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# CARIBBEAN FOOD CROPS SOCIETY

# 27

## Twenty Seventh Annual Meeting 1991

## DOMINICA

Vol. XXVII

# RESPONSE OF SELECTED HERBS TO IMPROVED PRODUCTION PRACTICES

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## ABSTRACT

Three field experiments were conducted on herbs using basil (Ocimum basilicum), oregano (Coleus aromaticus), and thyme (Thymus vulgaris) to determine the yield response of herb species to fertilizer applications, irrigation methods, and mulching. In the first experiment, N fertilizer was applied to oregano at 0, 50, 100, and 200 kg/ha. In the second experiment, basil was fertilized with 0, 38, 75, and 113 kg N/ha in combination with 0, 13, and 25 kg P/ha. Micronutrients in the form of Micro-Max R were added at the rate of 34 kg/ha to the treatments with 0-0-0, 75-13-0, and 113-25-0 N-P-K (kg/ha). The third experiment determined the effect of two irrigation methods (drip vs. sprinkler), two irrigation rates (40 vs. 60% Pan ET), and mulching on yield and minimum water requirement of thyme. Fresh and dry matter yields or oregano leaves were significantly increased by N application of 100 to 200 kg/ha. There were no significant yield differences between treatments suggesting that 50 and 100 kg/ha may be the minimum and optimum N rates, respectively, for oregano production. No distinct pattern on yield was observed for basil receiving various combinations of N, P, and micronutrients. For thyme, treatments with drip irrigation of low (40% Pan ET) and high (60% Pan ET), both without mulch were superior in yield to other treatments. The minimum water requirement of thyme appeared to be 40% Pan ET.

## INTRODUCTION

Herbs and species are fast becoming major cash crops for small farmers. This trend has allowed farmers with small landholdings and limited resources to compete for their share of the increasing herb and spice market. The herb and spice industry in the United States annually imports in excess of 208,698 tons of herbs valued at more than $439 million. Basil (Ocimum basilicum), oregano (Coleus aromaticus), and thyme (Thymus vulgaris) are among the eight most valuable imported herbs in the U.S. herb and spice industry. In 1987, 8000 metric tons were imported with a value of more than $10,000,000 (Larsen, 1987). The major exporters of herbs to the United States are the Mediterranean, South America, Egypt, and Central America. Most of these herbs and spices are harvested from the wild where their populations are declining. As the production of wild herbs continues to decline, there is a need to increase commercial production. Domestic commercial production in the U.S. has been unable to keep up with demands. The paucity of scientific information on the cultural practices of growing herbs will definitely be a limiting factor in increasing herb production. There is potential in the Caribbean for production of herbs and spices to help meet the demands of the growing world market. To

increase herb production, there are some major concerns which must be addressed. Fertilizer and irrigation requirements, harvesting techniques, and weed and pest control should be determined.

A series of experiments were, therefore, conducted to obtain information on fertility requirements for basil and oregano and irrigation requirements for thyme.

## MATERIALS AND METHODS

These studies were conducted at the University of the Virgin Islands Agricultural Experiment Station on St. Croix. The soil series is a Fredensborg clay loam which consists of well drained soils formed over limestone or marl (Rivera el al., 1970). The annual average rainfall is 113 cm and the average annual temperature is 26ºC (Jordan, 1975).

### Experiment 1. Response of Oregano to Nitrogen Application.

A field experiment was conducted to evaluate the response of oregano to varying rates of nitrogen. Initially, oregano stem cuttings were grown in DYNA-FLATS containing a commercial mixture of sphagnum moss and vermiculite (Pro-Mix) for three months to increase planting materials. Subsequently, a field experiment was established in October 1988 using stem cuttings. Plot size was 1.8m x 2.7m, with three rows spaced 0.6m apart. Spacing within rows was 0.3m. The treatments were arranged in a randomized complete block design with three replications. Urea (46% N) was applied to provide rates of 0, 50, 100, and 200 kg N/ha. Phosphorous and potassium were applied at rates of 25 kg and 50 kg/ha, respectively, across all N treatments. The urea was applied by hand, half at planting and half at 60 days after planting. Micro sprinklers were used for supplemental irrigation.

Harvesting, 111 days after planting, was done by cutting plant stems with hand shears approximately 15 cm above the ground. Marketable leaves were separated from the cut stems, weighed, and dried in an oven at 70ºC to a constant weight.

### Experiment 2. Response of Basil to Nitrogen, Phosphorus and Micronutrients.

A field experiment was conducted to determine the response of basil to different levels of nitrogen, phosphorous, and micronutrients. The application rates were four levels of nitrogen (0, 38, 75, and 113 kg/ha) ane three levels of phosphorous (0, 13, and 25 kg/ha). A micronutrients formulation (MICRO-MAX) containing 15% S, 12% Fe, 2.5% Mn, 1% Zn, 0.5% Cu, 0.1% B, and 0.005% Mo was applied at a rate of 34 kg/ha to three additional fertilizer treatments (0-0-0, 75-13-0, and 113-25-0). The experiment was arranged in a randomized complete block design with 15 treatment combinations replicated four times. Plot size was 1.2m x 1.2m with four rows per plot. Plant spacing was 0.3m within rows and between plants. Fertilizer was manually applied to each plot in two equal applications, one at transplanting and the other four weeks after transplanting. Micro-sprinklers were used for supplemental irrigation.

Basil plants were harvested at the early bloom stage by cutting plant stems 15cm above the ground level. At harvest, total fresh weight was recorded after which marketable leaves were separated from stems and weighed. Sub-samples of leaves and stems were oven dried at 70ºC to a constant weight.

Experiment 3. Effect of Irrigation Methods and Rates on Yield of Thyme.

A field experiment was conducted to determine the effect of two irrigation rates and two irrigation methods on the yield of thyme. The drip irrigation method (with and without black plastic mulch) and a micro-sprinkler method were compared at irrigation rates of 40 and 60 per cent pan evaporation. Seeds were sown in Speedling trays and kept in a greenhouse environment for 45 days before transplanting. Plot size was 1.5m x 3m, with rows 0.75m apart, and plants 0.20m within rows. The experiment was arranged in a randomized complete block design with six treatments and three replications. At harvest, plant stems were cut with pruning shears approximately 8cm above the ground level, and total fresh weight was recorded.

## RESULTS AND DISCUSSION

Experiment 1. Oregano.

Fresh weight yields of 45.6 t/ha and 44.3 t/ha were obtained from the 100 and 200 kg N/ha treatments, respectively (Table 1). These yields were

Table 1. Effect of nitrogen application on oregano leaf production

| Fertilizer treatment (Kg N/ha) | Leaf yield (t/ha) | |
|---|---|---|
| | Fresh wt. | Dry wt. |
| 0 | $37.4^{a}$ | $1.8^{a}$ |
| 50 | $41.4^{ab}$ | $2.0^{ab}$ |
| 100 | $45.6^{b}$ | $2.2^{b}$ |
| 200 | $44.3^{b}$ | $2.1^{b}$ |

Means in any column with the same superscript were not significantly different ($P<0.05$) as determined by Duncans Multiple Range Test.

significantly higher than the yield from the control (0 kg N/ha). Dry weight yield followed the same trend as the fresh yield with significant differences ocurring between the control and the 100 and 200 kg N/ha treatment (Table 1). The data seem to suggest that yield of oregano increased with increasing nitrogen application up to 100 kg N/ha. There was no additional benefit to increased N application to 200 $kg/ha^{-1}$.

Experiment 2. Basil.

The data showed no consistent results with increasing fertilizer rates. Application of nitrogen did not produce yields which were significantly higher than was obtained from the control (0-0-0) treatment. The highest fresh weight yield was obtained when phosphorous was applied at the low rate without nitrogen and micronutrients (Table 2).

Table 2. Effect of varying levels of nitrogen and phosphorous on total and leaf yields.

| Fertilizer treatment N-P-K (kg/ha) | Total fresh wt. (t/ha) | Leaf fresh wt. (t/ha) | Leaf dry wt. (t/ha) |
|---|---|---|---|
| 0-0-0 | 29.7$^{bc}$ | 13.8$^{abc}$ | 1.6$^{abc}$ |
| 0-0-0+m | 35.8$^{abc}$ | 18.3$^{abc}$ | 1.8$^{abc}$ |
| 0-13-0 | 57.5$^{a}$ | 20.9$^{a}$ | 2.8$^{a}$ |
| 0-25-0 | 34.2$^{bc}$ | 14.7$^{abc}$ | 1.8$^{abc}$ |
| 38-0-0 | 40.3$^{abc}$ | 17.6$^{abc}$ | 2.2$^{ab}$ |
| 38-13-0 | 30.7$^{bc}$ | 12.2$^{abc}$ | 1.4$^{bc}$ |
| 38-25-0 | 49.4$^{ab}$ | 20.1$^{ab}$ | 2.4$^{a}$ |
| 75-0-0 | 30.7$^{bc}$ | 14.8$^{abc}$ | 1.7$^{abc}$ |
| 75-13-0 | 36.7$^{abc}$ | 14.9$^{abc}$ | 1.8$^{abc}$ |
| 75-13-0+m | 25.0$^{c}$ | 11.3$^{bc}$ | 1.3$^{bc}$ |
| 75-25-0 | 26.3$^{bc}$ | 9.7$^{c}$ | 1.1$^{c}$ |
| 113-0-0 | 33.6$^{bc}$ | 15.2$^{abc}$ | 1.8$^{abc}$ |
| 113-13-0 | 35.1$^{abc}$ | 14.6$^{abc}$ | 1.6$^{abc}$ |
| 113-25-0 | 28.5$^{bc}$ | 11.3$^{bc}$ | 1.3$^{bc}$ |
| 113-25-0+m | 34.5$^{abc}$ | 14.1$^{abc}$ | 1.7$^{abc}$ |

Means in any column with the same superscript were not significantly different ($P < 0.05$) as determined by Duncan's Multiple Range Test.

M: micronutrients added to treatment.

Further fertility studies are necessary in order to clarify the results of this experiment.

Experiment 3. Thyme.

The highest yields were obtained in the drip irrigation treatments without mulch at the low and high irrigation rates (Table 3). These yields were significantly higher than the yields in the low rate sprinkler treatment and the low rate drip treatment plus mulch.

Fungal diseases were observed in the thyme plots, particularly in the mulched treatments. Inadequate soil drainage and wetting of foliage in the late afternoons provides a favorable environment for the promotion of fungi (Tucker and Maciarello, 1990). This may explain the low yield in the mulched plots. In addition, the use of drip irrigation without plastic

Table 3. Effect of two methods of irrigation and two irrigation rates on yield of thyme.

| Treatment | Fresh weight of thyme foliage (t/ha) |
|---|---|
| Sprinkler, low rate[1] | 2.3[bc] |
| Sprinkler, high rate[2] | 3.4[ab] |
| Drip, low rate | 4.0[a] |
| Drip, low rate plus mulch | 1.5[c] |
| Drip, high rate | 4.2[a] |
| Drip, high rate plus mulch | 2.6[abc] |

Means in any column with the same superscript were not significantly different ($P < 0.05$) as determined by Duncan's Multiple Range test.

[1]Low rate = 40% pan evaporation.
[2]High rate = 60% pan evaporation.

mulch allows farmers to better shape the thyme plants. This practice is known from practical experience to increase thyme production.

## CONCLUSIONS

These preliminary studies indicate that nitrogen fertilizer increased oregano production but did not increase basil production. Studies done by Angel et al. (1989) showed that basil production increased when nitrogen and potassium were increased. Thyme is very sensitive to waterlogging, this condition promoting the development of fungal diseases. These studies showed that increased thyme production is affected by the use of plastic mulch and micro-sprinklers.

The production of herbs can be a very profitable business for small farmers. However, in order to be successful, the appropriate technology and cultural practices must be developed.

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