

Pre-plant Soil Testing for Small Grains

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Pre-plant soil sampling is critical for profitable crop production. Soil analysis can help decide pre-plant fertilizer application, whereas plant tissue analysis is appropriate for post-plant N application decisions. To collect soil samples, one can use a sampling probe, auger, or small shovel. In a uniform field, a composite sample consisting of at least 20 representative soil cores should be collected from the top 6 inches of the soil. The more soil cores are taken, the more representative the sample will be for the field. When the field is not uniform or if the field is larger than 40 acres, one can divide the field into sections and take soil samples from each for possible individual management decisions. Pre-plant soil samples should be collected with adequate time to receive test results to plan your fertilizer program.

Typically samples are dried before being submitted to a lab. After soil samples are collected, spread soil on clean paper in a clean and dry area to dry for 2-3 days. Do not dry in places where sample may be contaminated (i.e. dust, fertilizer). Do not heat the samples in a kitchen oven because it might alter soil chemical properties (Walworth, 2011). Be sure to label your sample to identify field location. It is a good idea to find out preferred sample handling methods by contacting your soil testing lab.

Most laboratories conducting soil and plant analysis in Arizona (Schalau, 2010) should be able to return results of soil analysis in one to two weeks. A full nutrient analysis includes some soil properties (such as pH and electric conductivity), soil macro-nutrients (N, P, K, S, Ca, and Mg), and other plant essential nutrients (such as Fe, Mn, B, Mo, Cu, and Zn). Detailed explanations of soil analysis are included in publication “*Soil Sampling and Analysis*”. **In most areas in Arizona, growers need to pay attention to N and P particularly.**

Pre-plant N application is not necessary if soil nitrate-nitrogen (NO₃-N) concentration is higher than 10 ppm (Ottman and Thompson, 2006). Applying pre-plant N fertilizer while there is enough N in the soil for early growth could result in N leaching out of the root profile. When soil NO₃-N is less than 5 ppm, 50-75 lb/acre of pre-plant N is recommended. When non-legume residue is incorporated before planting, N could be tied-up by soil microorganisms. In this case, add 15 lb N/acre per ton of residue, up to an additional 50 lb/acre of N.



Fig. 1. A, soil sampling using augers with a mark of 6-inch depth, and B, small shovels with depth marks for soil sampling

Table 1. Pre-plant soil NO₃-N and sodium bicarbonate extractable P levels and recommended N and P fertilizer rate at planting.

Soil NO ₃ -N (ppm)	N fertilizer rate (lb N/A)	Soil P (ppm)	P fertilizer rate (lb P ₂ O ₅ /A)
0-5	50-75	0-7	50-100
5-10	0-50	7-13	0-50
>10	0	>13	0

Phosphorus fertilizer is not needed if sodium bicarbonate extractable P (Olsen P) level in the soil is greater than 13 ppm. When soil P is less than 7 ppm, 50-100 lb/A of pre-plant P₂O₅ is recommended (Ottman and Thompson, 2006). When soil P level is higher than 13 ppm, grain yield response to P fertilizer is unlikely. Pre-plant soil testing is especially important, because most P fertilizers need to be applied before planting and incorporated into the soils.

Deficiencies of other nutrients in small grains have not been documented in Arizona. There are plenty of K, S, Ca, and Mg in most soils and/or irrigation water in Arizona. Application of these nutrients and micro-nutrients should be based on soil or plant tissue analysis results and be economically justified.

Also see:

- Ottman, M. and T. Thompson. 2006. *Fertilizing small grains in Arizona*. <http://cals.arizona.edu/pubs/crops/az1346.pdf>
 Schalau, J. 2010. *Laboratories conducting soil, plant, feed or water testing*. <http://ag.arizona.edu/pubs/garden/az1111.pdf>
 Walworth, J.L. 2011. *Soil Sampling and Analysis*. <http://ag.arizona.edu/pubs/crops/az1412.pdf>

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