NUTRIENT SURVEY OF WHEAT

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This study was initiated in 1999 to see if there is any secondary or micronutrient that is deficient in wheat in Kentucky.

Since soil tests are not highly reliable for secondary and micro nutrients, plant concentration of these nutrients in the plant are a more reliable indicator of any of these nutrient problems. Sampling as late as possible (just prior to flowering) improves the chances of a better test.

METHOD:

Twenty fields were chosen across Kentucky that represent the wheat growing counties. The fields had little or no history of secondary or micronutrient applications. Twelve were surveyed in 1999 and eight in 2000. Areas in each field approximately 150 ft by 450 ft were chosen for intensive soil and plant sampling. Soil samples were taken from the areas at least 60 days after fertilization. Sampling depth was 0 to 6 inches for fields that had been tilled and 0 to 4 inches for fields that were no-till planted to wheat.

The plants were sampled at initial heading just prior to flowering. The flag leaf was taken on 100 to 150 plants in the sample area. The leaves were dried and ground soon after collection and then analyzed for nutrient concentration.

RESULTS AND DISCUSSION:

The plant nutrient concentrations are found in Table 2 and the soil test results are in Table 3.

Below is the sufficiency range for the plant nutrient concentration for wheat flag leaf at head emergence.

TABLE 1. GENERAL TOTAL NUTRIENT SUFFICIENCY RANGES FOR SELECTED CROPS IN THE SOUTH AT OR NEAR REPRODUCTIVE GROWTH (TAKEN FROM NUMEROUS PUBLISHED SOURCES).

Nutrient	N	P	K	S	Ca	Mg	Fe	Mn	Zn	Cu	B
Concentration	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm
Wheat (flag leaf)	3.0 to 4.5	0.25 to 0.5	1.5 to 3.0	0.20 to 0.5	0.30 to 1.0	0.16 to 1.0	25 to 300	20 to 475	16 to 70	6 to 25	6 to 20

This is the sufficiency range which means there is absolutely no problem with the amount of nutrients in the plant. One can be a little below these concentrations and not have a problem.

There is a critical range below the values shown above at which one might become concerned that the nutrient might actually be reducing yields.

The concentrations in Table 2 show absolutely no problem on any field for Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), Sulfur (S), Iron (Fe), and Manganese (Mn). All of the samples are in or very near to the sufficiency range. Sulfur, which is sometimes suspected of being deficient, was again very sufficient in both 1999 and 2000. This indicates that all these fields have a good supply of sulfur. Although a sulfur soil test is not a very reliable test, when more than 20 lb/ac of S is in the soil it is considered sufficient. All of the fields had more than this in the surface soil sample in 1999.

The remaining nutrients are Zinc (Zn), Copper (Cu) and Boron (B).

Only one sample had less than 16 ppm of Zn (Mashburn in Caldwell Co.). The 12 ppm is not critically lot, but indicates that it is on the low side, but is probably not reducing yields. The soil test results from this site show a high pH and a very high P content. Both of these will reduce Zn availability. The Zn soil test on this site was high and should be sufficient to supply adequate Zn to small grains and corn (which is the most sensitive crop).

Thirteen of the 20 sites were below the 6 ppm sufficiency range for copper (Cu). However, only 2 of the 20 sites were in the critical range (below 3 ppm). These 2 sites were slightly below the critical level and may not present a problem on these soil types. Copper deficiencies are very uncommon in mineral soils and mainly occur on organic soils.

Boron (B) is the most interesting nutrient studied. Most of the sites (18 of 20) were below the sufficiency range (below 6 ppm). There were 6 sites below the critical range (3 ppm). Even though there are some sites in this range, Dr. Jim Woodruff of U.S. Borax points out, that is very difficult to get a response to wheat from boron fertilization and very few yield increases have been reported. It is difficult to get a yield response from B applied to the soil. Some states recommend 0.25 lb/ac of foliar B at about heading and it can be applied with a fungicide. If this is done, it should be applied as a test strip because response is not assured.

Future Directions

This is the second year for this study and the results are very similar. The only secondary or micronutrients that showed any concern is boron. Low values occurred both years. It is very questionable if boron is having effect on the yield, but we will probably begin some boron testing in 2001 to look at any possible response from the application of boron.

TABLE 2. NUTRIENT CONCENTRATION OF THE WHEAT FLAG LEAF JUST AT INITIAL HEADING IN 1999 AND 2000											
	Plant Nutrient Concentration										
County	**N**	**P**	**K**	**Ca**	**Mg**	**S**	**B**	**Cu**	**Fe**	**Mn**	**Zn**
	---------- % ----------						---------- ppm ----------				
1999											
Caldwell											
Cotton	4.2	0.30	1.8	0.65	0.16	0.44	3.2	5.1	93	128	19
Mashburn	3.6	0.40	1.5	0.60	0.21	0.34	3.7	6.2	69	56	12
Calloway											
Kelly	3.7	0.33	1.4	0.53	0.20	0.33	3.2	4.5	94	65	16
Furches	3.7	0.39	1.5	0.64	0.14	0.37	3.0	3.8	85	74	17
Fulton											
Burnette (Casey)	4.6	0.41	1.6	0.85	0.25	0.44	2.8	5.9	104	44	21
Burnette (Jersey)	5.1	0.34	1.5	0.71	0.31	0.56	3.5	7.3	95	120	22
Hancock											
Boswell	4.1	0.38	1.7	0.62	0.21	0.46	3.9	7.5	101	129	22
Myer	4.2	0.37	1.6	0.50	0.17	0.44	3.0	6.4	82	59	20
Hardin											
Rogers	3.5	0.30	1.7	0.66	0.16	0.40	3.0	4.3	90	111	17
Wooden	3.6	0.39	1.7	0.43	0.12	0.29	2.3	6.3	92	67	19
Simpson											
Carter	3.3	0.37	1.5	0.69	0.21	0.36	6.6	6.2	74	105	26
Snyder	4.2	0.40	1.5	0.71	0.20	0.43	7.6	5.1	87	124	23
2000											
Fulton											
Sanger	3.9	0.32	1.2	0.68	0.23	0.3	2.9	2.6	79	48	24
Wilson	4.1	0.48	2.1	0.65	0.2	0.4	2.8	3.8	106	68	19
Christian											
Arnold (Site 1)	3.8	0.37	1.8	1.5	0.19	0.34	2.5	4.9	99	100	21
Arnold (Site 2)	3.8	0.37	1.7	0.68	0.22	0.33	2.4	4.6	99	91	23
Todd											
Gray (Site 1)	3.9	0.35	1.8	0.73	0.18	0.36	3.4	2.7	90	96	21
Gray (Site 2)	3.7	0.34	1.6	0.76	0.26	0.4	3	3.8	93	107	21
McLean											
Howard	3.7	0.32	1.8	0.54	0.13	0.37	3	3.5	107	73	19
Hayden	4.1	0.34	1.8	0.85	0.34	0.46	3.6	6.9	113	421	28

TABLE 3. SOIL TEST RESULTS OF THE AREAS IN EACH FIELD THAT WERE SAMPLED FOR FLAG LEAF NUTRIENT CONCENTRATIONS								
		Extractable Soil Nutrients (lb/ac)						
County	**Sample Depth (inches)**	**pH**	**P**	**K**	**Ca**	**Mg**	**S**	**Zn**
1999								
Caldwell								
Cotton	0-6	6.6	100	408	3740	209	32	1.3
	12-18	6.1	2	258	2600	332	54	0.2
Mashburn	0-6	6.9	201	260	3310	151	26	4.9
Calloway								
Kelly	0-6	6.5	69	229	3210	129	66	0.8
Furches	0-6	6.8	197	359	3430	126	44	2.5
	12-18	6.3	16	227	2350	74	18	0.0
Fulton								
Burnette (Casey)	0-6	6.7	166	309	3530	206	52	5.0
Burnette (Jersey)	0-4	6.2	95	279	3290	356	68	3.8
	12-18	4.8	36	245	1750	498	42	0.6
Hancock								
Boswell	0-6	7.0	99	257	3200	139	38	1.4
Myer	0-6	6.7	135	311	3740	203	48	2.3
Hardin								
Rogers	0-4	7.0	100	264	2840	188	26	2.3
	12-18	6.3	3	178	2450	84	46	0.2
Wooden	0-6	6.9	148	357	3530	187	24	1.5
Simpson								
Carter	0-6	6.5	124	286	1570	133	28	12.0
Synder	0-6	5.7	184	369	1720	150	30	8.5
	12-18	5.5	6	247	2070	191	40	00
2000								
		pH	P	K	Ca	Mg	B	Zn
Fulton								
Sanger	0-4	6.2	75	408	5715	792	1.5	6.5
Wilson	0-4	6.8	75	322	3492	188	1.1	3.7
Christian								
Arnold (Site 1)	0-6	7.0	68	311	3865	149	0.9	3.8
Arnold (Site 2)	0-6	6.6	53	282	4225	238	1.2	3.9
Todd								
Gray (Site 1)	0-6	6.8	246	426	3305	127	1.3	8.0
Gray (Site 2)	0-6	6.7	84	234	3329	245	1.0	1.7
McLean								
Howard	0-6	6.9	168	561	2669	182	1.3	5.1
Hayden	0-6	5.7	134	345	1799	173	1.3	1.8