-foot soil profile,	Total water used,	Yield	WUE
	- - - - - - - (in)	- - - - - - -	(bu/A)	(bu/A/in)
1) Spring plowed	6.6	10.9	60	5.5
2) Fall chiseled + spring Roundup + spring sweeprod	6.6	10.9	60	5.5
3) Fall disked + spring Roundup + spring sweeprod	6.2	10.5	57	5.4
4) Spring Roundup + spring sweeprod + Sencor on wheat	6.6	10.9	65	6.0
5) Spring sweeprod + Sencor on wheat	6.4	10.7	58	5.4
6) Spring Roundup + spring sweeprod	6.7	11.0	59	5.4

[1/] Values are 3-year averages. Excludes years when drought limited yields and when spring wheat was replanted; [2/] Soil water plus growing season precipitation of 4.3 inches; [3/] WUE is water use efficiency in bushels of wheat per acre per inch of water used.

Table 4. Estimated plant residues left on the soil surface immediately following seeding in fallow prepared by six fallow systems

Fallow system	Estimated percentage of[1/] plant residues on surface after seeding wheat
1) Spring plowed	< 5
2) Fall chiseled + spring Roundup + spring sweeprod	15-30
3) Fall disked + spring Roundup + spring sweeprod	10-15
4) Spring Roundup + spring sweeprod + Sencor on wheat	30-40
5) Spring sweeprod + Sencor on wheat	10-15
6) Spring Roundup + spring sweeprod	30-40

[1/] Seeded with John Deere HZ deep furrow drill with 16-inch row spacing.

inches. Division of the three-year average yield of wheat by the three-year average total water use gives the water use efficiency (WUE) in bushels of wheat per acre produced by one inch of water. WUE ranged from 5.4 to 6.0 bushels per acre per inch. Water use efficiencies for winter wheat in the drought in 1977 ranged from 3.0 to 3.9 and for spring wheat in 1979 from 2.2 to 2.5 bushels per acre per inch of water.

Residues:

Crop residue mulches enhance water conservation, when compared to bare soil, by maintaining water infiltration and slowing evaporation when soils are wet. High infiltration reduces runoff and soil erosion. Visual estimates of the percentage of plant residues remaining on the surface of the seeded fallow as influenced by the fallow system are presented in Table 4. Little residue remained on the surface of the seeded fallow where the fallow was moldboard plowed. Greatest amounts of residues remained on the surface of the seeded fallow where the wheat stubble remained standing over winter, was sprayed with Roundup to control the weeds, tilled once with a sweeprod, and seeded. Fall tillage of wheat stubble (chisel or disk) and spring sweep tillage without use of herbicide to kill the weeds were intermediate in estimated percentage of plant residues left on the surface of the seeded fallow.

CONCLUSIONS

1. In the semiarid (<12 inches precipitation) areas of eastern Oregon and Washington, fall chiseled or fall disked wheat stubble land stored less water in a fallow-wheat sequence than where the wheat stubble remained standing over winter.

2. Fall chiseled stubble land stored the most water in one cold winter when rain and snowmelt from the frozen topsoil entered the chisel grooves and infiltrated the soil at the non-frozen lower chisel grooves.

3. Mulch till fallow required fewest inputs, conserved the most water, produced highest yield and water use efficiency, and left most residues on the soil surface after seeding to enhance water infiltration and reduce wind and water erosion.

4. In mulch till fallow, wheat stubble is left standing over winter to trap snow and insulate the soil surface from freezing and evaporation of water. One spray application of Roundup in early March kills all vegetation. A single sweeprod tillage in mid-May results in reduced soil compaction, kills postspray emerged summer weeds, interrupts capillary water loss from the soil, and leaves 60 to 70 percent of the residues on the surface. In 70 percent of the years, no further tillage is needed. If rains of >0.30 inch occur, a rodweeding is required. Wheat can be seeded with band placement of recommended fertilizer.

REFERENCES

1. Gilkeson, Raymond A. 1965. Ritzville Series. Benchmark Soils of Washington. Washington Agriculture Experiment Station. Bulletins 665, 18 pp.

Estimating Seeding Rate Increase To Compensate for Delayed Planting

R. W. Rickman and Betty Klepper

INTRODUCTION

Farmers must plant into adequate soil moisture for good emergence. Winter wheat is usually seeded deep to reach moisture in fallow soil or planting is delayed until fall rains wet the top few inches of soil. When seeding is delayed, many farmers increase the seeding rate to compensate for the delay. This is necessary because late-planted seedlings do not have as much time for tiller production as do early-planted seedlings. With delayed planting, fewer heads form on each plant and a low head population can reduce yield. This article gives guidance on how to calculate the increase in seeding rate needed to compensate for reduced tiller formation caused by delays in planting.

SHOOT DEVELOPMENT PATTERN

The leaves and tillers of a wheat plant develop in a rigid and regular pattern. We have named each leaf and tiller on the plant by using the number of the node at which it is found (Figure 1). For example, the first node in the crown (Node 1) bears leaf one (L1) and the first crown tiller (T1). The successive leaves of wheat are produced on alternate sides of the stem so the base of the second leaf (L2) is immediately above Node 1 on the opposite side of the stem from L1. The main stem nodes are numbered successively up the stem beginning at the bottom of the crown where Node 1 is normally found. The coleoptilar node, located just below Node 1, is given the number "0".

The leaves on the main shoot (MS) of wheat elongate successively with the same amount of "biological time" (same number of degree-days) being required for elongation of each. The main shoot is the stack of nodes 0, 1, 2... through the node that produces the flag leaf. As the fourth leaf (L4) elongates, T1 appears in unstressed plants (Figure 2). This tiller continues to develop in lock-step with the MS so that the number of leaves on T1 and on the MS always remain offset by about three. For example, an unstressed wheat plant with 5.2 leaves on the MS will have a little more than two leaves on its T1. The general scheme presented in Figure 2 applies to all varieties of wheat, both winter and spring, both red and white. The steps of biological time represented by the small breaks in the vertical lines in the figure are called "phyllochrons". A phyllochron is the length of "biological time" it takes for a leaf to elongate. For example, it is the length of time or the amount of heat it takes to go from a main stem leaf number of 4.2 to one of 5.2.

---

[1] Soil scientist and plant physiologist, USDA-ARS, Columbia Plateau Conservation Research Center, Pendleton, Oregon, 97801.

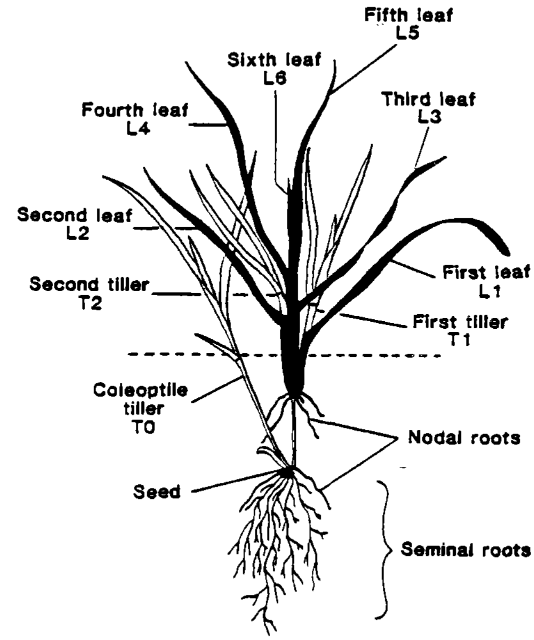


Figure 1. Winter wheat plant with labeled leaves, tillers, and roots.

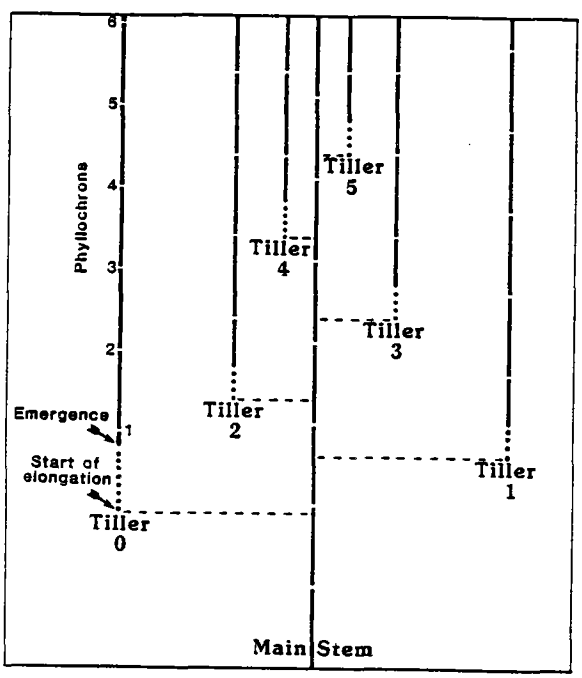


Figure 2. Diagram of leaf and tiller development pattern for wheat as related to the growing degree days after emergence with 100 degree days per phyllochron.

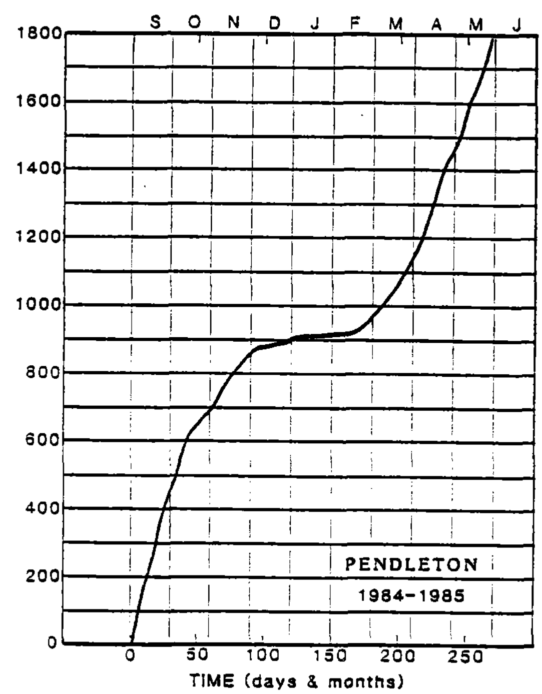


Figure 3. Accumulated degree days (0°C base) from September 1, 1984 for Pendleton, Oregon.

Accumulation of growing degree days, calculated from air temperature as a measure of heat, drives crop development and can be tracked from planting or emergence and even predicted if average weather data (maximum and minimum air temperatures) are available for a site. Cumulative growing degree days can then be used to predict the number of tillers on a plant (Figure 2).

BIOLOGICAL TIME OR GROWING-DEGREE-DAYS

The measurement of "biological time" under field conditions is by the use of cumulative growing degree days (GDD) with a zero celsius base temperature. To calculate base zero GDD's, follow these steps:

1. Obtain daily maximum and minimum Fahrenheit temperatures from planting to the present for a location close to the field you are interested in.

2. Calculate the average Fahrenheit temperature each day from

$$\frac{\text{Max + Min}}{2}$$

3. Convert this average temperature from Fahrenheit (F) to celsius (C) degrees with this formula:

$$C = \frac{5}{9}\,(F-32)$$

4. Since the base temperature of zero C applies to wheat, all average temperatures below zero are changed to zero.

5. Add together all of the daily values from planting date to the present day to obtain the current cumulative GDD's for the crop.

Be sure not to mix computations and growth estimates from GDD's calculated using different base temperatures or directly with Fahrenheit temperatures.

Figure 3 shows the base 0 C cumulative growing degree days for the Pendleton Experiment Station beginning on September 1, 1984, and continuing through late May of 1985. Tillering can be predicted using the information in Figure 2 or from any year or location temperature record.

Under most Pacific Northwest winter wheat planting conditions, it takes from 130 to 150 base zero GDD's for emergence and 90 to 100 base zero GDD's for each leaf to elongate. For example, if 500 GDD's had passed since planting, one would expect to find a little more than 3.5 leaves on a winter wheat crop. These plants probably would have tillers at the "0" and at the "1" node (Figure 2).

Tillering ceases at jointing, when stem elongation pushes the joints above the level of the soil, usually in early April. After jointing only tillers with 3 or more leaves expanded will survive to produce heads. Tillers with fewer than 3 leaves at jointing are aborted by the plant.

For a typical planting date of October 1, Figure 4 shows the expected number of heads per plant. For plantings later than October 1, the degree

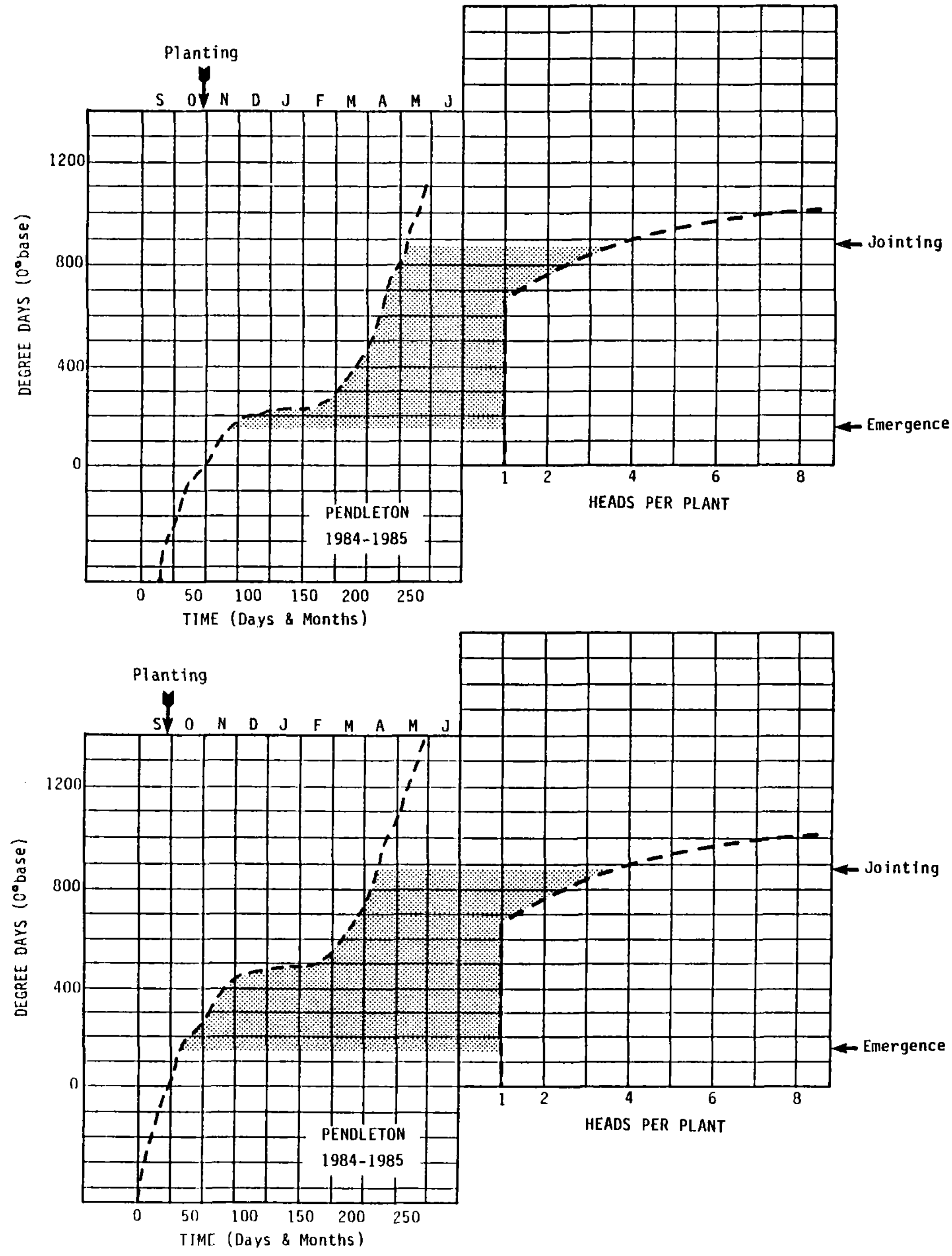


Figure 4. Degree days vs. date and heads per plant vs. degree days for an October 1 planting date and a delayed planting date. Emergence is expected at E (150 GDD).

day curve on the left-hand-side of Figure 4 would be shifted downward (dashed line) so that fewer degree-days would accumulate before the tiller abortion date in early April. There would consequently be fewer surviving tillers per plant. Figure 4 shows how planting date and desirable tiller populations are related.

HEADS/ACRE FOR MAXIMUM YIELD

Figure 5 is a current version of a relationship developed in the early 1960s (Leggett). Maximum historic yields from sites throughout the Northwest conform to this relationship for soft white winter wheat. Spring wheats or hard wheats follow similar lines with smaller slopes (4 to 5 bushels per inch of available water instead of 7). Table 1 uses 4 production levels: 35, 70, 105, and 140 bu/A (corresponding to 9, 14, 19, and 24 inches of water used by a crop) with kernel size of 40 mg/kernel (11,350 seeds/lb) and 36 kernels/head (18 spikelets with 2 kernels each) to illustrate the number of heads per plant required at different planting rates to produce various yields.

For a planting date of September 15, 900 degree days accumulate by April 1 (Figure 3) and 750 of these degree days accumulate after emergence. Tillers with three leaves by April 1 have a good chance of surviving. Three tillers, T1, T2, and T3 from Figure 2, had three leaves or more. Tiller T0 is not counted as it usually is presented only in exceptionally good seedbeds. With a seeding rate of 60 lb/A in Table 2, we find a yield potential of 105 bu/A or more. From Figure 5, there should be at least 19 inches of water available to the crop (extractable from the soil) to support that head population. If planting was delayed to October 1, only 700 degree days are accumulated by April 1 and only T1 has the required three leaves. Therefore only two heads/plant will be produced giving a yield potential of less than 70 bu/A for the 60 lb/A planting rate (Table 2). If the 19 inches of water was available to support a 105 bu/A crop, the seeding rate for the October 1 planting would have to be doubled to 120 lb/A if the potential head population to produce more than 100 bu/A was to be present. The general relationship for estimating the increase in seeding rate is: New seeding rate = original seeding rate * heads per plant then produce maximum yield possible with available water / heads per plant projected from delayed planting date.

April 1 is close to the time of jointing for the Pendleton, Oregon, area. A general method for estimating jointing date in any area is to follow the degree-day curve four phyllochrons (about 400 degree days) after January 1. See (J) in Figure 4.

Possible yield (Y) can be computed from the yield components with the following relationships:

$$Y = 2.937 \times 10^{-8} \text{ * heads per plant * kernels per head * weight per kernel * planting rate (pounds of seed per acre) * seeds per pound}$$

Weight per kernel is in units of milligrams.

Heads per plant, kernels per head and seeds per pound are just counts.

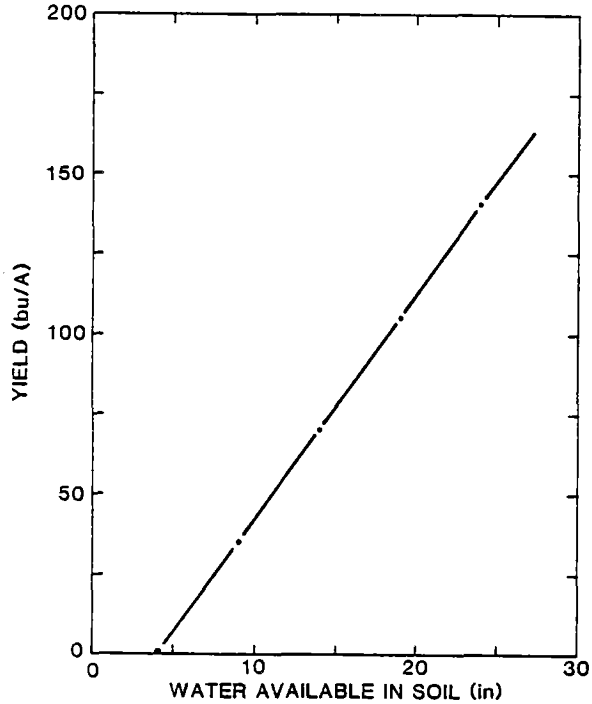


Figure 5. Maximum grain yield vs. available soil water for soft white winter wheat in the Pacific Northwest.

Table 1. Yield components required to produce different yields

Yield	40 mg/kernel	36 kernels/head
(bu/A)	(seeds/ft²)	(heads/ft²)
35	546	15
70	1093	30
105	1639	45
140	2185	61

Table 2. Heads required to produce different yields with 40 mg/kernel seed and 80% emergence

Yield	Planting rate in lb/A 45	60	75
(bu/A)	Heads/plant[1/]		
35	1.6	1.2	1
70	3.2	2.4	1.9
105	4.8	3.6	2.9
140	6.5	4.8	3.9

1/ Tillers per plant = heads per plant minus 1 where the 1 represents the head on the main stem of the plant.

The number $2.937*10^{-8}$ converts the units of the various terms on the right side of the equation into bushels per acre. It also reduces the number of plants surviving to 80% of the total number of seeds put into the ground.

Yield should equal 101 with 4 heads per plant, 36 kernels per head, 40 milligrams per kernel, 60 pounds of seed per acre, and 10,000 kernels per pound of seed.

SUMMARY

Delayed seeding can cause a decrease in the expected number of heads per plant. If the cumulative growing degree day relationship to calendar time is known for a particular site (Figure 3), then the number of growing degree days between planting and early April (jointing) can be determined for any planting date. This gives the growing degree days available for emergence (requiring approximately 150) plus those for tillering (Figure 2). The heads per plant will be less for later planting dates and seeding rate must be increased by the ratio of

$$\left(\frac{\text{normal planting heads/plant needed for max yield}}{\text{delayed planting predicted heads}}\right)$$

For example, in Figure 4, $\frac{4}{1.5} = 2.67$.

REFERENCES

1. Leggett, G. E. 1959. Relationships between wheat yield, available moisture, and available nitrogen in eastern Washington dryland areas. Washington Agricultural Experiment Station Bulletin 609.

Agronomic Zones in the Pacific Northwest

C. L. Douglas, Jr., J. F. Zuzel, R. W. Rickman, and B. L. Klepper[1]

INTRODUCTION

A series of agronomic zones useful in extending conservation tillage research and management practices in the Pacific Northwest has been delineated using climate and soil parameters. These zones containing similar temperature, precipitation and soil depth conditions, provide a logical, easily developed, foundation for transferring management and research information among separate but similar farming areas. Climate and soil parameters were obtained from National Weather Service historical records and Soil Conservation Service county soil surveys (1, 4, 5, 6, 7, 8), respectively. We used a 5-county area (Umatilla, Morrow, Gilliam, Sherman and Wasco Counties) in Northcentral Oregon to determine the minimum number of parameters that would be required to delineate the 5 major management patterns that exist in these counties. This paper will describe the criteria and techniques used to delineate the zones.

METHODS

Ramig et al. (2) indicate that good water conservation practices will enable storage of from 50 to 70% of the precipitation falling the first winter after harvest. If annual precipitation is 12 inches per year, soils less than 40 inches deep will fill the profile the first winter after harvest. Therefore, we used 40 inches as our soil depth delineator. If an area gets greater than 16 inches precipitation annually, there is enough water stored in the soil overwinter every year (except in very dry years) to grow a crop regardless of soil depth. Areas with 14 to 16 inches precipitation will be able to sustain annual cropping on an average 7 years out of 10 even if soil depths are greater than 40 inches. Areas with soil depths greater than 40 inches receiving less than 14 but greater than 10 inches precipitation yearly will require two winters' soil water storage to sustain a crop. Generally, if precipitation is less than 10 inches annually, irrigation is required for crop production. With these facts in mind, we used > 16, 14 to 16, 14 to 10 and < 10 inches annual precipitation as criteria for zone delineation.

Air temperature was used to determine total growing degree days (TGDD) from 1 January through 31 May (3). This time period was selected because all winter cereals will receive approximately the same amount of TGDD in a zone regardless of planting date. Also, this is a very influential vegetative and reproductive interval for winter cereals. TGDD of less than 700, 700 to 1000, and greater than 1000 were selected as appropriate boundaries. Areas with TGDD of less than 700 have tendencies for severe

---

[1] Soil scientist, hydrologist, soil scientist, and plant physiologist, USDA-ARS, Columbia Plateau Conservation Research Center, Pendleton, Oregon, 97801.

cold temperatures and short growing seasons. Areas with TGDD greater than 1000 have a high evaporative demand and low annual precipitation. Observed winter cereal growth in areas of 700 to 1000 TGDD indicated this was the best range of growing degree days.

DISCUSSION

The combination of precipitation, soil depth, and a temperature related plant development predictor (TGDD) fits existing management patterns in the 5-county Northcentral Oregon area. These 3 parameters are relatively easy to obtain for most dryland farming areas of the Pacific Northwest. Using this information we have delineated 5 agronomic zones as shown in Figure 1 and tabulated in Table 1. Zone 1 can be annual cropped as the profile fills every winter. Zone 2 can be annual cropped most years but management is critical because there will be dry years where the profile does not store enough water for crop growth. Zone 3 is an annual crop zone because soils are shallow and the profile will be filled with water every year. Again management is very critical as timeliness of precipitation is important. If fall rains are late it may be necessary to delay planting until spring. Zone 4 has deep soils and requires 2 winters' water storage to produce a good yield. Zone 5 normally does not economically produce a cereal crop unless irrigation is used.

Table 1. Agronomic zones for northcentral Oregon delineated by using[1/] growing degree days, soil depth, and annual precipitation

Zone	Name	TGDD[2/]	Soil depth	Precipitation
			(inches)	(inches)
1	Annual crop-wet	< 700	all	> 16
2	Annual crop-fallow transition	< 1000	> 40	14-16
3	Annual crop-dry	< 1000	< 40	10-16
4	Grain-fallow	< 700 - > 1000	> 40	10-14
5	Irrigated	> 1000	all	< 10

[1/] Umatilla, Morrow, Gilliam, Sherman, and Wasco Counties, Oregon.

[2/] TGDD: Total growing degree days from January 1 through May 31.

Use of the agronomic zone concept should increase the ability of producers to exchange ideas between areas in the 3 states that are in the same agronomic zone. For example, zone 4 in Washington has approximately the same combination of climate and soil depth as zone 4 in Oregon or Idaho. Management systems that work in one state in zone 4 should work in zone 4 in the other states. The zones should be useful for extension of conservation tillage research within zones. Erosion control techniques should be similar within zones but different between zones.

SUMMARY AND CONCLUSIONS

The parameters of depth, precipitation, and TGDD's best fit the 5 main zones of management systems presently used in a 5-county area in Northcentral Oregon. These 3 criteria are now being applied to the rest of Eastern Oregon, Eastern Washington and all of Idaho to determine their potential for delineating the same zones. The system will be evaluated by conferring with local service agencies, growers, and researchers to verify uniformity of practices within zones. Our intent is to describe, in future publications, the best management and conservation tillage practices for each zone.

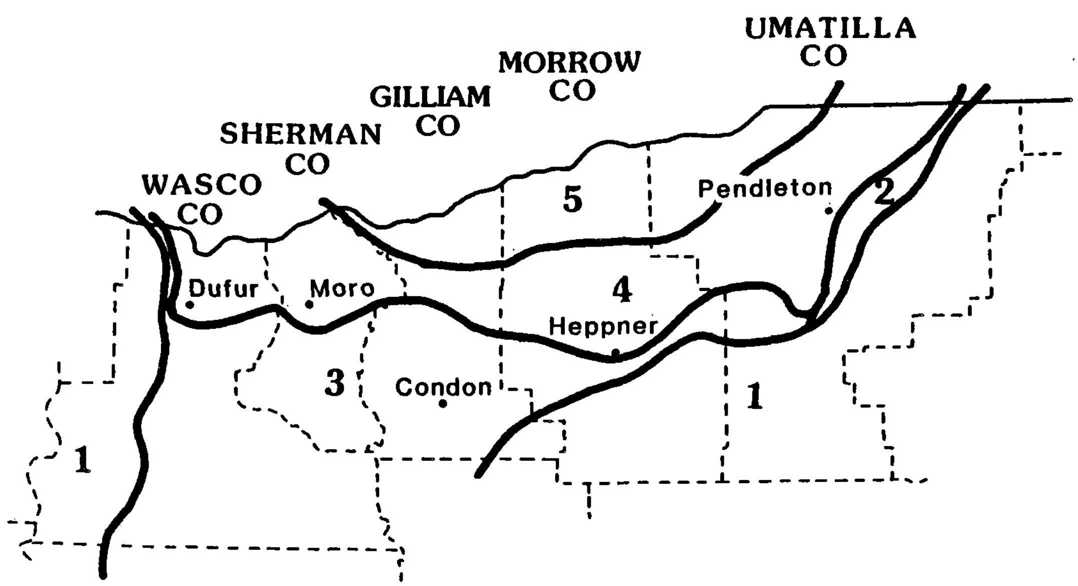


Figure 1 Agronomic zones for a five county area in Northcentral Oregon. Numbers refer to the zones listed in Table 1.

REFERENCES

1. Harper, W. G., F. O. Youngs, T. W. Glassey, E. F. Torgerson, and R. D. Lewis. 1948. Soil Survey, The Umatilla Area, Oregon. Series 1937, No. 21. USDA, Bureau of Plant Industry, Soils and Agricultural Engineering in cooperation with Oregon Agricultural Experiment Station. 125 pp. 2 maps.

2. Ramig, R. E., R. R. Allmaras, and R. I. Papendick. 1983. Water conservation: Pacific Northwest. In H. E. Dregne and W. O. Willis, eds. Dryland Agriculture. Agronomy Monograph 23, pp. 105-124. American Society of Agronomy, Madison, WI.

3. Rickman, R. W., Betty Klepper, and R. K. Belford. 1985. Developmental relationships among roots, leaves, and tillers in winter wheat. In W. Day and R. K. Atkins, eds. Wheat Growth and Modelling. pp. 83-98. Plenum Publishing.

4. U.S. Department of Agriculture Soil Survey of Gilliam County, Oregon. 1984. 172 pp. 77 maps.

5. U.S. Department of Agriculture Soil Survey of Morrow County Area, Oregon. 1983. Washington, D.C. 225 pp. 124 maps.

6. U.S. Department of Agriculture Soil Survey Sherman County, Oregon. 1964. 104 pp. 88 maps.

7. U.S. Department of Agriculture Soil Survey of Trout Creek-Shaniko Area, Oregon (parts of Jefferson, Wasco, and Crook Counties). 1970. 83 pp. 51 maps.

8. U.S. Department of Agriculture Soil Survey of Wasco County, Oregon, Northern Part. 1982. 125 pp. 69 maps.

Fall Seeded Barley, Wheat, and Triticale Variety Response To Fall Applied Glean[1] and Finesse[1]

Mathias F. Kolding and Dennis Wilson[2]

New cereal varieties are possible because there is heritable variation in the cereal populations. A part of that variation is visible, so we can see, within populations, a range of dense to lax heads, weak to stiff stems, or no beards to beards. Also, there are simple and very complex characters which we may never observe until the plants respond to a particular stress. Some examples of these stresses are disease, cold, heat, drought, flooding, high and low soil pH, and herbicide applications.

OBJECTIVE

The trials reported here were established in 1985 at the Columbia Basin Agricultural Research Center, Pendleton, Oregon, to study the response of various fall seeded barley, wheat, and triticale varieties to applications of Glean and Finesse.

METHOD

Nine barleys, eight wheats, and two triticale varieties, or advanced selections (Table 1) were tested in two trials. Eight chemical treatments and one control (Table 2) were main blocks. Varieties replicated four times within blocks were sub plots. Plots were two 15-foot long rows spaced at 12 inches. They were seeded with a four-row double disk opener grain drill to a 1 1/2 inch depth on October 3, 1985. The soil moisture was excellent so very desirable uniform stands were achieved.

One month before seeding, all plot areas were treated with one pint of Hoelon[3], worked into the soil surface within a half day of application, to control grassy weeds. The pre-emerge (Table 2) treatment was completed two days after seeding. When more than 75 percent of the plants were at the two leaf stage they were sprayed with the post-emerge treatments (October 23, 1985).

---

[1] Glean and Finesse are registered trademarks by E I Dupont Company.

[2] Senior instructor, Hermiston Agricultural Research and Extension Center, Oregon State University, Hermiston, Oregon 97838, and research and development representative, E I Dupont Company, Prosser, Washington 99350.

[3] Hoelan is a registered trademark by American Hoechst.

Table 1. Varieties used for the fall seeded cereal variety response to pre-emerge and post-emerge Glean and Finesse treatments trial at the Columbia Basin Agricultural Research Center, Pendleton, Oregon

Variety	Description
Mal	Mid tall winter barley primarily for irrigation.
Hesk	Mid tall winter barley for deeper dryland soils.
Kamiak	Mid tall winter barley for shallow dryland soils.
79 AB812	Mid tall winter barley from Idaho in last testing stage before release decision.
Exp Check	Composite mixture of several lines.
Boyer	Mid tall winter barley for dryland areas.
Scio	Mid tall winter barley for wetter dryland areas.
Schuyler	Mid tall winter barley good for early planting.
Steptoe	Mid tall spring barley with wide adaptation.
Malcolm	Soft white winter wheat good on high yield sites.
Stephens	Soft white winter wheat with wide adaptation.
John	Soft white winter wheat for snow mold problem sites.
Oveson	Soft white winter wheat newly released.
FW81454-301	Soft white winter wheat with good dwarf smut resistance in final testing stage.
Dusty	Soft white wheat newly released for dryland sites.
Hill	Soft white wheat taller and more cold hardy than Stephens, but no dwarf smut resistance.
FW75336-103	Soft white winter wheat with BYDV and soil disease tolerance in final testing stage.
Flora	A very cold hardy medium height winter triticale.
EMS 836039	A medium height winter triticale having plump seeds.

Daytime temperatures were generally from 40 to 60 degrees Fahrenheit. The favorable cool weather came to an abrupt halt during the second week in November when snow cover and freezing temperatures arrived and continued into the new year.

Heading dates were recorded when 50 percent of the heads were emerged. Plant height (ground to tip of spike), and heads per square foot were recorded just before harvest on August 4, 1986.

Table 2. Main treatments for the cereal variety response to Glean and Finesse applications and a visual assessment of probable plant damage in a trial grown at the Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1986

Time	Chemical		Application[1/]	Amount of damage[2/]	
			(ounce)	barley	wheat
Pre emerge	Glean	A	0.5	1	1
Pre-emerge	Glean	B	1.0	2	1
Pre-emerge	Finesse	A	0.5	1	1
Pre-emerge	Finesse	B	1.0	2	1
Post-emerge	Glean	A	0.5	2	1
Post-emerge	Glean	B	1.0	3	1
Post-emerge	Finesse	A	0.5	4	1
Post-emerge	Finesse	B	1.0	5	1
Control	None		0.0	1	1

1/ **Warning ! ! !** The purpose of this test was to observe variety response to potential herbaceous injury. Therefore, product rates and applications were selected to maximize injury potential. Neither the rates nor the timings is recommended. Consult product labels for further information in regard to using Glean and Finesse safely on wheat and barley.

2/ Amount of damage. A scale from 1 to 9 where 1 = no damage, 5 = probable long term damage, 9 = dead.

RESULTS

A plant response assessment in early May revealed some chlorosis and necrotic lesions in the barley, but none in the wheat.

No significant differential yield response was measured among the treatments on the barleys (Table 3) except for Finesse post-emerge treatment B. All Finesse and Glean treatments tended to delay heading dates and suppress plant heights. Head counts per square foot and percent of plump kernels were not affected.

Wheat and triticale grain yield, heading date and plant height were not affected (Table 4) by the chemical treatments. There is a trend for reduced tiller numbers which is probably accounted for by the two triticale (Flora and EMS 836039).

Yields are presented by variety in Tables 5 and 6. All barley varieties responded similarly to the chemical treatments, except that the experimental check appears the most stable. Wheat yields are stable across treatments.

SUMMARY

Fall seeded wheat and barley responded differently to the Glean and Finesse treatments in these trials. Wheats were primarily unaffected. Triticale, however, tended to have fewer tillers in the treated plots. Visual estimates of plant damage would have lead one to expect significantly smaller barley yields in the damaged plots than were measured. Since head count and kernel plumpness do not account for the smaller yields, it is probable that numbers of kernels per spike were reduced in the affected plots.

Table 3. Chemical treatment means of grain yield, heading date, plant height, heads per square foot, and percent plump kernels of fall sown barley treated with two rates of Glean and Finesse at pre-emerge and during the two leaf stage at the Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1986[1/]

Treatment		Grain yield	Date 50% headed	Plant height to tip of head	Number of heads	Plump[2/] kernels
		lbs/A	May	in	per ft²	%
			- - - - - Pre-emerge - - - - -			
Glean	A	3900	28	36	34	86
Glean	B	3740	30	32	26	87
Finesse	A	3960	28	35	26	85
Finesse	B	3330	30	30	24	85
			- - - - - Post-emerge - - - - -			
Glean	A	3390	30	31	27	87
Glean	B	3160	30	31	24	84
Finesse	A	3290	29	33	24	86
Finesse	B	2730[3/]	30	32	25	86
Control	-	4030	25	40	34	83
Mean		3500	29	33	27	85
S. Dev.		880	3	5	8	11

1/ Application rates are 0.375 (A) and 0.75 (B) ounce of active ingredient per acre.

2/ Plump kernels. Percent kernels remaining on a 5 1/2 by 3/4-inch slotted screen after 200 grams were shaken for a count of 20 shakes.

3/ This value significantly different from the control at the 5% level.

Table 4. Chemical treatment means of grain yield, heading date, plant height, and heads per square foot of winter wheat and winter triticale treated at two rates of Glean and Finesse at pre-emerge and during the two leaf stage at the Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1986[1/]

Treatment		Grain[2/] yield	Date 50% headed	Plant[3/] height	Number of heads
		lbs/A	June	in	per ft^2
		----- Pre-emerge -----			
Glean	A	95	1	37	49
Glean	A	96	1	36	45
Finesse	A	100	1	38	47
Finesse	B	102	1	36	50
		----- Post-emerge -----			
Glean	A	98	1	37	47
Glean	B	91	1	35	49
Finesse	A	98	1	36	48
Finesse	B	91	1	36	46
Control	-	93	1	38	52
Mean		95	1	37	49
S. Dev.		15	3	10	10

1/ Application rates are 0.375 (A) and 0.75 (B) ounce of active ingredient per acre.

2/ Grain yield. 60 pounds per bushel basis.

3/ Plant height. Measured from ground level to tip of spike.

Table 5. Grain yield of winter barleys treated with Glean and Finesse at two rates (A) and (B) per acre at pre-emerge and emerged (two leaf stage) in a trial grown at the Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1986[1/]

Treatment		Mal	Hesk	Kamiak	79 AB812	Check
		lbs/A				
		Pre-emerge				
Glean	A	4000	4148	4097	3949	3499
Glean	B	4133	4180	3908	3542	4110
Finesse	A	4021	4086	4016	4699	3891
Finesse	B	3010	3117	3007	3552	3966
		Post-emerge				
Glean	A	3882	3427	3375	3308	3728
Glean	B	3378	3650	2828	3410	3744
Finesse	A	3600	3276	3112	3684	3733
Finesse	B	2746	2753	2908	2902	3259
Control	-	4968	4366	4335	4180	3525
Average		3748	3667	3509	3691	3717
S. Dev.		1032	806	912	771	622

Treatment		Boyer	Scio	Schuyler	Steptoe	Average
		lbs/A				
		Pre-emerge				
Glean	A	3103	4344	4215	3742	3900
Glean	B	2984	3709	4108	3020	3744
Finesse	A	3720	3348	4154	3711	3961
Finesse	B	2792	3563	3683	3270	3329
		Post-emerge				
Glean	A	2249	3570	3610	3391	3393
Glean	B	2385	2888	3334	2834	3161
Finesse	A	2514	3403	3631	2694	3294
Finesse	B	2237	2781	2651	2311	2727
Control	-	3440	3584	4640	3252	4032
Average		2824	3465	3780	3136	3504
S. Dev.		740	773	867	1105	860

Tukeys critical range for pairs of means = 628

[1/] Application rates are 0.375 (A) and 0.75 (B) ounce of active ingredient per acre.

Table 6. Grain yield of winter wheats treated with Glean and Finesse at two rates (A) and (B) at pre-emerge and emerged (two leaf stage) in a trial grown at the Columbia Basin Agricultural Research Center, Pendleton, Oregon, 1986[1/]

Treatment		Malcolm	Stephens	John	Oveson	FW81454-301
		bu/A				
		Pre-emerge				
Glean	A	103	89	77	71	98
Glean	B	114	94	83	94	102
Finesse	A	115	100	86	92	104
Finesse	B	120	97	86	94	114
		Post-emerge				
Glean	A	114	105	81	94	104
Glean	B	107	98	75	85	94
Finesse	A	114	103	83	94	103
Finesse	B	106	96	82	83	91
Control	-	107	97	81	91	94
Average		111	97	81	89	100
S. Dev.		11.3	10.6	13.5	11.9	11.6

Treatment		Dusty	Hill	FW75336-103	Flora	EMS836039	Average
		bu/A					
		Pre-emerge					
Glean	A	93	98	96	79	69	86
Glean	B	100	95	104	94	78	96
Finesse	A	109	102	112	96	86	100
Finesse	B	111	108	113	96	85	102
		Post-emerge					
Glean	A	110	97	101	88	84	98
Glean	B	105	90	97	84	77	91
Finesse	A	112	98	108	85	79	98
Finesse	B	102	92	97	83	78	91
Control		105	93	104	82	76	93
Average		105	95	103	87	78	95
S. Dev.		11.4	12.1	12.1	11.4	11.4	11.8

Tukeys critical range for pairs = 8.76

[1/] Application rates are 0.375 (A) and 0.75 (B) ounce of active ingredient per acre.

What's New in Selective Grass Control in Cereals

D. J. Rydrych[1]

INTRODUCTION

For the last 60 years, eastern Oregon and Pacific Northwest wheat farmers have tried countless chemical and cultural innovations in an effort to eliminate downy brome (Cheatgrass) in cereal grains. Downy brome is a problem in most grain fields, and farmers are forced to manage their cultural practices and planting dates to coincide with cheatgrass germination. This often causes delays in planting or loss of moisture from seedbeds that are infested with the weed.

In addition, there are other grassy weeds such as ripgut brome (*Bromus rigidus*), jointed goatgrass, (*Aegilops cylindricum*), bulbous bluegrass (*Poa bulbosa*) and wild oat (*Auena fatua*) that contribute to the weed problem in cereal grains.

MATERIALS AND METHODS

Field experiments have been conducted since 1983 on downy brome (Adams), ripgut brome (Pendleton Experiment Station); bulbous bluegrass (Pilot Rock), jointed goatgrass (Wasco and Elgin), and wild oat (Elgin) control in both winter and spring grains by a combination of selective chemical and cultural methods.

RESULTS AND DISCUSSION

Field experiments show that downy brome and ripgut brome can be controlled with a combination of selective chemical and cultural controls. The results of a downy brome study in 1986 are recorded in Table 1. Downy brome selective trials have been successful in both conventional and no-till systems. The most effective compounds for downy brome control are metribuzin and ethyl metribuzin (Ethiazine). Metribuzin has been effective as a post-emergence treatment after the wheat plant has preliminary crown root development. Ethyl metribuzin has been effective pre-emergence or early post-emergence when downy brome seedlings are most vulnerable. Ethyl metribuzin has good crop tolerance and can be applied on winter wheat or winter barley that are 3-leaf to 4-tiller. Trials in 1986 (Table 1) showed that winter wheat yield was reduced 760-900 lb/A from natural weed competition. The yield differential was restored by the use of metribuzin (post) and ethyl metribuzin (pre or post). Pre-emergence application of mixtures containing metribuzin and ethyl metribuzin also look promising.

Ripgut brome is also relatively easy to control with existing grass herbicides such as diclofop methyl (Hoelon), metribuzin (Lexone or Sencor), ethyl metribuzin (Tycor or Siege) and trifluralin. New compounds which show good activity on ripgut brome include SD 95481 (Cinch), and acetochlor (Harness). The results of the ripgut brome trial are recorded in Table 2.

---

[1] Professor of agronomy, Columbia Basin Agricultural Research Center, Oregon State University, Pendleton, Oregon 97801.

Table 1. "Inversion" for cheatgrass control in no-till winter wheat at Adams, Oregon - 1986 (OSU-CBARC)

Treatment	Rate	Time	Cheatgrass control R1	R2	R3	R4	Avg.	Avg. yield
	(lbs/A)		- - - - - - - %	- - - - - - -				(lbs/A)
Atrazine	.50	PPS	99	95	99	90	96	2880
Metribuzin	.50	Post	98	99	92	94	96	3540
Ethyl metribuzin	1.50	Pre	99	99	99	99	99	3680
Ethyl metribuzin	1.50	Post	100	100	99	100	99	3580
Ethyl metribuzin + metribuzin	.75 + .12	Pre	96	99	99	99	98	3350
Control	-	-	0	0	0	0	0	2780

1/ Treatments: September 25, 1985 - Pre-plant surface (PPS)
October 7, 1985 - Pre-emerge
February 28, 1986 - Post-emergence

2/ Cheatgrass = 14 plants/ft^2

Table 2. Selective Ripgut brome control in winter wheat at Pendleton, Oregon - 1986 (OSU-CBARC)

Treatment	Rate	Time	Ripgut brome control R1	R2	R3	Avg.	Avg. yield
	(lbs/A)		- - - - - - - %	- - - - - - -			(lbs/A)
Metribuzin	.33	Post	96	100	100	99	4190
Ethyl metribuzin	1.50	PPS	100	96	98	98	4370
Ethyl metribuzin	1.50	Post	100	100	99	99	4190
Diclofop (Hoelon)	1.00	PPS	70	88	70	76	4170
SD 95481 (Cinch)	.75	PPS	96	99	95	97	4130
Trifluralin	1.00	PPS	90	80	80	83	4180
Acetochlor (Harness)	1.50	PPS	100	100	100	100	4450
Weeded control	-	-	100	100	100	100	4440
Control	-	-	0	0	0	0	3290

1/ Treatment: Pre-plant surface (PPS) - October 15, 1985
Post-emergence (Post) - February 3, 1986
Winter wheat 2-leaf - Ripgut brome 1-2 leaf

Ethyl metribuzin has shown excellent activity in ripgut brome with good crop safety. Winter wheat yield was reduced by 1150 lb/A based on comparisons with the weeded control and non-treated control. Selective herbicides in this test restored most of the yield potential. Ripgut brome is controlled more effectively with pre-plant surface or early post-emergence treatments. Compounds that have adequate safety levels for early treatment include diclofop and ethyl metribuzin.

Bulbous bluegrass is another grass problem that is found in the higher elevations of eastern Oregon or in lower elevations where fall moisture is abundant. Bulbous bluegrass can be partially controlled in spring fallow using glyphosate so that the existing root bulblets are killed before the fall crop is planted. Bulbous bluegrass can thrive in wet soils during low temperatures when wheat and barley remain dormant. Selective controls have been partially successful as long as weed seedlings are still relatively small. Many areas that have bulbous bluegrass must seed shallow, or seed late for annual crop production or make adjustments for fall moisture patterns. This makes it difficult to use selective herbicides in early fall when winter cereals are most vulnerable to injury. Tests conducted in 1986 in Pilot Rock (Table 3) show that ethyl metribuain has better crop safety than metribuzin on small grains.

Table 3. Selective bulbous bluegrass control in winter wheat and winter barley, Pilot Rock, Oregon - 1986 (OSU-CBARC)

		Avg. Bulbous bluegrass control			
		Winter wheat		Winter barley	
Treatment	Rate	Control	Injury	Control	Injury
	(lbs/A)	- - - - - - - - -	%	- - - - - - - -	
Ethyl metribuzin	1.50	85	0	82	0
Ethyl metribuzin	1.00	40	0	43	0
Ethyl metribuzin+Metribuzin	1.00+.25	75	8	98	12
Ethyl metribuzin+Glean	1.00+.33 oz.	60	0	92	0
Metribuzin	.50	99	12	97	12
Metribuzin	.33	60	6	70	5
Metribuzin+Glean	.33+.50 oz.	50	5	73	12
Control	-	0	0	0	0

1/ Treatments: Post - March 14, 1986
Winter wheat 3-4 leaf, Winter barley 4-5 leaf, Bulbous bluegrass 3-L to 3" clumps

The results in 1986 are encouraging because we now have a herbicide that can be applied to very small cereal grain in the fall and still maintain relative crop safety. Mixtures of ethyl metribuzin and metribuzin produced too much injury in wheat and barley, and more work is needed in this area.

Jointed goatgrass can be found in every county in eastern Oregon grain fields. It is becoming very difficult to maintain dryland areas that can raise certified seed that is free of goatgrass contamination. Roadsides, fencelines, waterways, and contaminated seed stocks remain the primary means by which the weed spreads into other areas. Preliminary research data have shown that cultural methods such as crop rotations, double fallow, and spring planted crops offer the most effective and best hope for jointed goatgrass control in winter cereals. Chemical controls are being investigated, and the results are recorded in Table 4.

Table 4. Selective jointed goatgrass control in winter wheat in eastern Oregon - 1986 (OSU-CBARC)

Treatment	Rate	Time	Wasco, Oregon		Elgin, Oregon	
			Goatgrass control	Crop injury	Goatgrass control	Crop injury
	(lbs/A)		- - - - - - - - - %	- - - - - - - - -		
Ethyl metribuzin	3.00	Post	98	0	65	6
Ethyl metribuzin	1.50	Post	85	0	20	0
Ethyl metribuzin + metribuzin	1 + .25	Post	93	1	40	0
Control	-	-	0	0	0	0

1/ Treatment: Post - Wasco, Oregon - March 17, 1986 (stubble mulch)
Winter wheat 4-5 tiller - Goatgrass 4-6 tiller
Post - Elgin, Oregon - March 20, 1986 (no-till)
Winter wheat 4-6 leaf - Goatgrass 4-5 leaf

Ethyl metribuzin is the most effective herbicide that has been screened for the selective control of jointed goatgrass in winter cereals. Good jointed goatgrass control was recorded at Wasco, Oregon, using ethyl metribuzin at 1.50 to 3.00 lb/A. Jointed goatgrass control at Elgin was poor using the high rate of ethyl metribuzin (3.00 lb/A) in a no-till environment. Combinations of Ethyl metribuzin and metribuzin showed good activity, but were probably applied too late to improve jointed goatgrass control at Wasco, Oregon. Similar tests conducted at Pendleton in 1986 showed that spring wheat resulted in 100% goatgrass control, double fallow winter wheat produced 95% control, and annual crop winter wheat had no control. When ethyl metribuzin was added to the cultural series, double fallow plots had 99% goatgrass control, and the annual crop produced 90% goatgrass control. This indicates that cultural practices plus the addition of herbicides may be very effective for goatgrass control in the future.

Wild oat is starting to cause problems in eastern Oregon. Areas that were relatively free of wild oat 10 years ago are now partially infested. Wild oat, like jointed goatgrass, has a dormant seed factor that enables it to survive in the soil through several seasons (3-5 years in eastern Oregon). Wild oat is very difficult to control using crop rotations because many farms are limited to specific crops. Wild oat has been controlled using several herbicides such as diclofop (Hoelon), propham (IPC), triallate (Avadex), difenzoquat (Avenge), and barban (Carcyne). Two new compounds which have been investigated for selective wild oat control in winter and spring grains include Bay 3440 and Assert. Bay 3440 has been excellent in the past, but was oversprayed with MCPA in 1986 and effective control was lost. However, Assert treatments were not affected by MCPA, and gave good wild oat control.

Herbicide Management In CRP Perennial Grass Seed Establishment

D. J. Rydrych and L. C. Burrill[1]

INTRODUCTION

The statewide Conservation Reserve Program (CRP) has created much interest during the past few months, particularly in the winter wheat-producing counties in eastern Oregon. The Oregon Wheat Growers League has estimated that farmers statewide have committed 321,000 acres to the CRP program. The largest plantings of perennial grasses occurred in the fall of 1986 in Sherman, Gilliam, Morrow, and Wasco counties. Some plantings were completed in the spring of 1987. The CRP program has created a large demand for quality perennial grass seed that is free of weeds and has good germination potential. The most important management considerations are effective seedbed preparation before planting, establishment of uniform stands, and weed control during establishment. Good stands are essential for successful grass seed establishment. A uniform stand of perennial grass goes a long way in the competition with annual and perennial weeds. Information on the proper selection of perennial grass varieties, and planting procedures should be obtained from ASCS and SCS professionals.

MATERIAL AND METHODS

Research trials in new and established perennial grass and legume fields have been established at 3 locations in eastern Oregon. Weed research plots have been established in mixed grass stands containing Crested, Siberian, Fall, Pubescent, and Intermediate wheatgrasses; Sherman Big bluegrass, Sheep Fescue, and Russian Wildrye. In addition, several other varieties are being selected for herbicide tolerance tests. Replicated tests have been established in plots in Gilliam, Morrow, Union, and Umatilla counties. Randomized plot designs in areas 10 feet wide and 20 to 50 feet long in areas using a winter wheat-fallow rotation are in place. Grass populations were established based on recommendations by SCS and other agencies. Weights of grass and weed dry matter will be taken from each plot at maturity. Weed control and herbicide-grass tolerance ratings will be taken as needed during each growing season.

RESULTS AND DISCUSSION

There will be a mixed bag of weeds that will give problems in grass establishment such as downy brome (cheatgrass), ripgut brome, bulbous bluegrass, volunteer rye, wild oat, and goatgrass. In addition perennial weeds such as field bindweed, knapweed, Canada thistle, and other perennials may be a problem in areas with a past history of these weeds.

---

[1] Professor, Columbia Basin Agricultural Research Center, Oregon State University, Pendleton, Oregon 97801; and Extension weed control specialist, Crop Science Department, Oregon State University, Corvallis, Oregon 97331.

Our weed control recommendations are not complete at this time. We are seeking a Section 18 for the use of Kerb in established grass seed plantings. But remember, Kerb is not registered yet, and we need to field test it on all the grass varieties for tolerance. We also are looking at other herbicides that are available but not registered yet for perennial grasses. Results from some of our 1987 tests should help provide information for new registrations for new plantings in the fall of 1987.

Read the label when buying grass seed. Avoid lots with weeds such as wild oat. We have seen perfectly clean areas become contaminated with wild oat that were planted with contaminated lots of grass seed. Try to get the best quality seed available. Do not buy grass seed without a label containing a germination and weed content list.

Start with a clean seedbed. We are able to use glyphosate to destroy volunteer grass and weed seedlings before planting. We do not have registered herbicides that can be used for soil application, to be applied at planting. Once seedlings emerge and become established, we have herbicides such as bromoxynil, bromoxynil-MCPA, 2,4-D, and chlorsulfuron that can help with the established process. However, be sure and check labels to make sure your grass variety is recommended or can be tolerated by the herbicide. Once the grass plantings are established for a year or longer, we can apply more residual herbicides such as simazine.

Annual broadleaf weeds are easy to manage in perennial grass plantings. There will be many broadleaf weeds that should be eliminated during the first six months. We have bromoxynil and chlorsulfuron (Glean) that are registered on specific grass varieties (read label). In addition we have the standard 2,4-D, and MCPA group that can be used for selective broadleaf weed control in grass plantings. Residual herbicides that are used for cheatgrass on established grass stands are also effective on many broadleaf weeds.

Cereal rye can be controlled by rope-wick in summer when perennial grasses are dormant, or in winter on established stands using the soil residual herbicides such as simazine. Goatgrass, bulbous bluegrass, and wild oat, when oats are in the seedling stage, can be controlled by using the same residual herbicides that are effective on cheatgrass. Perennial weeds such as Canada thistle, field bindweed, lupines, and sagebrush have to be dealt with individually. We have spot spray techniques that are effective using 2,4-D formulations, dicamba, and picloram. Other new products are being evaluated.

Perennial grasses used to be established without herbicides in the 1930s and 1940s by competition and occasional clipping of the stands. We have a few new label changes that now allow us to use herbicides such as bromoxynil, MCPA, 2,4-D, and chlorsulfuron for broadleaf weeds in established perennial grasses. However, selective annual grass weed control for weeds such as cheatgrass, goatgrass, bulbous bluegrass, rye, ripgut brome, and wild oat is limited. The research during the next few months is aimed at obtaining registrations for annual grass control. If good weed control can be maintained during the first two seasons, perennial grasses can maintain weed-free stands by competition.

Wheat Seed Treatments With Yield Enhancing Agents

Don Grabe, Floyd Bolton, and Carol Garbacik[1]

Yield trials were conducted with several purported yield enhancing agents to determine their effects on winter wheat. The products tested included (1) YEA!, containing chitosan, a derivative of crabshell, (2) Amplify-D, containing sodium phosphates and adenosine monophosphate, (3) Cardak, containing super slurper, a starch derivative, and (4) Golden X, containing *Aspergillus oryzae* in a carrier of sand washings. Another treatment consisted of passing the seed through a Bio-Mag magnetic seed treater. Controls consisted of untreated seed and seed treated with Vitavax 200.

The products were applied to Vitavax-treated seed at rates recommended by the suppliers. The three wheat varieties included were Hill 81, Malcolm, and Stephens. Plots were established at Hyslop Farm, near Corvallis, and the Columbia Basin Agricultural Research Center, near Moro. The experimental design was a randomized complete block with four replications.

No yield increases were obtained from any of the products tested at either location (Table 1). The yield trials were reestablished for harvest in 1987.

Table 1. Yields of winter wheat treated with yield enhancing agents

Seed treatment	Stephens	Hill-81	Malcolm	Average
	bu/A			
	Corvallis			
YEA!	131.1	136.2	134.3	133.9
Carkak	134.5	128.2	138.4	133.7
Amplify	131.8	142.4	135.0	136.7
Golden-X	132.8	140.9	137.7	137.2
Bio-Mag	135.1	137.1	136.6	136.3
Vitavax-200	133.8	141.0	141.6	138.8
Untreated	129.7	141.1	137.1	136.0
Average	132.7	138.1	137.4	136.1
	Moro			
YEA!	34.7	41.2	38.5	38.2
Carkak	35.0	40.4	36.7	37.4
Amplify	37.0	38.7	37.7	37.8
Golden-X	30.3	41.3	41.4	37.7
Bio-Mag	35.9	39.2	40.0	38.4
Vitavax-200	33.3	39.8	38.4	37.2
Untreated	34.3	41.2	41.4	40.0
Average	34.4	40.3	39.2	37.9

[1] Professor, Crop Science Department, associate professor, Agronomy Department, and research assistant, Crop Science Department, Oregon State University, Corvallis, Oregon 97331.

Precipitation Summary - Pendleton

CBARC - 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
58 Year Average	.77	1.38	1.95	2.17	1.91	1.54	1.67	1.47	1.36	1.29	.33	.47	16.31
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	1.29	2.30	2.12	.40	.02	20.00
1981-82	1.51	1.62	2.41	3.27	2.61	1.86	1.99	1.54	.48	1.12	1.02	.50	19.93
1982-83	1.68	2.68	1.46	2.69	1.63	2.97	3.90	1.23	2.08	1.92	1.00	.68	23.92
1983-84	.82	.91	2.79	3.44	.99	2.56	3.23	2.37	2.11	2.05	.05	1.25	22.57
1984-85	.98	1.18	3.43	1.96	.69	1.49	1.33	.65	.89	1.42	.05	.98	15.05
1985-86	1.54	1.34	2.66	1.27	2.38	3.04	1.94	.83	1.79	.09	.61	.19	17.68
*1986-87	1.87	.91	3.41	.95	2.08	1.31	1.85						
20 Year Average	.94	1.35	2.15	2.37	1.95	1.64	1.77	1.53	1.28	1.05	.38	.75	17.14

*Not included in 20 year average figures.

Precipitation Summary - Moro

CBARC - 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
75 Year Average	.48	.77	1.64	1.71	1.81	1.06	1.00	.71	.84	.64	.24	.42	11.34
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	.41	1.06	1.15	.20	0	12.10
1981-82	.92	.82	1.99	4.73	1.10	.72	.55	1.45	.37	1.15	.21	.40	14.41
1982-83	1.42	1.96	1.08	1.89	1.40	2.43	2.74	.61	1.96	.39	.80	.60	17.28
1983-84	.52	.62	2.45	2.31	.17	1.07	2.34	1.32	.97	1.09	.17	0	13.03
1984-85	.53	.86	3.18	.41	.27	.97	.44	.14	.63	.92	.05	.14	8.54
1985-86	1.11	1.09	1.19	1.12	1.84	2.39	.98	.34	.35	.06	.54	.07	11.08
*1986-87	1.52	.45	1.53	.78	1.68	1.10	1.54						
20 Year Average	.56	.81	1.75	1.76	1.58	1.05	.99	.73	.75	.66	.26	.46	11.37

*Not included in 20 year average figures.

Growing Degree Days