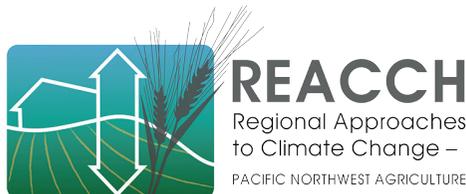


This an excerpt of

Advances in Dryland Farming in the Inland Pacific Northwest

Advances in Dryland Farming in the Inland Pacific Northwest represents a joint effort by a multi-disciplinary group of scientists from across the region over a three-year period. Together they compiled and synthesized recent research advances as well as economic and other practical considerations to support farmers as they make decisions relating to productivity, resilience, and their bottom lines.

The effort to produce this book was made possible with the support of the USDA National Institute of Food and Agriculture through the REACCH project. This six-year project aimed to enhance the sustainability of Pacific Northwest cereal systems and contribute to climate change mitigation. The project, led by the University of Idaho, also convened scientists from Washington State University, Oregon State University, the USDA Agricultural Research Service, and Boise State University.



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Glossary

adaptation. In relation to global climate change, an effort made to reduce the negative consequences of a changing climate or take advantage of new opportunities, for example by adjusting practices, processes, or structures.

aggregate stability. The capacity of soil aggregates to resist disintegration when exposed to external destructive forces.

aggregate. A group of primary soil particles that are held together by organic and inorganic materials.

agroecological class (AEC). A classification system used to characterize the diversity of agricultural cropping patterns. The three classes in the inland Pacific Northwest's dryland cereal production region are (1) Annual Crop with < 10% fallow, (2) Annual Crop-Fallow Transition with 10–40% fallow, and (3) Grain-Fallow with > 40% fallow. The AEC classification system differs from other classification systems that have been applied in the region because distinctions among classes are based on actual land use rather than biophysical characteristics. For additional description of AECs, see Chapter 1: Climate Considerations.

biochar. A solid, carbon-rich, porous material that is generated when organic materials are heated (thermochemically decomposed) in an oxygen-limited environment.

biosolids. The materials produced by municipal wastewater treatment of organic solids, transformed through the treatment process into a product that is made up of living and dead wastewater treatment microorganisms, small inorganic particles, and insoluble compounds.

bulk density. The ratio of the mass of oven-dry soil to its bulk volume.

carbon dioxide (CO₂) fertilization. The principle that increased carbon dioxide in the atmosphere may enhance crop growth by supplying more carbon dioxide to plants.

carbon-to-nitrogen (C:N) ratio. The ratio of the mass of organic carbon to the mass of total nitrogen in soil or in organic material.

cation exchange capacity (CEC). The sum of exchangeable cations that a soil can hold at a specific pH. It is a measure of total negative charges on soil surfaces.

compaction. The physical consolidation of the soil when soil particles are pressed together, reducing porosity (pore space) between them.

conservation (tillage) systems. Management practices that reduce tillage of the soil to provide soil erosion control, soil organic matter retention or accumulation, and soil fertility improvement.

conservation tillage. Tillage systems which retain residues from the previous crop on the surface, resulting in at least 30% coverage of the soil surface after the planting of the next crop.

conventional tillage. Intensive tillage requiring four or more tillage passes a year for seedbed preparation, weed control during a fallow period, and fertilizer incorporation prior to fall planting of wheat or spring planting of other crops. This term can vary in meaning depending on geographical location and date of published information.

cover crop. A crop planted primarily to manage soil erosion, soil fertility, soil health, water, weeds, pests, or diseases in a crop rotation.

direct seeding. A form of conservation tillage where typically a 1–2 pass operation is used for seedbed preparation, planting, and fertilizing. Low-disturbance direct seed operations typically disturb less than

Glossary

40% of the row width and retain maximum residue cover, whereas high-disturbance direct seed systems may disturb up to 65% of the row width, with moderate surface residue retention. Direct seed operations resulting in greater disturbance, including up to full-width, may be classified as mulch tillage. Low-disturbance direct seeding is often used synonymously with the term no-till.

dispersion. For soils, a process in which individual soil particles are kept separate from one another in a non-aggregated state.

dockage. Weed seeds, weed stems, chaff, straw, or grain other than wheat, which can be readily removed from the wheat by the use of appropriate sieves and cleaning devices; also, underdeveloped, shriveled, and small pieces of wheat kernels removed in properly separating, properly rescreening, or recleaning. The term also may be used to describe the amount of reduction in price taken because of a deficiency in quality.

electrical conductivity (EC). The ability of a soil solution to conduct electrical current; a measure of soluble salts in soil.

element toxicity. Suppressive effect of a nutrient to crop growth and health, which occurs when a nutrient is found in excess of crop needs.

facultative. Facultative small grains or oilseeds generally have reduced vernalization requirements (the period of exposure to cold temperatures required by some plants to enter their reproductive phase) compared to typical winter-type cultivars. Facultative types may be suitable as either a winter- or spring-sown crop. In wheat, facultative types generally have less cold hardiness, a shorter, distinct vernalization period, and initiate spring growth and flowering earlier than true winter wheats.

fallow. The part of a rotation in which cultivated land is not planted.

flex cropping. Cropping systems which provide flexibility in deciding whether the land is left fallow or planted to an alternative crop.

Advances in Dryland Farming in the Inland Pacific Northwest

Decisions to grow spring or winter crops or to summer fallow would depend upon market prices, pre-planting soil water status, and weed and disease incidence.

flocculation. For soils, a process of soil aggregation.

green bridge. The presence of host plants for pests (insects and diseases) during times of the year when the crop is typically not present.

growing degree day (GDD). A measure of heat accumulation used to predict plant and pest development rates.

harvest index. The ratio of crop yield to the crop's total aboveground biomass.

herbicide resistance. The acquired ability of a weed population to survive an herbicide application that was previously known to control the population.

herbicide tolerance. The inherent ability of a species to survive and reproduce after herbicide treatment. There has been no selection acting on the tolerant weeds species, and there has been no change in the weed species' lack of response to the herbicide over time.

hydraulic conductivity. The soil's ability to transmit liquid such as water within soil.

immobilization. A reverse of the mineralization process, where inorganic ions are converted into organic forms that are not directly accessible by plants.

infiltration. Downward entry of water into the soil after precipitation or irrigation events.

inland Pacific Northwest (inland PNW). As used in this publication, the area extending from the Cascade Mountain Range in Washington and

Glossary

Oregon eastward into parts of northern Idaho (see the introduction for a map showing this area). The major area of dryland and irrigated agricultural production includes three major land resource areas with distinctive geologic features and soils as defined by the USDA: the Columbia Basin, the Columbia Plateau, and the Palouse and Nez Perce Prairies, all of which are within the Northwestern Wheat and Range Region. The area also includes a small portion of dryland cropping area in the North Rocky Mountains major land resource area, adjacent to the eastern edge of the Palouse and Nez Perce Prairies.

instars. Larval growth stages of insects.

integrated pest management (IPM). An approach to pest management combining nonchemical approaches with judicious use of pesticides to achieve economically viable pest control. Integrated weed management (IWM) is a type of IPM.

leaching. For soils, downward movement of a dissolved substance with water percolating through soil.

matric potential. A component of soil water potential that results from the combined effects of adsorptive (adhesion) forces and capillarity (cohesion) within the soil matrix to influence water retention and movement.

mineralization. Microbial breakdown of organic substances into plant accessible (inorganic) forms.

mitigation. In relation to global climate change, an effort aimed at reducing the magnitude of climate change by decreasing the cause of that change, such as by reducing greenhouse gas emissions.

nitrification. Enzymatic oxidation of ammonium (NH_4) to nitrate (NO_3) by certain microorganisms in soil.

nitrifier. Microorganisms involved in the nitrification process, such as *Nitrosomonas*, *Nitrobacter*, etc.

nitrogen supply (N supply). The total amount of inorganic nitrogen in the rooting zone, including residual inorganic nitrogen at planting, fertilizer nitrogen inputs, and net nitrogen mineralization during the growing season.

nitrogen uptake efficiency. Ratio of crop nitrogen uptake to nitrogen supply, which characterizes how well the wheat recovers the supplied nitrogen.

nitrogen use efficiency (NUE). Grain yield per unit of nitrogen supply (e.g., wheat grain yield per lb of nitrogen) which characterizes how well the wheat uses the nitrogen supply to produce grain.

nitrogen utilization efficiency. Grain yield per unit of crop nitrogen uptake, which characterizes how well wheat utilizes its recovered nitrogen to produce grain.

no-till. A form of conservation tillage where a 1-pass operation is typically used for seedbed preparation, planting, and fertilizing, resulting in minimal soil disturbance (less than 25–35% of the row width) and maximum retention of surface residue. Often used synonymously with low-disturbance direct seeding.

PAMS. An integrated pest management (IPM) approach based on Prevention, Avoidance, Monitoring, and Suppression strategies outlined as part of the Natural Resources Conservation Service (NRCS) 595 Integrated Pest Management Practice Standard.

pest. In agricultural crops, an organism that causes damage or reduces yield. Weeds, insects, and diseases are types of pests.

pH. A measure of hydrogen ion (H^+) activity in a soil solution on a logarithmic scale (0 to 14) on which 7 is neutral, higher values (> 7) are basic or alkaline, and lower values (< 7) are acidic.

precision agriculture. The management of variable field patches to achieve explicit goals such as those relating to yield, percent protein, and

Glossary

nitrogen use efficiency (NUE). Precision agriculture applies data with high spatial and temporal resolution in order to guide management decisions that are relevant to the high degree of variability associated with agricultural production.

recrop. Planting after another crop without the typical fallow period (e.g., winter wheat after spring wheat harvest).

residue-to-grain (R:G) ratio. The ratio of dry residue yield to grain yield.

resistant. As applied to diseases and insects, the ability of a crop to prevent or suppress infection and reproduction of a pest, limiting the potential for yield loss.

soil health. The capacity of soil to function in a manner that sustains biological activity, maintains environmental quality, and promotes plant and animal health. The term is often used interchangeably with 'soil quality.'

soil microbial biomass (SMB). A measure of the mass of the living component of soil organic matter composed of microorganisms.

soil structure. The arrangement of soil particles into aggregates (groups of primary soil particles) of different shapes and sizes that regulate the amount of air and water present between them.

susceptible. As applied to diseases and insects, prone to infection by and reproduction of a pest, commonly resulting in damage or yield loss.

threshold. As applied to pest control in crops, a limit beyond which pest control measures are advised.

tolerant. As applied to diseases and insects, the ability of a crop to endure infection by and reproduction of a pest, without serious damage or yield loss.

unit nitrogen requirement (UNR). The amount of nitrogen needed to produce a unit of grain, which is the inverse of nitrogen use efficiency (NUE) at the economically optimal yield. For example, for wheat UNR is the amount of nitrogen required to produce one bushel of wheat, based on a grain protein goal in combination with plant-available soil moisture and nitrogen factors.

water holding capacity. The amount of water that a given soil can hold, which is primarily controlled by soil's texture and organic matter content.

water use efficiency (WUE). Grain yield per unit of available water (e.g., wheat grain yield per inch).

weed seedbank. The species composition and density of weed seed in soil.