Phosphorus Fertilization of Late-Seeded Winter Wheat in a Chemical Fallow System

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Winter wheat (*Triticum aestivum* L.) is produced in the low precipitation (8 to 12 inches) zone of north-central Oregon and east-central Washington using a conventional, summer fallow system. Chemical fallow (CF) is an alternative to the traditional method of farming. Optimism about CF is tempered by an understanding that yield reductions are often a consequence of delayed (late) seeding. Late seeding of winter wheat in CF is necessary because seed-zone moisture during optimum (early) planting dates is frequently less than that required for uniform germination and emergence. Yield reductions from late seeding may be offset, to some extent, by P fertilization.

Effects of fertilization were evaluated in a 3-year field experiment conducted at three locations each year. Phosphorus applied at rates of 10 and 30 lb P_2O_5/acre increased grain yield by an average of 4.1 and 7.3%, respectively. Yield responses among sites ranged from 0 to 14% and were most pronounced on slightly acidic soils where initial soil test (Olsen) P levels were less than or equal to 12 ppm. Yield increases were correlated to improvements in early-season dry matter accumulation, early-season P uptake, and the number of spikes per unit area.

Green Pea Responses to Phosphorus, Sulfur, Boron, and Zinc

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Growers use minimal fertility inputs for legume production in eastern Washington/northeastern Oregon. In 2005, green pea growers in the Walla Walla/Milton-Freewater area expressed interest in assessing the nutrient status of fields and whether more active fertility management could increase yields. Collaborative studies involving Washington State University, Oregon State University and the USDA-ARS were conducted at one location in 2005, one in 2006 (the study failed due to non-viable seed), two locations in 2007, and two in 2008 (results pending). Composite soil samples were collected from the surface 1 foot depth prior to planting and analyzed for macro and micro nutrients by a commercial laboratory. Based on conventional methods of soil analysis all samples tested low in sulfur and boron and several tested low in zinc; levels of phosphorus, potassium, manganese, iron, and copper always tested adequate. Replicated treatments consisting of fluid 11-37-0 or dry 11-52-0 forms of phosphorus (rate = 20 lb P_2O_5/acre), dry phosphorus+sulfur (16-20-0-13/15S; rate = 20 lb P_2O_5 + 13-15 lb S/acre), and fluid phosphorus in combination with zinc (2 lb/acre) or boron (0.25 lb/acre) were evaluated each year. Green pea yield responses to sulfur and boron were common and averaged approximately 500 lb/acre above the unfertilized control. There was a 750 lb/acre yield response to zinc in one year when the soil test was low. There was no response to phosphorus application, but soil test levels did not predict a response at these sites. Overall, soil testing predicted responses to applied nutrients in the majority of situations. Relatively small investments in nutrients when the need is determined based on soil testing can result in large green pea yield increases. These results may have broader implications for dry pulse crop production throughout eastern Washington/northeastern Oregon. Many fields routinely test low in sulfur, zinc and boron, but fields are rarely sampled prior to pulse crop production and even more rarely fertilized with sulfur, boron or zinc.