Primary nutrient balance as a new tool to evaluate nutrient utilization

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Abstract

A new tool, utilization rate of primary nutrients (UPN), is introduced to evaluate parallel nutrient load and efficiency of nutrient utilization. It is independent of the quality and quantity of final products and therefore allows comparison between any production systems or farms.

Keywords: nutrient balance, nutrient utilization, nutrient load, efficiency

Introduction

From an ecological point of view there is only one production process in the agricultural system, i.e. crop production or primary production. Primary production can be utilized either directly as human food or fed to animals. Nutrient load and nutrient utilization, i.e. efficiency to utilize nutrients, are two separate dimensions. If only crop products are produced, the nutrient load is less than an equal amount (kg nitrogen) of animal products.

Materials and methods

In order to reduce the nutrient load there are two choices: either to produce less or to improve the efficiency of nutrient utilization. Since the amount of primary production is highly dependent on the priorities in the human diet, it can be taken as a given constant. According to this assumption, the harvested yield (Y) to external nutrient input (=primary nutrients, P) ratio alone indicates the nutrient utilization in any system. Seuri (2002) derived two identical equations for the utilization rate of primary nutrients (UPN):

(I) $UPN = Y/P$ where Y = harvested yield and P = external nutrient input

(II) $UPN = U(P+S)/P = U*C$ where $U = Y/(P+S)$ = surface efficiency, $C = (P+S)/P$ = circulation rate, S = recirculated nutrient in crop production (secondary nutrient)

On the other hand, the absolute nutrient load (L) is always:

(III) $L = P+S-Y = (1-U)(P+S)$

Conclusions

UPN is able to separate between nutrient load and nutrient utilization, i.e. the efficiency to utilize nutrients, unlike the surface balance method or the farm-gate balance method. Pure crop production causes less loading than mixed production despite equal UPN.

References

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