

Organic Hay and Your Farm's Nutrient Budget

Rick Exner, Dec., 2006

Background: Organic farmers pay close attention to their farm's nutrient balance because replacing exported nutrients is more costly and inconvenient than in conventional agriculture. However selling organic hay draws down soil potassium reserves four times more rapidly than the average for corn and soybeans.

Objectives: Examine costs and nutrient sources to balance the potassium nutrient budget without over-fertilizing other nutrients.

Conclusions: Combinations of manure and purchased organic fertilizer may be the most economical and precise way to balance the farm's nutrient budget. Soil testing provides farmers the information to make these decisions.

Note: Thanks to everyone who participated in the listserv discussion on this topic.

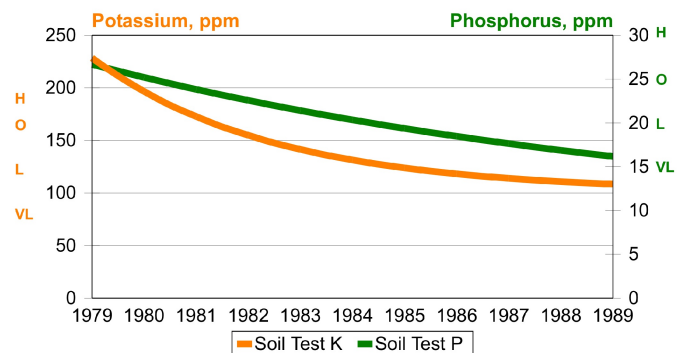
For organic farmers, the rapid development of new markets is generally a good thing, but the new opportunities can affect how their farming system works. Take organic hay. Demand for organic feed is strong thanks to, for instance, the explosion in demand for organic milk. Organic producers who have previously sold only grain and livestock now have opportunities to sell hay as well. This may have unforeseen consequences unless they keep in mind the farm's nutrient budget.

A nutrient budget is simply the balance of nutrients entering and leaving the farm. [Note for non-farmers: the "macronutrients" most often added to crops are nitrogen (N), phosphorus (P), and potassium (K).] Sustainably-minded farmers generate nitrogen right on the farm through N-fixing legume crops like clover and alfalfa. Phosphate (the agricultural form for phosphorus calculations) and potash (the agricultural form for potassium) are different. These nutrients are not generated on the farm. Certainly they can be efficiently recycled through manure and crop residues. Moreover, deep-rooted crops can tap additional resources of these nutrients. But what you have is what you have. When crops and livestock are sold, they take nutrients off the farm. The graph shows how soil phosphorus and potassium declined to low equilibrium values over 11 years of a corn-soybean rotation without any P and K inputs.

Organic farmers are accustomed to balancing these lost nutrients with fertilizer and manure purchased from off the farm. But while alfalfa has phosphorus needs similar to corn and soybeans, it uses *four times as much potassium* as those crops. A 5-ton hay crop can withdraw 250 pounds of potash per acre from the soil "bank." The table shows typical fertilizer costs for potassium fertilizers acceptable (except for conventional KCl) to organics.

Phosphorus and Potassium Decline

Corn-soybean rotation, unfertilized



Northeast Research Station, Nashua. Field-moist samples. Bray -1 P test; ammonium acetate K adjusted to dry sample basis.

Materials costs[§], 5T alfalfa potash balanced.

	price/lb potash	cost/250 lbs
greensand:	\$5.00	\$1,250
potassium sulfate:	\$0.45	\$112.50
mined KCl:	\$0.26	\$65
conventional KCl:	\$0.22	\$55

[§] Application costs not included.

Probably the majority of organic farmers balance their nutrient budget not with these fertilizers but with purchased manure. Manure is sometimes cheaper than amending individual nutrients, plus manure builds organic matter and stimulates soil biology in general. However, because manure contains multiple nutrients, producers may not be able to meet alfalfa's potassium needs entirely with manure unless they over-fertilize the crop in one or more other nutrients.

The applicator of manure must have a nutrient management plan if they have 500 animal units in confinement or 1,000 animal units in an open feedlot. That means there are limits on the amount of nitrogen and phosphorus they can apply to their own or customers' fields, based on crop needs, the recently introduced phosphorus index, and other factors. Even small farmers have a nutrient management plan if they have applied for an EQIP (Environmental Quality Incentives Program) grant. The table below shows: 1) how much of typical manures could be used to meet alfalfa NPK nutrient needs; 2) which nutrient(s) (bolded) would determine the maximum rate; and 3) the resulting deficit or surplus balance (\pm) of the other nutrients.

Manure amounts to balance alfalfa nitrogen or potash crop removal per acre.

		Nitrogen	Phosphate	Potash
		(lbs. nutrients removed)		
Corn-Soybean avg.:		179	56	61
Alfalfa, 5T:		250	60	250
		(lbs. nutrients added)		
Beef, concrete lots, 400 sq'/head				
tons:	35.7	214	71	250
		balance:	+11	0
Swine, pit, finishing, dry feed, no phytase				
thousand gal:	5.0	250	175	125
		balance:	+115	-125
Swine, concrete lots, 50 sq'/head				
tons:	16.7	250	83	167
		balance:	+23	-83
Swine, grow-finish, confined				
tons:	17.9	250	161	196
		balance:	+101	-54
Swine, finishing, hoophouse				
tons:	16.7	250	117	250
		balance:	+57	0
Swine, finishing, hoophouse, composted				
tons:	12.5	250	150	250
		balance:	+90	0
Poultry, layer, 4 lbs				
tons:	5.0	175	400	250
		balance:	+340	0
Poultry, broiler, litter, 2 lbs				
tons:	3.8	250	250	173
		balance:	+190	-77

Many of these manure applications do not fully meet alfalfa's need for potassium (potash). Most of them also result in a hefty surplus of phosphorus (phosphate). So in the near term, at least some potash fertilizer may be needed and may even turn out to be more economical than manure. In the future the fertilizer portion of the nutrient budget may increase if concern grows over manure nitrogen and phosphorus in public waters. But the first order of business is soil testing to determine potassium levels and to find out if soil phosphorus is low, sufficient, or surplus. Then the expense of replacing soil potassium can be built into the cost of organic hay sold off the farm.