EFFECT OF SOME CULTURAL TREATMENTS ON THE GROWTH AND OIL YIELD OF SOME MINT VARIETIES
(Mentha Sp.)

By

MAHMOUD MOHAMED KHALIL
(B.Sc. Agric.)

Thesis submitted in partial fulfilment of the requirements for the Degree of

MASTER OF SCIENCE

In

Horticulture (Floriculture)

Department of Horticulture
Faculty of Agriculture
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Date: [illegible] / [illegible] /1973

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I N T R O D U C T I O N

Mint oil is obtained by distillation from the herb or leaves of some species of Mentha, particularly <u>Mentha Viridis</u> (<u>Linn</u>.) and Mentha piperita (<u>Linn</u>.) and its varieties. These mints are cultivated in many parts of the world, including Japan, the United States of America and Europe (Schery 1963).

The essential oil of peppermint consists largely of menthol, which is used in antiseptics, cool lotions, nasal preparations, and thelike. It has certain definite pharmaceutical properties. The oil is widely used in many sorts of delicacies, dentifrices, medicinals, toilet waters and alcoholic liqueurs. So far as medicinal value is concerned the oil is generally preferred to menthol for internal uses, because of its more pleasant taste. Dried, pulverized leaves often is of culinary favor and kitchen use as well.

The object of this work was to study some of the important cultural practices, such as watering, time of planting, spacing, and the cutting intervals and their effects on the herb and oil yield of mint plants grown in A.R.E.

REVIEW OF LITERATURE

1. Irrigation Intervals :

It is commonplace knowledge that all plants require water in considerable quantities for their existence and development. Plant growth is stimulated by moderate quantities of soil moisture and retarded by either excessive or deficient amounts. Water performs so many roles in plant life. Most leaf cells in order to remain alive at all must have a finally high water content. There are likely to be several indirect effects of diminished water content as brought about either by continues or increased transpiration or by diminished water supply. Tumanov (1927) reported that even a single severe wilting, if the plant servived, might reduced the final yield of barly by as much as 50 per cent. The injurious effects of unbalanced water loss or marked water deficiencies are so obvious, it seems hardly necessary to enumerate them. The marked stunting of plants during periods of drought and the withering and death of older leaves or entire plants when transpiration is much in excess of absorption are apparent.

Birkeli (1948) stated that peppermint prefers a rather moist soil of a pH from 6 to 7. Hotin (1950) showed that the external conditions particularly temperature, soil moisture, and root nutrition were important factors affecting the synthesis of essential oil in peppermint. Low soil and air moisture caused a sharp drop in productivity with a corresponding fall in the percentage of oil in the leaves and inflorescences. He added that abundant moisture was very effective either with or without fertilizer addition. Kerekes (1960) found that the rate of peppermint transpiration depended more on the development and size of the leaves than on the temperature or relative humidity of the air. He revealed that the maximum of water consumption occurred prior to full bloom, at which time irrigation would be considered advisable. Since the oil is present in the leaves and not in the stems, Buchanan and Ownbey (1961) pointed out that any forcing of growth to a maximum by irrigation and fertilization would increase the yield of mint oil, only if accompanied by an increase in leaves. Schroeder (1963) reported that peppermint yielded most at 80-90% of field capacity. He also detected that the essential oil contents were highest at medium soil moisture levels. The root yield expressed as percentage of total material was inversely proportional to the soil moisture content. The transpiration quotient rose with an increase in water supply. Although peppermint yielded best in the wettest conditions, its transpiration quotient was low. No evidence was obtained to support the view that the essential oil acted as a transpiration check. The number of peppermint leaves, as well as the leaf size were largest under condition which gave the highest yied of plant material. The same investigator, also found a significant negative correlation between leaf size and oil gland density, but neither character showed a clear relationship with essential oil content. The variance in volatile oil content was due to different degrees of filling of oil glands. Gindic (1965) stated that the maximum increase in leaf yields of peppermint due to the application of fertilizer were obtained when adequate moisture was available to the plant. Kruepper, et al. (1968) stated that the effect of irrigation was dependent on the amount of precipitation and temperature. When the weather was dry and warm, the herb and essential oil yield of peppermint increases were noted even up to the greatest amount of water given. They concluded that an average of 65-80% of moisture capacity was favourable for the higher production. In 1966, Katin deduced that the soil moisture deficiency caused a decrease in the essential oil content of mint, coriander fruits and basil leaves. However, Nelson et al. (1970) stated that high soil moisture levels raised hay yields of Scotch spearmint but oil yields did not differ significantly.

The glandular scales of leaf of marjoram was studied by Koelie (1953), who found that the water deficiency decreased leaf size and hence gland counts but resulted in increased gland density. Bishr (1972), working with sweet marjoram, pointed out that the fresh and dry weight of the leaves were significantly increased by decreasing the irrigation intervals. The oil percentage was higher in the plants irrigated every 7 days than those irrigated every 14 or 21 days.

Todua (1971) stated that increasing the soil moisture content from 45 to 80% of its water holding capacity raised the fresh yields of patchouli (Pogostemon cablin). The essential oil content rose with increasing moisture content in alluvial light loamy soil.

Agena (1966) in her study on Pelargonium graveolens concluded that the fresh weight and oil percent increased as the irrigation intervals were shorter. Oil yield from plot irrigated every 8 days was nearly more than 2-3 times that irrigated every 20 days. In 1967, Weiss stated that high rainfall during 3 months preceeding each cut was conductive to high yields of green material with low oil yield of pelargonium. Also, Goletiani and Dzgarkava (1970) reported that the increase in soil moisture increased the size of the leaf blade and the length of petiole and also increased the stem: leaf ratio in the pelargonium. The percentage content of essential oil in the leaves rose with increasing soil moisture.

Toussaint (1967), stated that chrysanthemums growth was greatly improved by irrigation and the flower yield was increased by 61%.

El-Shamy (1968), revealed that irrigation of pyrithrin plants at daily intervals was more favorable for increasing the number of flowers per plant, weight of flowers, and the pyrethrin content of flower.

Hotin and Segal (1969), found that increasing the soil moisture from 40 to 80% of total moisture capacity doubled herbage weight and increased flower yields of chamomile by 66%. The essential oil content at 40 and 80% of soil moisture capacity was higher than at 60%. The optimum soil moisture was 60-70% of total capacity.

Ivanov (1959), found that in the Southern regions of Ukrainian USSR summer irrigation increased yields of castor beans 2 or 3 folds than without irrigation, and oil content also increased from 48 to 52%. El-Gamassy (1972) mentioned that higher oil percentage of castor bean was found with the 10 and 20-day irrigation intervals. The lowest oil percentage [illegible] was found with plants irrigated once every 40 [illegible]. The mean oil yield with the 20-day irrigation intervals reached up to twice as much as the yield obtained from the 40-day irrigation interval.

II. Cutting Intervals :

The number of cuttings during the season of growth is very important for the determination of the higher crop and oil yield. With plants capable to renew their vegetative growth after each cutting, such as mint, determining the period needed between each two harvests would help the increase of both herb and oil yield.

Rabak (1917) stated that the yield of oil from fresh plants of peppermint decreased as the plant matured. Most of the oil was found in the leaves and flowering tops. Also, Birkeli (1946) found that at the beginning of flowering, peppermint leaves contained the maximum ratio of volatile oil to dry matter. Panadero (1959) deduced that Japanese mint yields of essential oil in the Madrid area were highest immediately before and during the early part of the flowering period. Similar results were reported by Wallis (1967), who concluded that mint harvest is preferable just before the flower open. While, William (1959) reported that, peppermint crop was usually collected towards the end of August or the beginning of September just before the buds open.