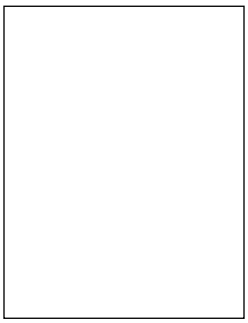

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# Compost Input Effects on Dryland Wheat and Forage Yields and Soil Quality

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## ABSTRACT

In the U.S.A., organic agricultural systems rely on organic amendments to achieve the crop fertility requirements, and weed control must be achieved without synthetic herbicides. Our objective was to determine the crop yield and soil quality effects of a transition from grass to dryland organic agriculture in the Central Great Plains of North America. This study evaluated three biennial beef feedlot compost (BFC) applications in 2010-2015: none added (control), 22.9 T $ha^{-1}$, and 108.7 T $ha^{-1}$ on two dryland organic cropping systems: A wheat (Triticum aestivum)-fallow (WF) rotation harvested for grain, and a triticale (Triticosecale)/pea (Pisum sativum)-fallow (T/P-F) rotation harvested for forage. The T/P-F biomass responded positively to the 108.7 T $ha^{-1}$ BFC treatment, but not the 22.9 T $ha^{-1}$. The WF biomass was not affected by BFC addition, but BFC increased biomass N content. Beef feedlot compost input did not increase WF grain yields, but had a positive effect on WF grain zinc content. Soil total C and N increased with the 108.7 T $ha^{-1}$ BFC addition after three applications, but not with the 22.9 T $ha^{-1}$ rate. Soil enzyme activities associated with N and C cycling responded positively to the 108.7 T $ha^{-1}$ BFC treatment. Saturated salts were high in the soil receiving 108.7 T $ha^{-1}$ of BFC, but the increase was not enough to affect crop yields. These results show that BFC is effective in enhancing forage yields, wheat grain quality, soil C, and N, as well as specific microbial enzymes important for nutrient cycling. However, the large rates of BFC necessary to elicit these positive responses did not increase grain yields, and resulted in an excessive buildup of soil P.

*Key Words*: organic agriculture, soil enzyme activity, soil carbon, soil nitrogen, triticale.

## INTRODUCTION

Dryland wheat (Triticum aestivum) in the Central Great Plains of North America is typically grown in a wheat-fallow (WF) rotation because of limited precipitation and high evaporative demand. The lack of photosynthesis during the fallow phase tends to cause soil organic matter (SOM) losses over time, degrading soil quality and productivity (Sainju et al., 2006). Organic WF systems do not use herbicides, and are further challenged because the tillage necessary for weed control can promote oxidation of SOM, as well as exacerbate soil moisture losses.

Beef feedlot composts (BFC) are a valuable resource in the Central Great Plains, and they can be used as fertilizer in organic systems. The large beef industry facilitates local compost availability. Conservation tillage and intensified crop rotations can increase SOM and improve soil physical properties, but these increases are measurable only after many years of intensive management (Benjamin et al., 2007). In