NEWS & VIEWS

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Nutrient Management for Top-Profit Soybeans

SOYBEAN nutrient requirements for optimum growth are very site-specific. With developing global positioning systems (GPS) and Geographic Information Systems (GIS) technology, growers can utilize more science based information to make better decisions relating to nutrient management and its interactions with other production practices. This technology is being fit to the long growing season in the Southeast and it lends itself to double cropping soybeans after the harvest of small grains.

Higher soybean yields are possible in most fields. Growers in the Southeast have proven that 70 bushel wheat can be followed by 45 bushel soybeans. Higher yields through improved management are fundamental to lowering the unit cost of production and generating higher profit per acre. Also, profit potential can be improved by double cropping soybeans after small grain. This generates two crops in one year and allows better use of labor, equipment, residual fertility, and other resources.

A highly productive soil is also a fertile soil. Soil testing is the best way to monitor soil acidity and phosphorus (P) and potassium (K) nutrient levels. Aglime should be applied and incorporated into the root zone at least three months before planting to effectively neutralize soil acidity. Soybeans need for the soil pH to be adjusted to about 6.5. Target medium to high soil test levels for P and K.

Nutrient requirements increase with yield level. The total quantity of nutrients absorbed by an acre of soybeans yielding 50 bushels of grain is presented in **Table 1**. For higher yield levels, nutrient uptake values can be estimated from the line showing the nutrients needed for each additional bushel of yield goal. A part of this amount will be supplied from soil nutrient reserves and the remainder from fertilizer applied prior to critical stages of plant growth. High-yield field research which correlates crop response to applied nutrients is vital for determining fertilizer needs.

Build soil fertility before shifting to minimum tillage. Why? Because lime works best when mixed into the crop root zone. Likewise, medium to high soil test levels for P and K are desired. A well limed and fertile soil allows better root development and improved crop use of available soil moisture and efficient use of applied fertilizer.

Soybean nutrient uptake continues throughout the season. Any restriction in root growth, decline in the rate of photosynthesis, or serious nutrient shortage can prevent the full development of a soybean's genetic potential. The goal is to supply each plant with its specific needs throughout the season. As shown in **Table 2**, nearly two thirds of the P and K are absorbed after plants reach full bloom. Thus, mid to late season soybean nutrition deserves special attention. Timing and method of application of nutrients will vary from field to field depending upon soil characteristics, the cropping system, weather patterns, and yield potential.

Table 1. Nutrient uptake by soybeans yielding 50 bushels per acre.

	N	P_2O_5	K_2O	Ca	Mg	S	B	Micronutrients
Total, lb/A	257*	48	187	49	19	23	Trace	Trace
Pounds/bushel	5.14	0.96	3.74	0.98	0.38	0.46	"	"

*Soybeans get most of their N from the air.

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Table 2. Nutrient and dry matter accumulation during various stages of soybean growth.

Growth stage	Days in period	Dry matter	N	P_2O_5	K_2O
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Emergence to full bloom	60-70	30	30	30	33
Full bloom through early pod development	12-15	25	25	25	34
Pod filling to maturity	35-45	45	45	45	33

Soybeans accumulate N, P, and K in pods and seed more than in the leaves and stems (**Table 3**). Although P is especially important for early season root development, more than 60 percent ends up in the pods and seed. Demand for N and P is greatest as pod and seed development takes place. Nitrogen is needed for the high protein seed while P compounds deliver the energy needed for seed formation. Peak absorption of K takes place from flowering through early pod development and can range from 5 to 8 pounds per acre per day. Since K is not a fixed part of any plant compound, it is more uniformly distributed within the plant.

Table 3. Nutrient accumulation in soybean plant parts at physiological maturity.

Plant part	N	P_2O_5	K_2O
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Leaves	23	16	25
Petioles	3	6	14
Stems	8	14	22
Pods & seed	66	64	39

Soybean nutrient adjustments following small grain. Double cropping soybeans and small grains places a greater urgency on timeliness of operations and requires an adjustment to several nutrient management practices. Many of these changes focus on the need for early maturity and harvest of the small grain followed by immediate planting and rapid emergence of vigorously growing soybean seedlings. Consider the following when planting soybeans behind a small grain crop.

Harvest small grain as early as possible. Soybeans need those early days for vegetative growth (height) and more time for pod set and seed development.

Select varieties with a good performance record. Use certified seed of the best maturity group for the area. Consider the emerging technology of genetically engineered seed which allows significant changes in the management and control of insects and weeds.

Narrow the rows with late planted beans. This allows the short plants to close the row early to reduce weed growth and improve light and water use efficiency.

Minimum tillage saves time and soil moisture. Good seed contact with moist soil is vital. Consider a light irrigation, if available, to speed seed germination and seedling growth.

Nitrogen can jump start soybean seedlings. Nodules start producing N after about two weeks. So, 20 to 30 lb/A of N should do the job. Too much N can reduce nodule effectiveness.

Phosphorus is vital for high yield soybeans. It can be banded or applied preplant. Also, it can be applied to the previous wheat crop. Soils should test at least medium and preferably high if residual fertility is to supply high yield soybean nutrient needs.

Potassium needs are greatest during early pod fill. Half of the K might be applied with P, either preplant or to the previous wheat crop. The rest needs to be sidedressed before the pods begin to fill. For sandy soils in heavy rainfall regions, consider half of the K applied preplant and the rest sidedress at first flower or before the rows close.

Sulfur is essential for plant protein formation. Except for very sandy soils, sulfur (S) needs of the soybean crop could be applied to the previous small grain crop.

Boron (B) promotes new tissue growth in plants. It also helps transfer sugars from leaves to seed storage. Recent research revealed that soybean yield was improved by a quarter pound of B mixed with the insecticide Dimilin (control of velvet bean caterpillar) and foliar applied at early pod set.

Scout each field early and often. Early detection allows for early correction of many production problems. GPS/GIS technology now allows problem areas to be geographically located for precise treatment or development of improved management practices for future cropping systems. Remote sensing technology will soon allow crop stress detection before the eye can see it. Soil, plant leaf, and/or petiole sampling and laboratory analysis remain a dependable set of tools for establishing the cause(s) for problem areas in a field.

Good nutrition provides soybean stress protection. Every season soybeans must cope with stress. Healthy plants are more resistant to disease, tolerant to temperature and moisture extremes, and competitive with combatant weeds.

Nutrient management is an excellent investment. A well planned soil fertility program is a major pathway to profitable soybean production. A knowledge of what the nutrients do, which ones are needed, how much to apply, and when to apply them becomes an important part of the management package for success. Even a good fertility program will be inefficient and costly if it is not coupled with a management system capable of integrating and balancing all of the controllable inputs. ■