

How much Root Zone is needed for livestock nutrients?

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Mass balance is the balance between the inputs and outputs within a system. In manure management, phosphorus (P) mass balance is used to estimate the acres of land or the amount of “root zone” needed to use livestock manure nutrients. Simply, $P \text{ balance} = P \text{ imported} - P \text{ exported}$. Environmental risk to surface and ground waters is increased if the amount of P brought onto the farm (e.g., from fertilizers, feed, and animals) exceeds the amount of P leaving the farm (e.g., crops, animals, manure, or animal products such as milk, meat, eggs, and fibers). Mass balance estimates shown in the table above right were derived using standard diets, animal performance, and 50 lbs./acre P_2O_5 crop removal. Estimates do vary among farms.

Livestock producers may consider moving manure off site, but when not feasible, potential feeding strategies to reduce needed land base include:

- Diets should be formulated based on “available P.” Pigs and birds are able to absorb only part of the P in feeds. Grains for swine and poultry can vary from 14 to 50% available P whereas over 90% of P is available in cattle and sheep feeds due to microbes in the rumen.
- Formulate rations to meet the animal’s exact P requirements for maintenance, lactation, growth and pregnancy. For lactating dairy cows, 1 gram of P for each pound of milk produced generally is sufficient and

Examples of phosphate (P_2O_5) excretion and land bases needed for various livestock enterprises per 1000 head of production.

Livestock Enterprise	Pounds P_2O_5 Excreted	Acres needed
growing-finishing beef	17,500	350
horses	22,000	440
lactating dairy cows	86,000	1,720
dairy heifers	27,000	540
laying hens	1,200	24
cow-calf beef	48,000	960
sheep	13,500	270
swine breeding herd with phytase	37,000	740
swine growing-finishing with phytase	3,600	72
turkeys with phytase	1,300	26

is fed when dietary P ranges from 0.32 to 0.38% (dry matter basis).

- Routinely complete laboratory analyses of feeds and rebalance rations.
- Cattle rations may not need P supplementation to meet the animals’ requirements. Discontinuing P supplementation may reduce land base by 25 to 50% (depending on the amount of over-supplementation in the original feeding program).
- If typical rations (corn silage, soybean meal, alfalfa, and corn grain) contain more P than needed to meet requirements, and if land base is limiting, alternative feedstuffs should be considered. The cost of using alternative feedstuffs may be less than the cost of using common “least-cost” feeds and managing excess manure P.
- Phytase in corn-soybean meal based-diets for swine and poultry increases P availability so that 25 to 35% less total P is required in the feed.
- Pellet and reduce the particle size of rations to increase the efficiency of P use by pigs and poultry by 5 to 10%.



For lactating dairy cows, 1 gram of P for each pound of milk produced generally is sufficient and is fed when dietary P ranges from 0.32 to 0.38% (dry matter basis).



Reducing phosphorus in rations reduces land base requirements for manure applications.

- Formulate rations for specific production phases, genotypes and gender. “Phase-feeding” programs for growing swine and lactating dairy cows can reduce manure P by 5 to 10%.

Visit www.rootzone.msu.edu for more details on P ration reduction strategies. 🌱