Herb and oil composition of dill (Anethum graveolens L.): effects of crop maturity and plant density.

Callan, N. W., Johnson, D. L., Westcott, M. P., and Welty, L. E.

Abstract

Steam-distilled dill (Anethum graveolens L.) oil yield and composition varies with the relative amount of vegetative and reproductive tissue and the maturity of the plant material distilled. The characteristics of the dill plant at harvest may be manipulated through production practices. A study was conducted in western Montana to determine the effect of crop maturity and plant density on dill plant growth and on oil production and quality. The crop was harvested at intervals from early fruit formation through fruit pigmentation. Oil yield declined with fruit maturity over the sampling period, particularly after the completion of fruit ripening and “seed” shatter. The carvone content of the oil increased and α-phellandrene decreased as the plant progressed from flowering to fruit ripeness. The highest oil yields with maximum carvone levels were obtained when most of the fruits on primary umbels were pigmented but had not become dry and fully mature. The balance between carvone and phellandrene in the oil was a function of the proportion of mature umbel tissue to vegetative and immature umbel tissue. Seeding rates of 2.2 to 17.9 kg ha-1 resulted in average plant densities of 100 - 474 plants m-2. Total biomass production and oil yield were generally unaffected by plant density, but plant population influenced plant architecture and oil composition. Plants grown at low density had a more extensive development of umbellate fruiting structures and a lower proportion of leaf and stem tissue than did plants at high density. Carvone was higher in oil from widely-spaced plants, while phellandrene, α-pinene, and dill ether (3,9-epoxy-1-p-menthene) were lower. Harvest date and plant density affected oil composition in a complementary manner. An early harvest or high plant density is preferable if the characteristics of an herb oil are desired, while a late harvest or low plant density is suitable when growing dill for seed or for a high-carvone oil.

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