Effect of Organic Nitrogen Fertilizer on Leaf Biomass and Quality of Peppermint (*Mentha x piperita*) in Eastern Washington

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INTRODUCTION

- Peppermint is used in several Amway products
  - Siberian EnerG Tablet
  - Ginseng Herbal Tablet
  - Enteric Coated Garlic Tablet (+LM India)
  - Garlic with Vitamin E
- Peppermint grown in Trout Lake Farm East for many years
  - Supply Amway/Nutrilite with leaf only product
  - Supply third part with shoot
- How fertilizer affects phytochemical content is unknown
  - The typical practice is to apply 6 tons/acre of composted cattle or chicken manure during winter break
  - A incomplete study was conducted in 2014
- In the present study, we investigate the nitrogen effect on peppermint production, leaf nutrient level, and phytochemical content

ABSTRACT

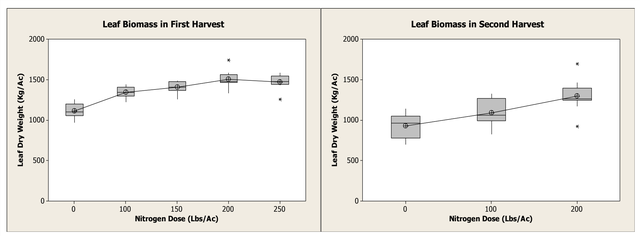
Peppermint (*Mentha x piperita*) is an herbal medicinal species often used in dietary supplements. Trout Lake Farm East located in Ephrata, WA grows peppermint organically and supplies leaf feedstock for extraction and processing for Amway. In 2015, a nitrogen benchmarking study was conducted to investigate the peppermint leaf production, nutrient contents, and phytochemical content in response to nitrogen rates. Nitrogen feathermeal (13-0-0) was applied to peppermint (Variety: Black Mitcham) twice a year in a randomized 5x3 factorial design. Factor A represents the spring application of 5 levels of nitrogen (0, 100, 150, 200, or 250 pounds Nitrogen/Acre (lbs. N/Ac)) and factor B represents the 3 levels of nitrogen (0, 100, or 200 lbs. N/Ac) applied in the summer after the first harvest. Results showed that organic nitrogen fertilizer increased peppermint leaf biomass in both the spring and the summer application. In the spring application, plants that received 200 and 250 lbs. N/Ac application reached the highest leaf biomass. Nitrogen fertilizer also increased peppermint leaf nitrogen content after both the spring and summer applications. In the spring application, plants that received 200 and 250 lbs. N/Ac application had the highest leaf nitrogen content. Results indicated that 200 lbs. N/Ac is the optimum nitrogen fertilizer rate for peppermint growth. There were no interactions between the two nitrogen fertilizer applications on leaf biomass and leaf nitrogen content, suggesting that nitrogen fertilizer should be applied after each harvest. Spring or summer nitrogen fertilizer application did not affect peppermint leaf eriocitrin content based on leaf dry weight.

Key words: Peppermint, organic farming, leaf biomass, Nitrogen content, Eriocitrin content

Materials and Methods

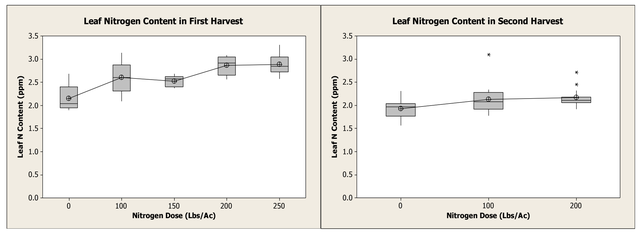
- Plant materials
  - Species: Peppermint
  - Variety: Black Mitcham
- Experiment Design
  - Factorial design
    - Five treatments in first application,
    - Three treatment in second application
    - Total of fifteen treatments
  - Three replications for each treatment
  - Each plot is 6' x 12'
  - Total of 45 plots
- Treatments
  - Spread 13-0-0 feathermeal on each plot
  - First one was applied at April 14, 2015
  - Second one was applied at June 5, 2015
- Harvest
  - First harvest at June 2, and 3, 2015
  - Second harvest at October 6, 2015
- Measurements:
  - Leaf dry weight
  - Nutrient Content (N, P, K, Ca, Mg, etc.)
    - Conducted at A&L Laboratory
  - Phytochemical (Eriocitrin) content –
    - Measured internally at Analytical Sciences Group in Ada.

Summary Of Results – Statistical Analysis



Source	DF	SS	MS	F	P
N Application 1 (Lbs/Ac)	4	83801	20950	0.81	0.531
N Application 2 (Lbs/Ac)	2	1007463	503731	19.39	0.000
Interaction	8	200121	25015	0.96	**0.483**
Error	30	779387	25980		
Total	44	2070772			

Figure 1. Organic nitrogen fertilizer effect on peppermint leaf biomass



Source	DF	SS	MS	F	P
N Application 1 (Lbs/Ac)	4	0.04039	0.010097	0.14	0.967
N Application 2 (Lbs/Ac)	2	0.51350	0.256749	3.50	0.043
Interaction	8	0.29655	0.037068	0.50	**0.843**
Error	30	2.20280	0.073427		
Total	44	3.05323			

Figure 2. Organic nitrogen fertilizer effect on peppermint leaf nitrogen (N) content

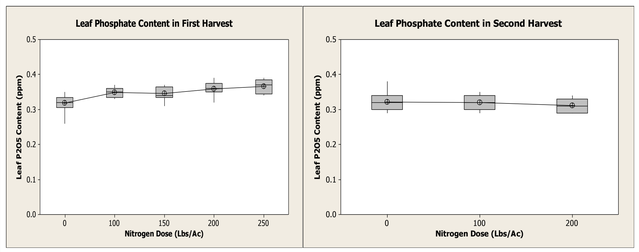


Figure 3. Organic nitrogen fertilizer effect on peppermint leaf phosphate (P_2O_5) content

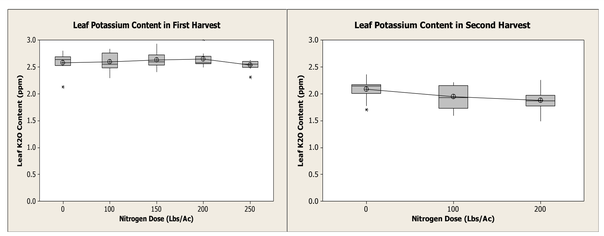


Figure 4. Organic nitrogen fertilizer effect on peppermint leaf potassium (K_2O) content

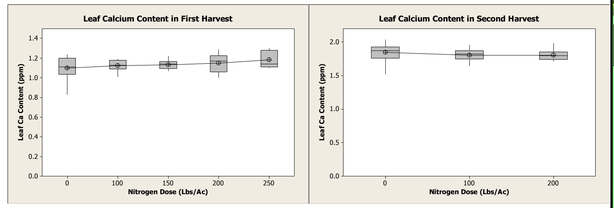


Figure 4. Organic nitrogen fertilizer effect on peppermint leaf calcium content

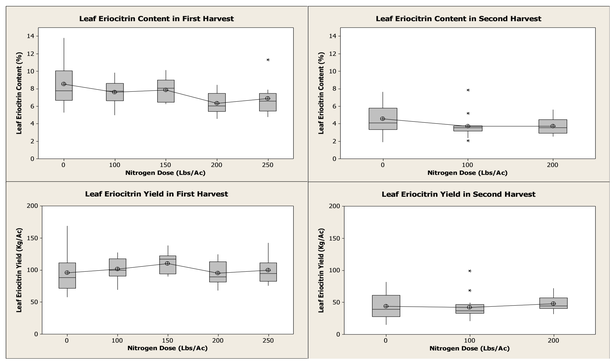


Figure 6. Organic nitrogen fertilizer effect on peppermint leaf leaf Eriocitrin content (based on leaf dry weight) or Eriocitrin yield (based on the acreage)

Statistics

- Run statistics in Minitab
  - One way ANOVA for results of each harvest
  - Two way ANOVA for testing interaction between two applications

CONCLUSIONS

- Organic nitrogen fertilizer (Feathermeal) application on Black Mitcham Peppermint increased leaf biomass (dry matter)
  - Each nitrogen fertilizer application increased leaf dry matter.
  - 200 lbs. N/Ac is the optimum dose for the fertilizer.
  - No interaction between two applications.
- Organic nitrogen fertilizer application increased peppermint leaf nitrogen content
  - Each application increased leaf nitrogen content, respectively
  - No interaction between two applications.
- Organic nitrogen fertilizer application did not affect peppermint other leaf nutrient content
- Organic nitrogen fertilizer application did not affect peppermint leaf phytochemical (Eriocitrin) content and Eriocitrin yield.