PACIFIC NORTHWEST

The Critical Role of Nutrient Management in Mint Production

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Mint (spearmint and peppermint) has been grown in the U.S. as a specialty crop for hundreds of years. Mint is primarily grown for the oil produced from its leaves. While relatively few growers produce mint, the U.S. is the world-leading producer of mint oil. The top-producing states in the U.S. are located north of the 41st parallel, where the right amount of daylight and favorable conditions produce high yields and quality of oil (**Figure 1**).

Research results from the Pacific Northwest demonstrate the importance of fertilizer nutrients in the production of mint, used to add flavor to a wide variety of specialty products.

Mint, a perennial plant that produces no seed, is planted in rows using roots dug from existing fields. Typically, by the second year the mint rhizomes have spread sufficiently to create a solid plant stand. The oil, stored in glands on the underside of the leaves, is recovered after the plant is cut, dried in windrows, and hauled from the field to a steam distillery.

An acre of mint generally produces about 85 lb of peppermint and 110 lb of spearmint oil. **Table 1** lists the amounts of mint oil used in some products.

Careful nutrient management is essential to balance high biomass growth and production of high quality oil—two essential ingredients for profitable production. This article summarizes region-wide research results conducted in the Northwest U.S. Additional details are available directly from the authors.

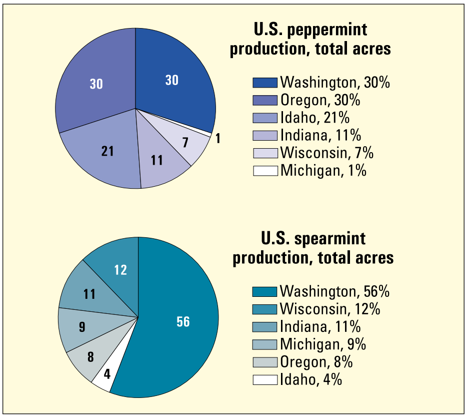

Figure 1. Percentage of U.S. mint production acreage in top producing states.

TABLE 1. Approximate production from mint.

A 400-lb drum of mint oil:	
	400,000 tubes of toothpaste
	5,000,000 sticks of gum
	20,000,000 mint candies
One ounce of mint oil:	
	62 tubes of toothpaste
	780 sticks of gum
	3,125 mint candies
One drop of mint oil:	
	2.5 tubes of toothpaste
	31.25 sticks of gum
	125 mint candies

Nitrogen (N) Management

Nitrogen management is challenging for mint production. Since little opportunity exists for mechanical incorporation, fertilizer N is typically applied to the soil surface.

Mint requires approximately 200 to 250 lb N/A to support optimum growth. Multiple applications of N through the growing season are commonly made to maintain a continuous nutrient supply for maximum oil production. Slow-release N sources can be used, but must release nutrients sufficiently quickly to maintain active vegetative growth and development of new leaves for maximum oil production.

Threshold values for stem nitrate concentrations have been determined as a guide for fertilization during the growing season. Additionally, critical levels for leaf chlorophyll content using a SPAD meter have been established as an aid to adjusting in-season N fertilization rates. When N supplies are limited, plant biomass and oil yields are reduced.

This peppermint plant was grown with complete nutrition. Various nutrient deficiencies can hurt production.

Phosphorus (P) Management

An adequate supply of P is important through the growing season (**Figure 2**) and also to stimulate new root growth after harvest. Fertilizer P is typically applied prior to crop establishment and then surface applied following harvest as recommended by soil testing. Phosphorus removed with harvest ranges from 44 to 88 lb P_2O_5/A based primarily on the biomass removed.

Potassium (K) Management

Mint has a constant demand for K during the growing season (**Figure 2**) and an average yield of mint biomass of 3 t/A removes over 300 lb K_2O. Soils with a low K-supplying capacity can become depleted in K with this high rate of crop nutrient removal. Potassium fertilizer can be applied in the fall or the early spring according to the soil test.

Rapid shoot and root growth during the summer can strain the soil nutrient supply

Nitrogen Deficient **Phosphorus Deficient** **Potassium Deficient** **Sulfur Deficient**

Nitrogen deficiency is manifested as chlorosis beginning in the older leaves and progressing to the entire plant. Stunted growth and red leaves are also observed with inadequate N supplies.

Symptoms of low P supplies include increased purple pigmentation on the leaves and stems. The stunted plants may also have unusually dark green leaves that are smaller than normal.

Low K supplies may be exhibited with stunted plants that have bronzing on the leaf margins, with interveinal chlorosis commonly observed.

Symptoms of low soil S are stunted plants that have chlorosis, beginning with the younger leaves.

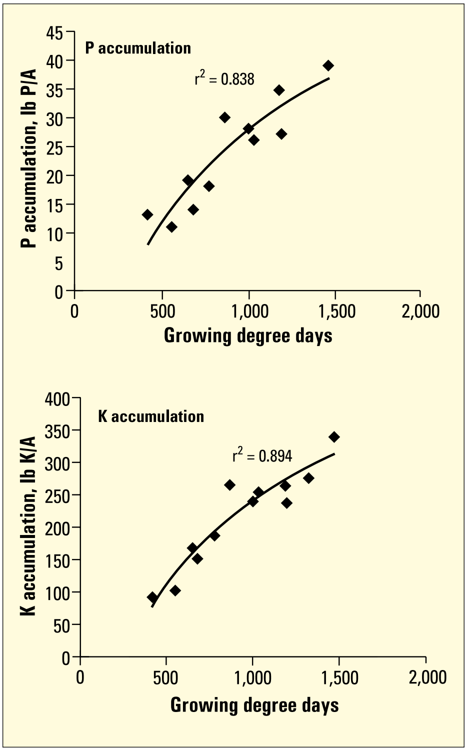

Figure 2. Accumulation of P and K by peppermint during the growing season in the Willamette Valley of Oregon, using base of 5°C (Hart et al., 2003).

and limit growth if adequate nutrient supplies are not present.

Sulfur (S) Management

Sulfur is applied to mint more frequently in higher rainfall areas of the northwestern U.S. High rates of sulfate (SO_4)-S application have no effect on oil quality. However, application of elemental S on mint leaves results in conversion of one peppermint oil component (Germacrene-D) to undesirable mint sulfide. Elemental S should only be used at low application rates when needed for disease control, at least 30 days prior to harvest.

The U.S. is the largest producer of mint, grown for the oil produced from its leaves.

Conclusion

Fertilization is an important part of the overall management of mint. Timely soil testing and tissue testing are essential tools for production of maximum yield of high-quality mint oil. BC

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Additional information about nutrient management for mint is available from the authors or from these sources:

Brown, B. 2003. Mint soil fertility research in the PNW. Western Nutrient Management Conf. 5:54-60.

Hart, J., N. Christensen, M. Mellbye, and G. Gingrich. 2003. Nutrient and biomass accumulation of peppermint. Western Nutrient Management Conf. 5:63-70.

Westcott, M.P. 2003. Peppermint nutrient deficiency symptoms. Western Nutrient Management Conf. 5:61-62.

Additional images showing deficiency symptoms are available at the following website: >http://ag.montana.edu/warc/Peppermint deficiency symptoms_files/frame.htm<.