INTRODUCTION

The decomposition of organic matter is vital to nutrient cycling in ecosystems. We are participating in a research study using a standardized methodology for global measurement of decomposition rates in a range of climates, soil types, and treatment studies (Didion, 2016). As part of the project, the bioassay of Lipton’s fast-decomposing green (Camellia sinensis) and slow-decomposing rooibos (Aspalathus linearis) tea were installed from 405 sites and retrieved after 3 months, 1, 2, and 3 years (Didion, 2016).

The nutrients available in litter and soil influence the rate of decomposition (Berg & Matzner, 1997). Our study investigates how decomposition is altered by nitrogen, phosphorus, and calcium additions. We expect green tea to decompose faster than rooibos tea. We hypothesized that nutrient treatments will delay the rate of decomposition after three months of incubation.

METHODS

Site description
- This study was within the Multiple Element Limitation in Northern Hardwood Ecosystem (MELUNE) Project.
- We used a mid-age and old-age stand in Bartlett (BEF), Hubbard Brook (HB), and Jeffers Brook (JB) experimental sites located in the White Mountains of NH (Fig. 1).
- Within the stands, five plots were fertilized with N (NH₄NO₃), P (NH₄PO₄), N+P, Ca (CaSO₄), or left untreated.

Teabag Incubation Procedure
- A total of 240 nylon bags containing rooibos and green tea with 0.25mm mesh were dried at 60ºC (Fig. 2).
- On August 24th and 25th 2016, four teabags were buried at the bottom of the soil’s Oa layer, 1 cm below the mineral layer of each site (Fig. 2A & 2B).
- Three months later, the teabags were extracted and frozen (Fig. 3). Once dried at 60ºC and cleaned, 221 teabags were weighed (Fig. 3B).

Analysis
- The initial and final masses were used to determine the percentage of mass remaining.
- The initial and final masses of each sample were used to calculate the percentage of mass remaining (%).
- Percent decomposition was averaged in each plot. We used a randomized complete block design analysis of variance (ANOVA) with stands as replication. We used an interaction among treatment and placed between the site of tea to test for a difference of decomposition among treatments. A 2 x 2 factorial was used to test for the effect of N and P. We tested for a difference among treatments and between stands age by nesting age within stands. (SAS version 9.6).

RESULTS

Rooibos Tea
The average mass of rooibos tea remaining was 71%. The ANOVA we used to test for an interaction of treatment excluding tea type showed that there was a weak difference of mass between control and N teas (p = 0.11). In the 2 x 2 factorial, teas treated with N (average = 73%) and/or P (73%) delayed decomposition when compared to the control (70%) (p = 0.06). Rooibos tea decomposed faster in Hubbard Brook (69%) compared to Bartlett (average = 72%) or Jeffers Brook (72%) (p = 0.10). Stand age did not significantly influence decomposition (p = 0.16).

Green Tea
The amount of decomposition between rooibos and green tea was significantly different (p < 0.005). The average mass of green tea remaining was 31%. Teabags from old stands (average = 30%) decomposed faster compared to teabags in mid-age stands (32%) (p = 0.01). The average mass remaining of teabags in Jeffers Brook (32%) vary to Bartlett (30%) and Hubbard Brook (30%), but was not significant (p = 0.13). Treatments did not significantly alter decomposition (p = 0.87).

DISCUSSION

- Rooibos and green tea are different species. Organic matter decomposition rates vary among species due to lignin to N ratios (Melillo et al., 1982). High lignin to low N ratios decompose faster than the inverse (Melillo et al., 1982).
- The rapid decomposition of green tea in our old stands may be caused by the lack of available high-quality substrate (Bauhus et al., 1997), so decomposers prefer leafy tea.
- Site variation may be due to temperature differences. At higher temperatures, microbial activity is increased which increases decomposition of soil organic matter (Wang et al., 2016). Hubbard Brook is the warmest site and the rooibos tea incubated there decomposed the fastest.

CONCLUSION

- Because of the rapid mass loss after 3 months, green tea will likely be too far decomposed to show a treatment effect of decomposition. We expect Rooibos tea will have a stronger treatment effect as decomposition progresses.
- This study represents a sliver of the information being gathered on a global scale. By advancing our knowledge of decomposition rates around the world, we will have a greater understanding of factors controlling nutrient cycling on a global scale.

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REFERENCES