Nutrient budgeting for trace elements: Examples from Scottish organic farms

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ABSTRACT

Farmgate nutrient budgets have been calculated for Cu, Co and Mo for six farms in NE Scotland. All five livestock farms studied had a positive balance for Co, one showed a negative balance for Cu and two showed negative balances for Mo. The stockless farm studied showed a positive balance for Cu but negative balances for Co and Mo. These balances were calculated for a one-year period only and may thus have been strongly influenced by one-off purchases e.g. calcified seaweed. Future work will calculate budgets over whole rotations to provide a clearer picture of the long-term sustainability of trace element use on organic farms.

Keywords: organic farming; nutrient budgets; trace elements

INTRODUCTION

Trace element deficiencies in livestock are known to affect animal performance and thus farm profitability. On organic farms the addition of trace elements is restricted and it has been suggested that sound organic agricultural practice should make mineral supplementation to livestock unnecessary (Soil Association 2000). Realistically, however, farms will export trace elements in crop and livestock products and there will be a need to balance outputs with inputs in order to maintain the nutrient resource capital of the farm. Nutrient budgeting is now widely used as a tool for managing nutrients on farms and for indicating the sustainability of farming practices. Nutrient budgeting has usually been applied to N, P and K on organic farms (Watson *et al.* 2002) although it is equally relevant as a mechanism for managing trace element use. When comparing budgets for major and trace elements it is important to note the difference in order of magnitude between these elements. N, P and K budgets are usually quoted in kg ha^{-1} $year^{-1}$ and trace elements in g ha^{-1} $year^{-1}$.

MATERIALS AND METHODS

Six organic farms in NE Scotland were visited in summer 2001 and information obtained from the farmers on cropping and livestock, purchases and sales of nutrients for the year 2000/2001. Farms were selected with the help of the Scottish Organic Producers Association (SOPA). Farms 1,2,5 and 6 had known trace element deficiencies; there were no known deficiencies at Farm 3 or 4 (Table 1). Information on quantities of different materials bought and sold (e.g. animal feed, straw) were used together with the Cu, Co and Mo contents of the different materials to calculate farmgate nutrient budgets (Jarvis, 1999). The trace

element contents of the materials were determined either by direct measurement or from the literature (Owens, 2001).

RESULTS AND DISCUSSION

All five livestock farms studied had a positive balance for Co, one showed a negative balance for Cu and two showed negative balances for Mo (Table 1). The stockless farm studied showed a positive balance for Cu but negative balances for Co and Mo. Purchase of calcified seaweed was a major source of both Cu and Co, while straw was an important source of Cu and Mo (data not shown). The farms without recorded trace element deficiencies (Farms 3 and 4) showed positive balances for the three elements studied but all other farms showed deficiency of one or more element. These balances were calculated for a one-year period only and may thus have been strongly influenced by one-off purchases e.g. calcified seaweed. All the budgets showed a difference between input and outputs of less than 100 g ha^{-1} $year^{-1}$. Inputs per farm were in the range 145-1989 g $year^{-1}$ for Cu, 11-446 g $year^{-1}$ for Co and 4-202 g $year^{-1}$ for Mo.

Table 1. Farmgate nutrient budget (Input-Output) g ha^{-1} $year^{-1}$

Farm type	Cu	Co	Mo
Farm 1 - beef/sheep	+29.6	+15.7	-1.2
Farm 2 - beef/sheep	+7.5	+3.9	-0.3
Farm 3 - beef	+27.4	+0.8	+3.0
Farm 4 - dairy	+30.7	+1.0	+3.0
Farm 5 - mixed	-7.8	+0.3	+0.1
Farm 6 - arable	+17.6	-1.6	-0.6

Future work will calculate budgets over whole rotations to provide a clearer picture of the long-term sustainability of trace element use on organic farms.

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