CARIBBEAN
FOOD
CROPS SOCIETY

27

Twenty Seventh
Annual Meeting 1991

DOMINICA

Vol. XXVII

EFFECT OF VARYING LEVELS OF APPLIED NITROGEN ON THYME PRODUCTION

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ABSTRACT

Thyme (Thymus vulgaris) plants grown in field plots were evaluated for response to nitrogen fertilizer (applied as urea) at levels of 0, 56, 112, 169, and 225 kg N/ha. The fertilization rates were divided into three equal applications, the first after transplanting and the others following the first and second harvests. The highest yield of fresh and dry thyme for the first harvest was obtained for the 112 kg N/ha treatment but these yields did not differ significantly from the yields of the 56 and 169 kg N/ha treatments. There was a drastic decline in yield of fresh thyme for the 112 kg N/ha treatment in the second harvest (4.7 t/ha) when compared to the first harvest (10.0 t/ha). Cumulative fresh and dry matter yields for the three harvests showed that the 112 and 169 kg N/ha treatments were superior to the 0 kg N/ha treatment.

INTRODUCTION

In recenty years the herb industry has become a booming business. As people become more health conscious their diet reflects the increased use of fresh vegetables, white meat, low fat, low sodium, low cholesterol, and ethnic recipes. This has created an increase in the demand for herbs to flavor these dishes (Larsen, 1988).

The United States is the World's largest importer of herbs, mostly from the Mediterranean, Africa, and Latin America. In 1987, the U.S. imported 208,698 metric tons of herbs with a value of $439 million (Anon., 1988). Domestic U.S. production is presently only a small percentage of consumption, but has been increasing.

The unpredictability of both supply and prices has forced major U.S. processors to look for alternative sources of herbs (Kebede, 1988). Farmers in the Caribbean area should see this as a favorable sign to encourage them to obtain a share of this promising new enterprise.

Herbs are ideal alternative crops adapted to small plot production without sophisticated machinery. They can be marketed in a number of ways allowing greater market flexibility. Compared to temperate climates, the lack of a winter season provides a significant advantage for year-round production in the Caribbean and close proximity to the U.S. offers an opportunity to supply a lucrative export market.

Production of herbs in the Caribbean is traditional and encompasses a broad spectrum of genotypes. Of the many types successfully grown in the U.S. Virgin Islands, basil (Ocium basilicum), thyme (Thymus vulgaris), rosemary (Rosmarinus officinalis), sweet marjoram (Origanum marjorana), chives (Allium schoenoprasum), parsley (Petroselinum crispum), celery (Apium graveolens), and recao (Eryngium foetidum) are the most visible in the market place. Thyme is one of the most versatile and widely used herbs. Its sharp, aromatic flavor adds distinction and quality to almost all savory dishes. Thyme can be marketed fresh or dried. Its many uses include culinary, medicinal, cosmetic, domestic, fragrance, teas, baths, landscape plants, and bridal bouquets. Thyme is also among the top eight herbs with the largest import volume. In 1987, 1270 tons of thyme were imported in the U.S. (Larsen, 1988).

There is little documented research information on fertilization, irrigation, pest control, and other biological and environmental factors that affect herb production. While herbs are commonly believed to repel pest, many destructive insects and diseases can be found on thyme plants in the field. There is also a lack of registered pesticides available for weed, insect, and disease control. Fertilizer rates for thyme and most herbs have been based on other leafy vegetables. Fertility recommendations should be based on proper soil analyses and the specific needs of the crop (Simon, 1987).

This study was conducted to obtain information on appropriate rates of urea nitrogen fertilizer application for optimum thyme production.

MATERIALS AND METHODS

The study was conducted at the University of the Virgin Islands Agricultural Experiment Station on St. Croix. The soil is a Fredensborg clay loam. This series consists of well drained soils formed over limestone or marl (Rivera et al., 1970).

Thyme plants were started from seed planted during June 1990 in potting mix contained in Speedling trays. Plants were removed from the greenhouse 45 days later and transplanted into the field in August 1990. Plot size was 0.9 m x 2.4 m and consisted of three rows 0.3 m apart. Plants were spaced 0.2 m within rows. The experimental design was a randomized complete block with four replications. Urea was applied to the plots by banding in amounts to provide 0, 56, 112, 169, and 225 kg N/ha in three equal applications. The first application was made after transplanting. The other two applications followed the first and second harvests. Phosphorous and potassium were applied at rates of 50 and 30 kg/ha, respectively. Micro-irrigation was applied to all treatments using drip-strip (Hardie Irrigation) tubing.

Thyme plants were harvested every three months, with the first harvest made at three months after transplanting. Ten plants were harvested from the center row of each plot using pruning shears. Plant stems were cut at 6-7 cm above ground level.

Total fresh weight of the harvested materials was recorded. Subsamples were oven dried at 70ºC to a constant weight for dry matter determination. Leaf dry matter was also recorded for the second and third harvests. Statistical analysis of yield data was performed using SAS General Linear Models procedure (SAD Institute, 1988).

RESULTS AND DISCUSSION

First Harvest.

The data from the first harvest (Table 1) show that yield increased with increasing levels of nitrogen up to 112 kg/ha. There was no change in yield for treatments above 112 kg N/ha. Both fresh and dry weights of thyme were highest for plots that received 112 kg N/ha. These yields were significantly different from the control plots (no nitrogen) and the 225 kg N/ha treatment. Fresh and dry weights decreased at the highest nitrogen level (225 kg N/ha).

Table 1. Yield of thyme (first harvest) in response to varying levels of applied nitrogen.

Fertilizer treatment (kg N/ha)	Fresh wt. (t/ha)	Dry wt. (t/ha)
0	5.8^{c}	1.6^{c}
56	7.7^{abc}	2.2^{abc}
112	10.0^{a}	2.9^{a}
169	9.2^{ab}	2.7^{ab}
225	6.8^{bc}	1.9^{bc}

Means in the same column with the same superscript are not significantly different ($P < 0.05$).

Second Harvest.

There was a noticeable decrease in thyme yield for treatments receiving 50 and 112 kg N/ha during the second harvest (Table 2). The 112 kg N/ha treatment produced lower fresh and dry matter yields than all other treatments including the control. The lower yield from the treatment receiving 112 kg N/ha suggests that regrowth could be suppressed following removal of excessive vegetative growth. Harvesting intervals may have to be adjusted to prevent excessive vegetative growth. Yields from the other treatments were similar to those from the first harvest. The highest yield was obtained from the treatment fertilized with 169 kg N/ha (Table 2). The production of dried leaves followed a pattern similar to the fresh and dry matter yields.

Third Harvest and Total Yield.

Treatments receiving 112 and 169 kg N/ha had the highest yields of the third harvest (Table 3). More than 10 t/ha of fresh thyme were produced

Table 2. Yield of thyme (second harvest) in response to varying levels of applied nitrogen.

Fertilizer treatment (kg N/ha)	Fresh wt. (t/ha)	Dry wt. (t/ha)	Leaf dry matter (t/ha)
0	7.0^{ab}	2.1^{ab}	1.3^{ab}
56	6.1^{ab}	1.8^{ab}	1.1^{ab}
112	4.7^{b}	1.4^{b}	0.9^{b}
169	8.6^{a}	2.8^{a}	1.7^{a}
225	8.1^{ab}	2.4^{ab}	1.4^{ab}

Means in the same column with the same superscript are not significantly different ($P < 0.05$).

Table 3. Yield of thyme (third harvest) in response to varying levels of applied nitrogen.

Dertilizer treatment (Kg N/ha)	Fresh wt. (t/ha)	Dry wt. (t/ha)	Leaf dry matter (t/ha)
0	5.3^{b}	1.7^{b}	1.0^{b}
56	7.9^{ab}	2.9^{ab}	1.4^{b}
112	12.7^{a}	4.7^{a}	2.5^{a}
169	11.0^{ab}	4.0^{ab}	2.0^{ab}
225	7.1^{ab}	2.5^{ab}	1.4^{b}

Means in the same column with the same superscript are not significantly different ($P < 0.05$).

from these treatments. The best yield was obtained from the treatment which received 112 kg N/ha. Production for this treatment increased dramatically in the third harvest (12.7 t/ha fresh, 4.7 t/ha dry) when compared to the second harvest. In fact, the dry matter produced for the 112 kg N/ha treatment in the third harvest was equal to the fresh weight of time obtained from the same treatment in the second harvest. The 112 kg N/ha treatment produced significantly more dried leaves than all of the other treatments except the 169 kg N/ha rate. The dry weight yield followed a similar trend to fresh weight.

The cumulative thyme production weight from all three harvests (Table 4) was significantly higher in treatments receiving the 112 kg N/ha (27.3 t/ha fresh, 9.0 t/ha dry) and 169 kg N/ha (28.7 t/ha fresh and 9.5 t/ha dry) than in the treatment receiving 0 kg N/ha (18.0 t/ha fresh, 5.4 t/ha dry).

Table 4. Total yield of thyme in response to varying levels of applied nitrogen.

Fertilizer treatment (kg N/ha)	Fresh wt. (t/ha)	Dry wt. (t/ha)
0	18.0^{b}	5.4^{b}
56	21.6^{ab}	6.8^{ab}
112	27.3^{a}	9.0^{a}
169	28.7^{a}	9.5^{a}
225	22.0^{ab}	6.7^{ab}

Means in the same column with the same superscript are not significantly different ($P< 0.05$).

Thyme is a perennial plant and this study has shown that good production can be successfully obtained from successive harvests of fertilized field plots. This study is an important first step in improving thyme production practices in the Caribbean. The results clearly indicate that thyme should be fertilized with nitrogen to increase yield. Nitrogen application rates of 112 or 169 kg N/ha are needed to significantly increase production.

Work in Israel has demonstrated similar results. The fertilization of young seedling significantly increased the fresh yield of thyme after 7-10 days when compared to seedlings which were not fertilized (Putievsky, 1990).

The yields obtained in this trial are comparable to yields from other thyme producing areas. Spain, the main producer of dried thyme leaves, has an annual production of 2000 tons. There a yield of 8.0 t/ha of dried product was reported (Verlet, 1989). Yields of dried leaves in our trials ranged from 0.9 to 2.5 t/ha per harvest. Thyme production of 6.52 t/ha (fresh) and 3.18 t/ha (dry) has been reported for Indiana, U.S. (Simon et al., 1989). The per cent dry matter (49%) yield in Indiana is superior to the range of 30-33 per cent obtained from our trials.

There are many other factors of thyme production that require research. These include application rates of various forms of nitrogen, P, K, and micronutrients (especially in our high pH soil), irrigation rates and methods. Pest and disease problems also need priority attention for research. Frank et al. (1987) reported that pest problems have caused severe economic losses in herbs, spices, and medicinal plants, where few chemical pest control methods are available. The fluctuations in yield of thyme between harvests for the high yielding treatments suggest the need for further studies on harvesting methods and intervals.

REFERENCES

Anonymous. 1988. U.S. Spice Trade. Foreign Agricultural Services, Circular Series FTEA 1-88.

Frank, R.J, Baron, J.J., and Guest, R.T. 1987. Pesticide for use in herbs, spices and medicinal plants. The Herbs, Spices and Medicinal Plant Digest. 5(1).

Kebede, S. 1988. Growing herbs under contract: Meeting the needs of the processor. In: Proceedings of the Third National Herb Growing and Marketing Conference, Louisville, Kentucky, 24-27 July 1988. 334p.

Larsen, D.J. 1988. Herb production for the processing industry: Reality and opportunity. In: Proceedings of the Third National Herb Growing and Marketing Conference, Louisville, Kentucky, 24-27 July 1988. 334p.

Putievsky, E. 1990. Fertilization and irrigation of herbs. In: Proceedings of Herb's 90: The Fifth Annual Conference of the International Herb Growers and Marketers Association, Baltimore, Maryland, 30 June-3 July, 1990. 228p.

Rivera, L.H., Frederick, W.D., Farris, C., Jensen, E.H., Davis, L., Palmer, C.D., Jackson, L.F., and McKinie, W.E. 1970. Soil Survey of the Virgin Islands of the United States. USDA Soil Conservation Service. 78p.

SAS Institute Inc. 1988. SAS/STAT User's Guide, Release 6.03 Edition. SAS Institute Inc., Cary, N.C.

Simon, J.E., Cebert, E., and Russ-Bubenheim, D. 1989. Cultivar evaluation of culinary herbs. In: Proceedings of Herbs '89: Fourth National Herb Growing and Marketing Conference, San José, California, 22-25 July 1989. 466p.

Verlet, N. 1989. Production practices in Europe. In: Proceedings of Herbs '89. Fourth National Herb Growing and Marketing Conference, San José, California, 22-25 July 1989. 466p.