First Cultivation Trials of Lemon Basil (Ocimum basilicum var. citriodorum) in Turkey

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Abstract: Lemon basil is grown as a culinary herb, used fresh and dried in floral arrangements, and potpourris. In this research we studied essential oil component and herb and oil yields of commercial lemon basil grown in Mediterranean region of Turkey. Lemon basil were cultivated under Çukurova conditions in Turkey, and could be harvested 3 times at the full-flowering. In our conditions, harvest number increased four providing that earlier sowing is performed. Total fresh leaf yield and total dried leaf yield were 2760 kg/da and 571.52 kg/da, respectively. Essential oil contents in leaves and flowers were analyzed by GC. The maximum essential oil yield (0.71 %) was obtained at the I. harvest time from the dried flowers. Main component of essential oil was citral. The maximum citral (neral+geraniol) content (89.28 %) was determined at the II harvest time.

Key words: Labiatae, lemon basil, yield, citral, Ocimum basilicum var. citriodorum

Introduction
Lemon basil cultivar with an intense lemon aroma, light green leaves, and small white flowers, provides a new type of lemon basil for the herb industry (Morales and Simon, 1997). As a result of the increased interest in the use of basil as ornamental herbs Morales and Simon (1997) initiated a selection and breeding program to identify promising new ornamental basils. First released cultivar, originally identified in an extensive intermated germplasm collection of Ocimum spp. in 1989, was developed by selfing and selection from a tall upright basil with an intense lemon aroma (Morales et al., 1993) and released as “Sweet Dani” in 1996 (Morales and Simon, 1997). Sweet dani was derived by four generations of pedigree selection from a plant found in the progeny of U.S. Department of Agriculture (USDA) PI # 358465 that had undergone natural out crossing with 51 order USDA (originally from Yugoslavia) that basil accessions from six countries (Iran, Taiwan, Thailand, Turkey, Yugoslavia and Zambia) planted for observation in 1985 (Morales and Simon, 1997).

New basil (Ocimum basilicum) varieties appearing on the German market are characterised by a new range of aromas which have been used in their nomenclature, such as the varieties Cinnamon, Lemon and Liquorice. Lemon remains of small stature and compact with thin and fairly small leaves, recommending it for culinary decoration (Echim, 1993). Lemon basil is grown as a culinary herb, used fresh and dried in floral arrangements, and potpourris (Hasegawa et al., 1997). Also lemon basil is used drug, perfume, spice and cosmetic industry. Chemical composition and morphological characteristics of basil species are highly variable, depending largely on the source and can vary by extraction methods with developmental stage (Burbott and Loomis, 1967; Guenther, 1972).

In this research we studied essential oil component and herb and oil yields of commercial lemon basil grown in Mediterranean region of Turkey.

Materials and Methods
The seeds of Lemon basil (Ocimum basilicum L.) were provided Germany. The field trials have been carried out at the experimental area of Field Crops Department of Agricultural Faculty, Çukurova University in 1995 and 1996. Field trials were arranged in the complete randomised block design with 3 replications. The experiments were carried out in two consecutive years and the data were taken as the average of two years. Seeds were sown in green house for raising seedlings during last week of March in 1995 and 1996. When seedlings have at least 2 pairs of true leaves were transplanted into the previously prepared plots in rows 20x25 cm apart on April. During the vegetation period plots were weeded and irrigated when needed.

Lemon basil was harvested at the full bloom and three harvests were taken during June, August and September respectively under the Mediterranean region during summer period. After the each harvest, all plant materials were immediately weighed, then, the leaves, flowers and stems were separated. Fresh flowers, fresh leaf, dried flowers and dried leaf were subjected to hydro distillation for 3 h using a clevenger type apparatus for determining the oil content (% v/w). The composition of oils fresh leaf and flowers of basil were evaluated by Carlo Erba GC equipped with OV-1 column carrier gas N2. GC oven temperature was kept at 100°C, injector temperature, 225°C, detector temperature 250°C at 20 min. Identification of each individual compounds was made by comparison of their retention times with those of authentic samples. All results were subjected to a statistical analysis of variance to determine Least Significant Differences.

Results and Discussion
Lemon basil could be grown under the Çukurova conditions prevailing Mediterranean type climate, which has hot and drought summer and mild rainy winters consequently, were harvested at full flowering three times a year. Leaf of O. basilicum flavor changes after flowers open (Rindels, 1998). Each basil cultivars were harvested at the full bloom for the highest flower yields and essential oil yields (Halva, 1987; Morales et al., 1993). During the ontogeny of O. basilicum the essential oil, flavonoid, tannin, polyphenol contents changed much in quantity. The maximum fresh herb yield (2054 kg/da) was obtained at the second harvest time (Table 1). Over all 5591 kg/da, this value is lower than previously stated (7447 kg/da) in which O. basilicum having (1.8 cineol, linalool, methyl cavicol, methyl eugenol and 2,3,5-trimethyl cinnamate (Nacar, 1997). The maximum values of dried matter (22.5 %), dried herb yield (686.2 kg/da), fresh leaf yield (1014 kg/da), dried leaf yield (213.6 kg/da), fresh flowers yield (390 kg/da) and dried flowers yield (122.0 kg/da) were determined at the second harvest times (Table 1). Higher yields of O. basilicum were obtained from later phenological stages (Putievsky et al., 1978). Sharma et al. (1987) stated that higher yield of herb and oil of O. basilicum was recorded when harvesting was done between early seeding (full bloom) to late seeding stage of growth at Delhi conditions. The maximum essential oil content (0.7 %) was obtained in dried leaves at the first harvest time (Table 2). In general, essential oil of dried flowers and leaf of Lemon basil were higher than content of essential oil of fresh flowers, fresh leaf and dried leaf. Lemberkovics et al. (1993) reported that in early flowering stage the oil components were present first in leaves, but during the full
and late flowering stages they concentrated mainly in flowers. The essential oil content showed a variation but during the ontogeny it reached own maximum already in the early flowering stage.

The main components of essential oil of fresh leaf and flowers were identified as linalool, and citral (neral + geranial). Citral and linalool showed differences according to harvests and the parts of plant (Table 3). This phenomena is also determined in the oil composition having citral *Melissa officinalis* leaves (Schultze et al., 1993a, b). In general, differences can be due to various factors influencing the oil composition of *Melissa officinalis* leaves (Koch-Heitzmann and Schultze, 1984). Previous authors Schultze et al. (1989), (1993a, b) and Hose et al. (1991) cited that oil composition of *Melissa officinalis* were changed according to the origin of plants, the date of harvest, ontogenetic stages of leaf development, the age of the leaves collected, the upper and lower side of the leaves and the flowers. In our experiment, maximum citral (neral + geranial) content (89.3 %) of lemon basil was obtained at the second harvest (Table 3). Morales and Simon (1997) stated that Citral contents (28-68 %) varied according to different lemon basils cultivars. Newly related cultivar Sweet Dani is taller and a higher concentration of citral (60 to 76 %) than the commercial lemon basils studied. High citral content in the essential oil results in a distinct and strong lemon aroma (Morales et al., 1996). Although the yields of lemon basil lower than the other *Ocimum* chemotype, herb yields can be increased by taking 4 harvests from the earlier sowings at the Cukurova conditions, consequently, oil yields can be increased.

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**References**


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