Agronomics and economics of no-till facultative wheat in the Pacific Northwest, USA

L.S. Bewick\textsuperscript{a,\*}, F.L. Young\textsuperscript{b}, J.R. Alldredge\textsuperscript{c}, D.L. Young\textsuperscript{d}

\textsuperscript{a}Department of Crop and Soil Sciences, Washington State University, Pullman, WA 99164, USA
\textsuperscript{b}Land Management and Water Conservation Research Unit, USDA-ARS, Washington State University, Pullman, WA 99164, USA
\textsuperscript{c}Department of Statistics, Washington State University, Pullman, WA 99164, USA
\textsuperscript{d}School of Economic Sciences, Washington State University, Pullman, WA 99164, USA

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Abstract

Winter wheat (\textit{Triticum aestivum} L.) (WW) rotated with dust-mulch summer fallow (WW/SF) has been the dominant production practice in the low-precipitation zone (<300 mm annual precipitation) of the Pacific Northwest (PNW) since the early 1900s. Over time, WW/SF has experienced several problems including severe wind erosion, increased pest problems and costs of production, and reduced crop yields. Producers need system alternatives to replace or modify the traditional WW/SF system. One proposed alternative is production of no-till facultative wheat (\textit{T. aestivum} L.) (FW). Generally, FWs have less cold tolerance, a shorter but distinct period required for vernalization, and start growing and initiate flowering earlier compared with true WWs. This study compares agronomic, economic, and soil moisture components of FW/chemical fallow (FW/ChF), FW/spring wheat (\textit{T. aestivum} L.) (FW/SW), and WW/reduced tillage SF (WW/RSF) rotations as part of an inter-disciplinary, multi-component research trial conducted near Ralston, Washington, USA. Over the 4-year study period, spring soil water content (SWC) was greater for ChF compared with RSF at all depths except 0.3–0.6 m. In the full, difference in SWC between ChF and SF disappeared at depths below 0.6 m but was less for ChF from the soil surface to 0.6 m. WW/RSF and FW/ChF were more productive, both economically and agronomically, than FW/SW, with WW/RSF being more productive than either FW rotation by a wide margin. The FW/SW rotation produced lower yields that were more susceptible to fluctuations in crop year precipitation, contained more weeds, cost more to produce, and was less profitable than either WW/RSF or FW/ChF. The FW/SW rotation was less variable than WW/RSF; however, net returns over total cost were consistently negative for FW/ChF and averaged $69.00 rotational ha\textsuperscript{-1} less than WW/RSF. Even though FW/ChF yielded and earned less than WW/RSF, the FW/ChF rotation may be a viable conservation system with cost sharing and/or further research. The yield of FW following ChF was excellent in 2002 in large-scale demonstration plots, in 2003 in the main study where it out-yielded WW, and in 2006 when FW was planted into ChF without sulfentrazone herbicide. The advantages of FW/ChF include (1) spread-out fall planting and summer harvesting operations; (2) opportunities to control problem winter-annual weeds; (3) better competition with summer annual weeds than spring wheat; and (4) a late planting date that does not rely on seed-zone soil water like WW.

Keywords: Chemical fallow; Reduced tillage summer fallow; Winter wheat; Spring wheat; Low precipitation; Soil moisture

1. Introduction

Since the early 1900s the dominant production practice in the low-precipitation zone (<300 mm annual precipitation) of the inland Pacific Northwest (PNW) has been to alternate winter wheat (\textit{Triticum aestivum} L.) (WW) with dust-mulch summer fallow (WW/SF), resulting in one crop every 2 years (Papendick, 2004). During the summer fallow period, a weed-free dust-mulch is maintained to a depth of 100–150 mm by multiple tillage operations (Thorne et al., 2003) and serves as a barrier that reduces evaporation of soil moisture below the tillage line. The summer fallow period maximizes soil water storage and reduces the risk of crop failure or uneconomical yields (Peterson et al., 1996). The WW/SF system remains the major rotation in this