MSU Extension offers pulse crop fertilization information

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Summary: Clain Jones, MSU Extension soil fertility specialist, outlines the unique soil fertility needs of pulse crops in contrast to small grains.

A high-resolution photo to accompany this story is available on the Web at: http://www.montana.edu/cpa/news/pressroom.php?id=16867

Caption: Clain Jones, MSU Extension soil fertility specialist, outlines the unique soil fertility needs of pulse crops in contrast to small grains. MSU Photo by Kelly Gorham.

BOZEMAN – Montana State University Extension Soil Fertility Specialist Clain Jones is sharing information on the unique soil fertility needs of pulse crops in contrast to the needs of small grains.

More in-depth information on the topic is available from MSU's Soil Fertility Extension website in the Montana Cool-Season Pulse Production Guide and the Pulse Crop Inoculation and Fertilization presentation.

Montana is seeing a steady increase in the acres planted to peas, lentils and chickpeas, also collectively called pulse crops, according to Jones, who works in the Department of Land Resources and Environmental Sciences in the MSU College of Agriculture. These crops have unique soil fertility needs, different from small grains, he added.

"The most obvious difference is that (pulse crops) are legumes, which can produce their own nitrogen, rather than relying heavily on nitrogen fertilizer," said Jones. "But, that doesn't mean soil nitrogen can be ignored."

Jones said that legumes rely on nitrogen fixation by rhizobia, a type of soil bacteria, which start to produce nodules on the roots around two weeks after plant emergence.

"It takes around four weeks after germination for nodules to be active, which is about the third node stage," he said. "The nitrogen up to that point needs to come from the top 12 inches of soil."

There are several factors that can limit nodulation and nitrogen-fixation, Jones said. These include saline soils, soil pH less than 5.5 or greater than 8, high levels of soil nitrate and waterlogged or dry soils.

"Nitrogen fixation can stop if the legume becomes drought-stressed," Jones said. In Montana's dryland production, this means that nitrogen fixation can be slowed by flowering, forcing the plant to rely on soil and plant stores of nitrogen for seed production, he explained.

"The trick is to have about 15 to 30 pounds total nitrogen per acre at seeding to get the plants off to a good start, but not inhibit nodulation," he said.

Producers can encourage healthy nodulation and nitrogen fixation by using and properly handling species-specific inoculant, according to Perry Miller, professor of cropping systems.

"Liquid inoculants are on the pulse seed coat so thinly that they can dry out and die between the time of coating and seeding," Miller said. He recommends granular inoculants on new fields because of their higher effectiveness over liquids or peat-based powders. For cost and handling reasons, however, he suggests liquids or peat-based powder on fields with a history of pulses.

“Inoculation is needed on fields that have never had pulses grown on them to avoid large yield losses,” Jones said. On fields with a pulse history, yield and protein responses are generally small with inoculation. Using inoculant often doesn’t pay if another factor, like disease, is controlling crop yields. This points out the need of using a seed treatment, he added.

"If you don't provide inoculant, then provide up to 10 pounds of starter nitrogen next to the seed row," Jones said. The starter nitrogen gives the seedlings a jumpstart, works as insurance against nodule loss to pea leaf weevil and, if nodules dry up, the plant can continue to produce by relying on soil nitrogen if that fertilizer has been moved to moister subsoil layers with early season rains, he concluded.

A crop with yellow lower leaves or nodules that are white or brown rather than pink to red inside has poor nodulation and, likely, a nitrogen deficiency, according to Jones. In this case, he recommends a rescue treatment of 40-50 pounds of nitrogen per acre, top-dressed up to six weeks after seeding, which may help. If nitrogen is applied later, the plants can produce too much vegetative growth, with poor pod set and delayed maturity. Yield gain may not offset the cost of a rescue treatment if weather is starting to turn hot and dry near the time of the planned rescue treatment, in which case it might be better to graze, hay or terminate as a cover crop, Jones said.

Upper yellow leaves in pulse crops indicate sulfur deficiency, according to Jones. Soil tests are not very reliable for sulfur; rather, sulfur fertilization needs to be based on either tissue tests or known response to sulfurfrom previous years, he noted.

“Elemental-sulfur can be banked at 70 pounds per acre in a rotation two to three years before the pulse crop,” Jones said. “Liquids containing sulfate can be applied to the side of the seed row at around 15 pounds of sulfur per acre. Granular or liquid sulfur sources can be used as an in-season rescue treatment at three to five pounds of sulfur per acre.”

Both phosphorus and potassium are critical for nitrogen fixation, Jones said. Fertilization guidelines for both are based on soil tests and are provided in MSU’s Montana Cool-Season Pulse Production Guide.

“The response to phosphorus varies by pulse species and variety,” Jones said. “Limited amounts of phosphorus can be seed-row placed, depending on soil type and moisture, phosphorus source and opener width. More phosphorus can be built up with a prior crop or subsurface side-banded. Potassium needs are high for pulses and should be based on soil tests.”

Producers can see the Montana Cool-Season Pulse Production Guide at http://landresources.montana.edu/soilfertility/documents/PDF/pub/MTCool-SeasPulseProd%20EB0210.pdf and a presentation on inoculation and fertilization of pulse crops at http://landresources.montana.edu/soilfertility/documents/PDF/pres/PulseInocFertJan2017.pdf.

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