

# Nutrient Removal by Alabama Crops

Nutrient removal should be an important consideration in overall soil fertility management for Alabama farmers. However, fertilizing based solely on nutrient removal could lead to nutrient deficiencies or result in overuse of some fertilizer nutrients. The behavior of each nutrient, soil properties, and crops to be grown must also be considered.

**NITROGEN:** Crop removal indicates a minimum amount needed. Leaching and denitrification of fertilizer nitrates may result in as much as 50 percent fertilizer nitrogen lost. Some nitrogen may be supplied from organic matter in the soil, but this amount is usually small in Alabama soils. Soil microorganisms can also tie up soil nitrogen as fresh organic residues decay. Legumes obtain all of their nitrogen requirements through fixation of atmospheric nitrogen by Rhizobia bacteria in nodules on the roots. Although legumes such as soybeans, peanuts, and alfalfa remove large quantities of nitrogen, as much as 100 pounds per acre of nitrogen are returned to the soil in the crop residue.

**PHOSPHORUS:** Crop removal is not a good indicator of fertilizer phosphorus needs. Well-fertilized soils have an abundant reserve of soil phosphorus which is available to crops. Since phosphorus does not leach, it can build up to very high levels in well-fertilized crops. However, any factor which inhibits root growth can also limit phosphorus uptake even in "high" phosphorus soils. On the other hand, high rates need to be applied to soils testing low in phosphorus because a large portion of the fertilizer phosphorus is tied up by soil iron, aluminum, and calcium.

**POTASSIUM:** Fertilization based on crop removal works better for fertilizer potassium than any other nutrient. In most Alabama soils, some leaching of potassium results in less than 100% fertilizer efficiency. Mineralization of potassium from primary soil minerals and organic residues occurs, but this may not be large enough for high-yielding crops. Fertilizer potassium will also accumulate in clayey soil horizons (subsoils) underlying sandy surface soils. If crop removal of potassium is greater than fertilizer applied, deficiencies can occur on succeeding crops. This is particularly serious where cotton, soybeans, or peanuts follow a poorly fertilized grass forage crop. Grasses are efficient users of soil potassium and can deplete soil reserves.

**CALCIUM AND MAGNESIUM:** Crop removal is seldom a consideration with these two nutrients because properly limed soils contain excesses of calcium and magnesium. Some crops such as peanuts, peppers, and tomatoes

have special calcium needs and may require the addition of calcium on some soils beyond what the crop actually removes.

**SULFUR:** Crop removal of sulfur could be used as a fertilizing guide on deep, sandy soils which retain very little sulfur. However, most Alabama soils contain adequate sulfur as sulfate in the clayey subsoil. Rainfall deposits around 10 pounds per acre of sulfur each year from atmospheric sources. Combine this with sulfur mineralized from organic matter, and enough sulfur is available for Alabama crops. However, fertilizing according to crop removal would be good insurance on sandy soils. It is recommended that all crops receive about 10 pounds of sulfur per acre per year in the fertilizer or in pesticide applications.

**BORON:** Boron is not retained by sandy surface soils so it must be added annually to those crops sensitive to boron deficiencies. Crop removal is a reasonable estimate of need, but practicality and leaching dictate using several times this much. Cotton, peanuts, reseeding clovers, alfalfa, and vegetable crops often require boron fertilization on sandier soils.

**COPPER, IRON, MANGANESE, AND ZINC:** The availability of these micronutrients has little to do with crop removal. They are needed in extremely small quantities and often, as is the case with iron, the soil contains thousands of times more than the crop needs for maximum production. Soil properties such as pH and organic matter govern micronutrient availability to plants.

The following table can be used as a guide for establishing crop removal. Yields are for high-yielding Alabama crops. Values reported in this table may differ from values from other sources. Healthy, high-yielding crops can vary considerably in the nutrient concentration in the grain, fruit, leaves, stems, and pods. Plant "uptake" is also higher than crop "removal." Nutrients not actually removed from the land are returned to the soil in organic residues. Crop removal should be adjusted in proportion to the actual yield.

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ECP, 3.5M, Revised Oct 1999, ANR-449

Nutrient Removal by High-Yielding Alabama Crops

Crop	Yield Per Acre	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Ca	Mg	S	B	Cu	Fe	Mn	Zn
Alfalfa Hay	8 tons	415	94	401	151	36	26	0.43	0.11	1.67	0.45	0.30
Bahia or Bermudagrass Pasture	200 lb. beef	6	5	1	...	...	...	...	...	...	...	...
Bermudagrass Hay	8 tons	400	92	345	48	32	32	0.13	0.02	1.20	0.64	0.48
Cabbage (Heads)	10,000 lbs.	32	9	32	4	2	16	0.03	0.01	0.04	0.02	0.02
Corn, Grain	180 bu.	170	70	48	15	16	14	0.12	0.06	0.15	0.09	0.15
Stover	8,000 lbs.	70	30	192	27	34	16	0.05	0.05	0.90	1.50	0.30
Corn Silage	16 wet tons	160	67	160	28	33	20	0.11	0.07	0.70	1.06	0.30
Cotton, Lint & Seed	2 bales-- (2,600 lbs.)	63	25	31	4	7	5	0.03	0.18	0.06	0.33	0.96
Burs, Stalks & Leaves	3,000 lbs.	57	16	72	56	16	15	0.02	0.05	0.12	0.06	0.75
Fescue or Ryegrass Pasture	300 lb. beef	9	7	1	...	...	...	...	...	...	...	...
Oats, Grain	100 bu.	80	25	20	3	5	8	...	0.04	0.80	0.15	0.06
Straw	2.5 tons	35	15	125	10	15	11	0.05	0.04	0.15	0.15	0.36
Peanuts, Nuts	4,000 lbs.	140	22	35	6	5	10	...	0.04	0.04	0.30	0.25
Vines	5,000 lbs.	100	17	150	88	20	11	0.02	0.02	0.20	0.15	...
Peas, Vines & Pods	5,000 lbs.	120	31	62	175	15	12	0.04	0.06	0.60	0.40	0.02
Clover	2 tons	80	20	80	55	14	6	0.05	0.02	1.00	0.44	0.28
Potatoes (Sweet)	300 bu.	40	18	96	4	4	6	0.05	0.02	0.20	0.06	0.03
Vines	...	30	4	24	...	5	...	...	...	...	...	...
Potatoes (White)	30,000 lbs.	90	48	158	5	7	7	0.08	0.06	0.08	0.14	0.08
Vines	...	61	20	54	...	12	7	...	...	...	...	...
Sorghum, Grain	135 bu.	107	60	30	5	9	6	...	0.01	...	0.05	0.05
Stover	3.75 tons	106	30	170	36	23	22	0.06	0.04	0.56	0.18	0.22
Sorghum-Sudan Hay	4 tons	160	61	233	30	24	23	...	...	...	...	...
Soybeans, Beans	50 bu.	188	41	74	19	10	23	0.06	0.05	0.50	0.06	0.05
Leaves, Stems & Pods	6,100 lbs.	89	16	74	30	9	12	...	...	...	...	...
Tobacco, Leaves & Stalks	3,000 lbs.	126	26	257	75	24	19	0.05	0.03	0.25	0.55	0.07
Tomatoes, Fruit	300 cwt.	50	12	108	3	14	20	...	0.07	1.30	0.13	0.16
Vines	...	40	13	60	...	...	...	...	...	...	...	...
Wheat, Grain	80 bu.	92	44	27	2	12	5	0.06	0.05	0.45	0.14	0.21
Straw	6,000 lbs.	42	10	135	9	12	15	0.02	0.02	1.95	0.24	0.08

Prepared from data from The Fertilizer Institute, Phosphate and Potash Institute, and independent research sources.