Farming with the Wind II

Wind Erosion and Air Quality Control on the Columbia Plateau and Columbia Basin

College of Agricultural, Human, and Natural Resource Sciences Special Report XB1042
by the Columbia Plateau PM\textsubscript{10} Project
Washington State University
February 2004

by

Robert I. Papendick
Department of Crop and Soil Sciences
Washington State University
(Formerly Soil Scientist, USDA-Agricultural Service, Pullman, Washington, now retired)

University Publishing
Washington State University, Pullman

ON THE COVER: Grower Ron Jirava observes wheat harvest of direct-seed trials on his farm near Ritzville, WA. In the background is a dust cloud from wind erosion on an intensively tilled fallow field. The goal of the CP\textsubscript{10} is to control wind erosion on agricultural lands with soil conservation techniques under study on the Jirava farm and elsewhere in the Columbia Plateau and Basin.
Principal Contributors and Reviewers

A.J. Busacca, Department of Crop and Soil Sciences, Washington State University
D.G. Chandler, Department of Biological Systems Engineering, Washington State University (now at Utah State University, Logan, UT)
C.S. Claiborn, Department of Civil and Environmental Engineering, Washington State University
E. Donaldson, Department of Crop and Soil Sciences, Washington State University (deceased)
A.D. Esser, Adams County Cooperative Extension, Washington State University
B.E. Frazier, Department of Crop and Soil Sciences, Washington State University
A.C. Kennedy, USDA-Agricultural Research Service, Pullman, WA
J. Kjelgaard, Department of Biological Systems Engineering, Washington State University (now at Texas A&M University, College Station, TX)
B.K. Lamb, Department of Civil and Environmental Engineering, Washington State University
D.A. Lauer, Benton Clean Air Authority, Richland, WA
S. Machado, Oregon State University, Pendleton, OR
D.K. McCool, USDA-Agricultural Research Service, Pullman, WA
W.L. Pan, Department of Crop and Soil Sciences, Washington State University
B. Rude, Department of Ecology, Olympia, WA
K.E. Saxton, USDA-Agricultural Research Service, Pullman, WA (retired)
P.F Scales, Jr., USDA-Natural Resources Conservation Service, Spokane, WA
W.F. Schillinger, Department of Crop and Soil Sciences, Washington State University
B.S. Sharratt, USDA-Agricultural Research Service, Pullman, WA
E. Skelton, Spokane County Air Pollution Control Authority, Spokane, WA
R.J. Veseth, Cooperative Extension Washington State University, and the Department of Plant, Entomological and Soil Sciences, University of Idaho (deceased)
D.J. Wysocki, Oregon State University, Pendleton, OR
D.L. Young, Department of Agricultural Economics, Washington State University
F.L. Young, USDA-Agricultural Research Service, Pullman, WA

Collaborating Institutions and Agencies

Washington State University
USDA-Agricultural Research Service
USDA-Cooperative States Research, Education and Extension Service
US Environmental Protection Agency
Washington State Department of Ecology
University of Idaho
Oregon State University
USDA-Natural Resources Conservation Service
Benton Clean Air Authority
Spokane County Air Pollution Control Authority
Washington Association of Wheat Growers
Oregon Wheat Growers League
Adams County Conservation District

Support

Funding for this publication was provided by Washington State University, the USDA-Agricultural Research Service, and the USDA-Cooperative States Research, Education and Extension Service. The contents and views expressed in this publication are those of the author and reviewers and do not necessarily reflect the policies and positions of the supporting and collaborating institutions and agencies.

Special thanks and acknowledgments

Special thanks and appreciation are extended to W.F. Schillinger and B.S. Sharratt for their comprehensive reviews of the publication in its entirety and to scientists who reviewed selected chapters. The author also thanks C. Warriner, R. Rupp, and R. Bolton of the Department of Crop and Soil Sciences, Washington State University for their professional assistance with the graphics and photographs used in the work.

The information presented in this publication is for educational purposes only. References to commercial products or trade names do not constitute an endorsement by the collaborating institutions and agencies, and do not imply discrimination against similar products.
# Contents

## CHAPTER 1

**Purpose, Progress and Perspectives**  
Introduction 5  
Farming with the Wind: The First Five Years (1992-97) 7  
Background and Current Status of Regional Particulate Matter Standards 8  
Summary Observations 10

## CHAPTER 2

**An Analysis of Historical and Present Dust Depositions on the Columbia Plateau**  
Fourth of July Lake Core Study 13  
The Role of Geologic Input on the Generation, Transport and Deposition of Sediments on the Columbia Plateau 14  
Summary Observations 15

## CHAPTER 3

**Wind Erosion, Dust Emissions and Air Quality Prediction**  
Wind Erosion and Dust Emissions Modeling 17  
Assessments of Erosion and \( PM_{10} \) Emissions 19  
Potential of Columbia Plateau Soils 23  
Measuring and Predicting the Transport and Dispersion of \( PM_{10} \) from Wind Erosion 25  
Summary Observations 25

## CHAPTER 4

**Cropping Systems Research to Control Wind Erosion and Dust Emissions on Dryland Farms**  
Agricultural Outlook on the Columbia Plateau 29  
Controlling Wind Erosion and Dust Emissions with Soil Cover and Random Roughness 30  
Winter Wheat–Fallow Systems 31  
Winter Wheat–No-Till Spring Cropping Systems 35  
Continuous No-Till Spring Cropping Systems Compared with Minimum Tillage Fallow: The Ralston Field Study 37  
Continuous No-Till Spring Wheat Compared with Winter Wheat–Fallow in the Horse Heaven Hills of South Central Washington State 41  
Drought Effects on the Economic Risk of Continuous No-Till Spring Crops Compared with Winter Wheat–Fallow in Adams (Ralston) and Benton (Horse Heaven Hills) Counties 43  
Continuous No-Till with Alternative Spring Crop Rotations 44  
Managing Russian Thistle in Dryland Cropping Systems 48  
Summary Observations 50

## CHAPTER 5

**Wind Erosion Control Research on Irrigated Lands of the Columbia Plateau**  
No-Till Sowing in Stubble of Irrigated Crops Instead of Burning and Plowing 53  
Managing Cover Crops for Erosion Control and as a N Source for Crops 54  
Use of Remote Sensing to Assess Soil Surface Characteristics and Cover Crop Adoption by Growers 58  
Summary Observations 60

## CHAPTER 6

**On-Farm Testing and Extension Outreach to Aid Adoption of Best Management Practices**  
On-Farm Testing Project 63  
Management of Spring Wheat in Direct Seed and Minimum Tillage Systems 63  
Economic Comparison of Hard Red Spring Wheat (HRSW) with Soft White Spring Wheat (SWSW) 66  
Agronomic and Economic Comparisons of Direct Seed and Conventional Planted Spring Barley 66  
Effect of Increased Seeding Rates and Seed Treatments on Grain Yield and Economics of Direct Seed (No-Till) Spring Wheat and Barley 68  
Extension Education in Wind Erosion and Air Quality Control 69  
Summary Observations 71

## CHAPTER 7

**Promoting and Applying Conservation Practices on Dry and Irrigated Croplands**  
Farming to Protect Soil Ecosystem Health 73  
Farming with the Air Quality Standards and the Natural Events Policy 75  
What Factors Motivate Growers to Adopt Conservation Practices? 80  
Summary Observations 81

## CHAPTER 8

**Wind Erosion and Air Quality Issues Addressed in the 2002 Farm Bill**  
Conservation Reserve Program (CRP) 83  
Environmental Quality Incentives Program (EQIP) 84  
Conservation Security Program (CSP) 84  
Summary Observations 85

## CHAPTER 9

**Summary: CP3 Highlights and Priorities for the Future**  
Highlights 87  
Looking Ahead: Research and Education Priorities for the Future 91

## APPENDIX A

**Abbreviated Objectives of the Northwest Columbia Wind Erosion/Air Quality Project** 93

## APPENDIX B

**Supplemental Photographs** 94

## APPENDIX C

**Tribute to Roger Veseth** 96
Preface

This book is a follow-up to Farming with the Wind published in 1998 by the Columbia Plateau PM_{10} Project (CP_{3}) on best management practices for controlling wind erosion and air quality on the Columbia Plateau. The need for Farming with the Wind II became apparent when reviewing research progress by University and USDA scientists and engineers in their efforts to develop new and improved methods, technologies and strategies for predicting and controlling wind-induced soil erosion and dust emissions from the region's farmlands since the earlier publication six years ago. Consequently, compiling and summarizing this new information for our user clientele involved with soil conservation and air quality issues was considered to be an urgent priority. So far, agriculture on the Columbia Plateau and Columbia Basin has not been implicated as contributing to nonattainment of EPA air quality standards due to increases of particulate matter in the atmosphere, both locally and downwind. This is attributed primarily to increased adoption of improved farming practices and new technologies based on CP_{3} research and development along with input and innovations by growers themselves.

This book emphasizes throughout that maintaining year-round vegetative cover as crop canopy or residue, and surface roughness is key to controlling wind erosion and dust pollution in downwind areas. Soils of the Columbia Plateau and Columbia Basin are highly susceptible to blowing because of the dry environments, limited vegetation, high winds, intensive tillage, and because they contain substantial quantities of readily erodible and suspendible fine particles. Much of the potential for erosion is on cultivated dry and irrigated farmlands that the region depends on for the production of a variety of cereal, horticultural, vegetable and hay crops.

The goal of the CP_{3} from its inception and yet today is to develop conservation practices that will enable growers to control wind erosion and dust emissions without suffering economic hardship, and to assist them with adopting these practices on their farms. Progress of the CP_{3} toward this end has been highly successful, and indeed, exemplary. This can be attributed to the acumen and organized efforts of Project managers, scientists and educators from regional institutions and agencies working in collaboration with growers, grower organizations and the farming community. Without their combined contributions to an outstanding list of accomplishments, this publication would not have been possible.

It is far more economical and less frustrating for growers and society alike to prevent designation of an area as nonattainment for particulate pollution than to correct the problem and return to attainment status. Though much has been learned about the principles and control of wind erosion and dust emissions on the Columbia Plateau and Columbia Basin in the past decade, the work needs to be strengthened and continued with special emphasis on the development and implementation of control technologies at the farm level. This will help to ensure compliance with EPA ambient air quality standards by agriculture in the region. The CP_{3} has the organization and experience to accomplish this task both effectively, and in the best interest of the public that it serves.

Robert I. Papendick
February 2004