MSU Ag Alert

Soil Acidity: An emerging issue that requires scouting

June 25, 2018

MSU researchers encourage crop producers and crop advisers to be on the lookout for decreasing soil pH leading to low production and sometimes crop failure. Farmers in several Montana counties are experiencing nearly complete yield loss in portions of their fields due to soil acidity (low pH). This is an emerging issue in the state, where low soil pH has traditionally not been a concern. MSU soil scientists, Extension Agents, crop advisers, and producers have now identified fields in 20 Montana counties with soil pH levels below 5.5, some as low as 3.8. MSU will be hosting a field day at the Post Farm (west of Bozeman) on July 13, where Clain Jones, Extension soil fertility specialist, will share research-based information on the topic in the afternoon.

Bulked soil sampling (containing multiple subsamples) in the top 0 to 6-inch depth across large field landscapes may not be helpful in identifying fields with soil acidity problems. Many Montana fields have wide spatial variances in soil pH. Often soil pH in low lying areas will be considerable lower than in summit hill slope positions only a 100 yards away. Also, many Montana fields exhibit pH differences of up to 3 units (e.g. 5 to 8) between the surface and 18 inches down. Because the lowest pH is generally in the top 2 to 3 inches of soil, this low pH may be masked by collecting soil samples in a standard 0 to 6-inch depth increment.

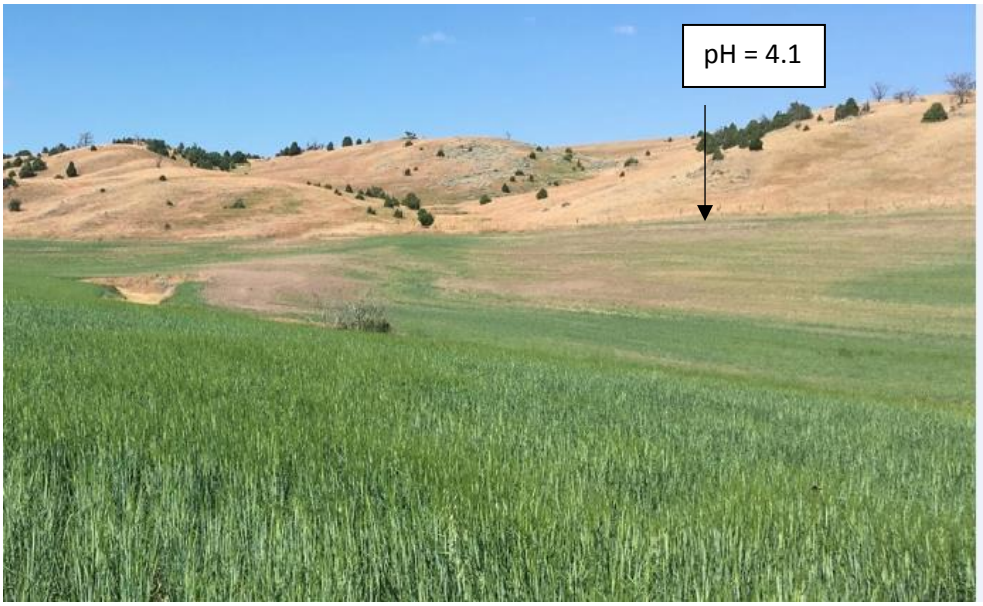
At pH levels below 5.0, naturally-occurring soil metals like aluminum and manganese become more soluble and can stunt root and shoot growth. Young plants in acidic areas are often yellow (similar to nitrogen deficiency, yet less uniform) or even pink with club or “witch’s broom” roots (similar to nematode damage). Substantial yield losses occur at pH levels below 4.5. The most sensitive cereal crops appear to be barley and durum, followed by spring wheat. Legumes can develop nitrogen deficiency in low pH areas before they exhibit aluminum toxicity because nitrogen fixation is impacted below about pH 6 (see photograph below).

Acidity problems usually start in low lying areas of a field, where yield has historically been high, and acidity symptoms spread outward. Producers are encouraged to look at pH values in top 6-inch soil tests. If the pH is consistently above 7.5, it’s unlikely the field has a problem. If pH is below 6.0, the producer should consider sampling different topographic areas of their fields. If pH is between 6 and 7.5, a judgement by the crop adviser and/or producer will need to be made if additional soil sampling or scouting is worthwhile. Surface soil pH can vary more than 2 pH units over short distances (< 100 yards). For example the soil pH in low lying areas may be less than 5, and then abruptly change up a small hill/slope. Soil sampling is recommended even if no symptoms are observed, because once low pH symtoms are observed, yield has likely been lost.

On fields where standard bulked soil test pH levels are below 6.0 scout for yellow seedlings and club roots. To verify that those symptoms are caused by low pH, the top 3 inches of soil can be analyzed for pH, either with a field pH stick, probe, color strips, or lab analysis. Soil in the zone at the edge of poor growth areas should also be sampled to determine if the pH is close to toxic on the margins but crops do not yet exhibit symptoms. The potential is there for problem areas to grow in size. Areas where pH is less than 6 should be managed differently to prevent further acidification.

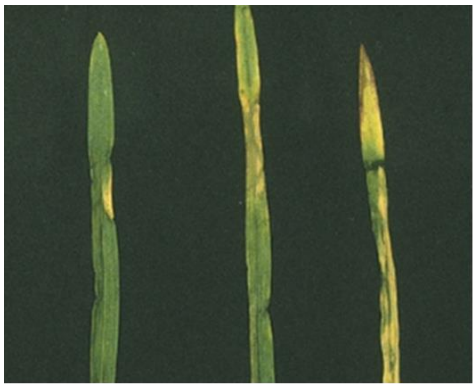
Based on regional research, the major cause of acidification appears to be ammonium fertilizers, including urea, applied in excess of crop uptake. No-till concentrates the acidity near the surface where fertilizer is applied. A cooperative research study led by Rick Engel (LRES) and including Dr. Jones, and people from the Central Ag Research Center, the Montana Salinity Control Association, Chouteau County Extension, Chouteau County Conservation District, and producers is in progress to develop prevention, mitigation, and adaptation options for Montana croplands.

For additional information on cropland soil acidification, go to http://landresources.montana.edu/soilfertility/acidif/index.html or contact Clain Jones at mailto:clainj@montana.edu, 406-994-6076.



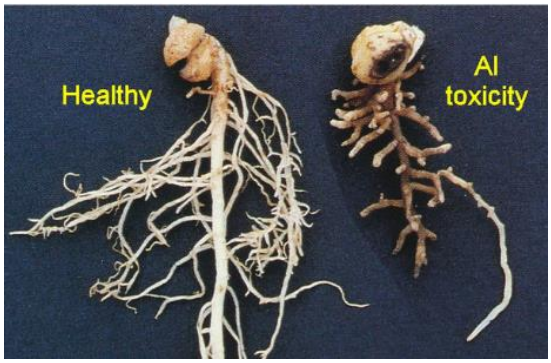
Gallatin County field with areas of low pH. Courtesy Clain Jones

MORE PHOTOS ON NEXT PAGE



Yellowing leaves from Al toxicity.
Courtesy CIMMYT.org

Stunted growth and club roots from Al toxicity.
Courtesy Rick Engel



Healthy and stunted field pea roots.
A. Robson. https://agric.wa.gov.au/n/4487

Lentils in the background are greener and larger (lime added, soil pH 5.5 to 6.0) vs. foreground (unlimed, soil pH 4.5 to 4.9). Courtesy Rick Engel.