Phosphorus fertilizer can increase pea and lentil yield on many Montana soils

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BOZEMAN--Applications of phosphorus fertilizer can increase pea and lentil yield, two Montana State University studies suggest.

An MSU experiment on soils containing 12 parts per million of available phosphorus in central Montana found that phosphorus fertilizer improved grain yield of spring pea and lentil by about 10 percent as long as moisture was adequate. For winter pea and lentil grown in soils with 14 parts per million phosphorus, yield and forage increases from phosphorus fertilization were less common. The research studies were conducted at MSU's Central Agricultural Research Center at Moccasin and Western Triangle Agricultural Research Center at Conrad by Chengci Chen and Grant Jackson.

"Many Montana soils are deficient in phosphorus, and many crops show significant responses to phosphorus fertilization," said Clain Jones, MSU Extension soil fertility specialist. "It is important to test soil for phosphorus to determine phosphorus fertilizer requirements."

Soil phosphorus levels may be tested using the "Olsen P" test, which tests for phosphorus levels in soils that are neutral to alkaline (pH greater than 7). Those soils predominate in Montana. When Olsen P values are greater than about 16 parts per million, adding no or only small amounts of fertilizer phosphorus (less than 15 pounds P_2O_5 per acre) is recommended, because any added phosphorus likely results in relatively small yield increases. "Olsen P levels in the major pea and lentil producing areas of the state are often 8 parts per million or lower, so these soils would likely benefit from phosphorus fertilization," Jones said.

Jones said the Montana studies showed that adding phosphorus is important to optimize legume yield.

"Application of 30 pounds of P_2O_5 per acre increased spring pea and lentil yields by 100-150 pounds per acre compared to plots that did not receive phosphorus fertilizer applications. However, application of phosphorus in very dry conditions did not increase annual legume yields," said Chen of his research. Phosphorus significantly increased winter legume grain yield in only one of eight trials and forage yield in one of six trials, "This is possibly because soil test phosphorus levels were near the critical level," Chen added.

Chen said that growing pea, lentil and chickpea in rotation with cereal crops provides many benefits to cereal-dominated cropping systems. Not only do they have great potential for Central Montana environments, but they also require minimal nitrogen fertilizer due to their ability to fix atmospheric nitrogen. However, phosphorus is necessary for nitrogen fixation to occur.

Jones said some Montana soils that have been fertilized with phosphorus and cropped for at least 20 years have been found to have significantly lower Olsen P test levels compared to non-fertilized, non-cropped soils. "This is likely due to increased plant phosphorus uptake and subsequent plant removal from fertilized and cropped soils," Jones said. "That is why it is necessary to soil test regularly to optimize crop yield."

Jones cautioned that the economics of adding phosphorus were not part of the studies. However, Montana fertilizer guidelines have long recommended adding phosphorus based on yield and economics.

"The rate of phosphorus application should be in the range of 15-30 pounds P_2O_5 per acre, but could be altered based on soil test results and cultivar selection," recommends Chen. "In low to moderate Olsen P soils (less than 12 parts per million), applications of phosphorus closer to 30 pounds P_2O_5 per acre may improve annual legume forage and grain yields, especially if other resources, such as water, are not limiting."

Summaries of both legume studies may be found at http://landresources.montana.edu/fertilizerfacts (#38 and # 40). Contact your local MSU Extension agent or crop adviser for help with phosphorus fertilizer decisions, or for additional information on soil testing, phosphorus fertilizer calculations and placement, see Nutrient Management Modules 1, 4 and 11 on the Web at http://landresources.montana.edu/nm.