

Introduction

The central concept of sustainable agriculture is the maintenance of soil health. However, the intensive cultivation and minimal organic matter return during potato (*Solanum tuberosum* L.) production can reduce soil health. Organic potato production uses extended rotations (>3-4yrs) including legume forages to potentially rebuild the soil. However, little is known whether these rotation lengths are long enough to allow for soil recovery.

The study objectives are to (i) examine the time required for the soil to rebuild its health prior to the inclusion of the potato crop and (ii) evaluate the use of the Collembola, *Folsomia candida*, as a potential standard indicator of soil health.



Fig. 1. Bulk density core sample



Fig. 2. Hand sorting earthworms

Materials and Methods

Composite soil samples (n=4, i.d.=4.8) were collected from six fields throughout the 4 year potato/grain/forage rotations at four farm sites across PEI and NB. Available C and N, microbial biomass C, light fraction, bulk density, and C:N ratio, were determined from this soil. Earthworm abundance and biomass were determined by hand-sorting two 75cm x 75cm x 15cm quadrats from each field throughout the potato rotation.

Preliminary Results and Discussion

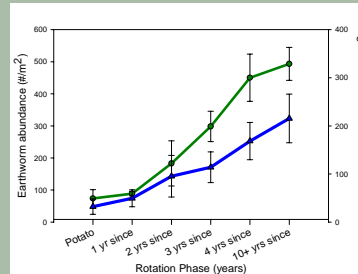


Fig. 3. Earthworm abundance (number/m²) and biomass (g/m²) throughout the potato rotation. Error bars represent the standard error of the means.

Table 1. Soil C and N concentration, C:N ratio, bulk density as affected by the phases of the organic potato rotation.

Phase of Rotation	C (g C kg ⁻¹)	N (g C kg ⁻¹)	C:N Ratio	Bulk Density (g/cm ³) ¹
Potato	22.9	0.91	19	1.12
1 yr since	18.2	0.85	17	1.22
2 yrs since	19.3	0.86	22	1.14
3 yrs since	23.5	1.05	19	1.15
4 yrs since	19.8	0.74	26	1.27
10+ years	24.3	1.19	20	1.10

¹ Samples were converted using corrected bulk density

• Earthworm biomass and abundance and abundance were lowest in the potato year and highest in the pasture land out of cultivation for more than ten years (P=0.01 and <0.001, respectively). Earthworm levels after potato required 4 years to reach the same levels as in the pasture (Fig. 3).

• The length of time in rotation had no significant (P=0.730) effect on soil bulk density (Table 1).

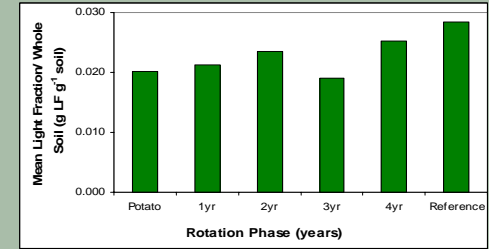


Fig. 4. Effect of years in rotation on light fraction organic matter (LF)

• Soil C and N concentration and ratio throughout the potato rotation did not indicate any significant differences or trends (P = 0.316, 0.692, 0.654 respectively) (Table 1).

•The light fraction organic matter (LF) indicated an increasing trend as the length of time in the rotation increased.

Conclusions

• Length of time in rotation increases the abundance and biomass of earthworms as well as the amount of light fraction. Rotations shorter than 4 yrs after potato should be avoided as earthworm levels and LF will not have fully recovered affecting soil health. Total carbon, nitrogen and bulk density did not respond to rotation length however, other potentially more sensitive indicators of organic matter dynamics are under study.

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