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Fresh-cut
Culinary Herb
Trials 1989-1991

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SUMMARY

During 1989-1991, cultivar trials of parsley (*Petroselinum* sp.) and florence fennel (*Foeniculum vulgare*) were conducted at Mt. Carmel in a loamy upland soil. Also grown were annual herbs, such as dill (*Anethum graveolans*), summer savory (*Satureja hortensis*) and marjoram (*Origanum majorana*), and perennial herbs, such as oregano (*Origanum* sp.), sage (*Salvia officinallis*), French tarragon (*Artemisia dracuncululus*), and thyme (*Thymus vulgaris*). In 1989 and 1990, average total yields/plant of parsley were 14.9 oz and 22.1 oz respectively in four pickings. In 1990, high yields were attained despite an average loss of 21% of plants due to crown rot. In 1991, a year of below-average rainfall in spring, average yield/plant decreased to 11.0 oz in three pickings. Among the curled types, Afro, Forest Green, Sherwood, and Unicurl had the greatest yields in the 3-year trial. Among the plain-leaf types, Gigante had the greatest yields in two of three years.

Among the florence fennels, spring yields of the hybrids Zefa Fino and Fennel Fino were greater than Florence Fennel, an open-pollinated cultivar. Low yield of Florence Fennel in 1990 was due to bolting before the bulbs formed.

Among the annual herbs, yield/plant in 1990 of dill was 1.7 oz, summer savory 17.0 oz, and marjoram 2.3 oz. Among the perennial herbs, yield/plant in 1990 exceeded 6.0 oz for oregano, sage, and thyme.

Fresh-cut Culinary Herb Trials 1989-1991

BY DAVID E. HILL

Culinary herbs are mostly non-woody plants that contain essential (aromatic) oils that have been used for centuries as condiments to enrich the flavor and aroma of meat, fish, and vegetables. The earliest account of herbs are from the Mycenaean culture in the 13th Century B.C. (Mabberley, 1990). Cultivated herbs were spread from the Mediterranean area throughout Europe by Roman legionnaires (Page, 1971) and ultimately found their way to America's shores at the turn of the 19th Century.

Medicinal uses of herbs are well known throughout written history. The Greek physician, Hippocrates, in the 4th Century B.C., described use of tarragon to relieve the pain of insect and mad dog bites (Sutton, Humphries and Hopkinson, 1985). In the 1st Century A.D. the Roman agricultural and natural history writers Columella and Pliny the Elder described varieties of parsley (Ryder, 1979) and the use of thyme "to put all venomous creatures to flight" (Page, 1971). In the past few decades advanced technology has been able to identify and separate the numerous essential oils contained in thyme, oregano, and tarragon and determined their controlling effect on bacterial (Deans and Svoboda, 1989) and fungal (Steinmetz and Moulin-Traffort, 1988) growth.

Although herbs are not consumed in large quantities, their nutritional value cannot be overlooked. Among 14 species of herbs analyzed, fennel had the highest content of ascorbic acid (vitamin C) and 16 free amino acids (Davidyuk, Baranova and Vinogradov, 1981). Parsley had up to 11 mg/100g of B-carotene and exceeded its content in carrots (Vyrodova, Andryushchenko, and Zataliveter, 1988). With new-found nutritional analyses of herbs it is small wonder that Dr. John Hill, in a medical treatise in 1772, observed the virtues of sage that "retards the rapid progress of aging...aids memory...prevents depression of the spirits and makes the lamp of life burn brightly..." (Page, 1971).

The growing of herbs in Connecticut has long been practiced by ardent backyard hobbyists. In the past two decades, however, commercial growth of potted and fresh-cut herbs has flourished among a few dedicated growers. They report high cash returns for their efforts in greenhouse and field culture. Herbs, as niche crops, are

worthy of study to determine the best cultivars and their yields in Connecticut's soils and climate. In this bulletin I shall report yields and management strategies for the annual herbs parsley, fennel, dill, summer savory, and marjoram and perennial herbs such as oregano, sage, French tarragon, and thyme.

METHODS AND MATERIALS

Trials were conducted at Lockwood Farm, Mt. Carmel, on Cheshire fine sandy loam (1989), a well-drained loamy upland soil with a moderate moisture holding capacity and on Watchaug loam (1990-91), a moderately well-drained loamy upland soil with a moderate moisture holding capacity. Seeds for all annual and perennial herbs were sown in a greenhouse maintained at 50-75 F. Six-week-old seedlings were moved to a cold frame for hardening 7-10 days prior to field planting. The seedlings were planted at a 12-inch spacing in rows 18 inches apart, but 24 inches apart between cultivars (average of 21 inches) to provide 29,040 plants/A.

The seedlings were grown in Promix BX in 36-pot packs, each pot 2-5/8 x 2-1/4 x 2-5/16 inches. Water soluble 20-20-20 fertilizer (1 Tbsp/gal) was added to the seedlings 1 week before transplanting.

Parsley was repeatedly harvested to 1-inch above the crown when the stems were long enough to bunch. The yield/plant of each harvest was calculated from the total weight of each cultivar divided by the number of plants harvested. The total yield/plant is the sum of four harvests (three in 1991). The yield/A of each harvest was calculated by multiplying the yield/plant x 29,040 plants/A x % plants harvested. The total yield/A is the sum of all harvests. In 1989-1990 the first three harvests were spaced about 4 weeks apart beginning in mid-June. The final harvest was in early November. In 1991, the first harvest was delayed until August 1 because of spring and summer droughts. Fennel planted only in spring was harvested in late July when the bulbous base reached marketable size and before formation of flower stalks. Testing of two cultivars in 1989 and 1990 was expanded in 1991 to four

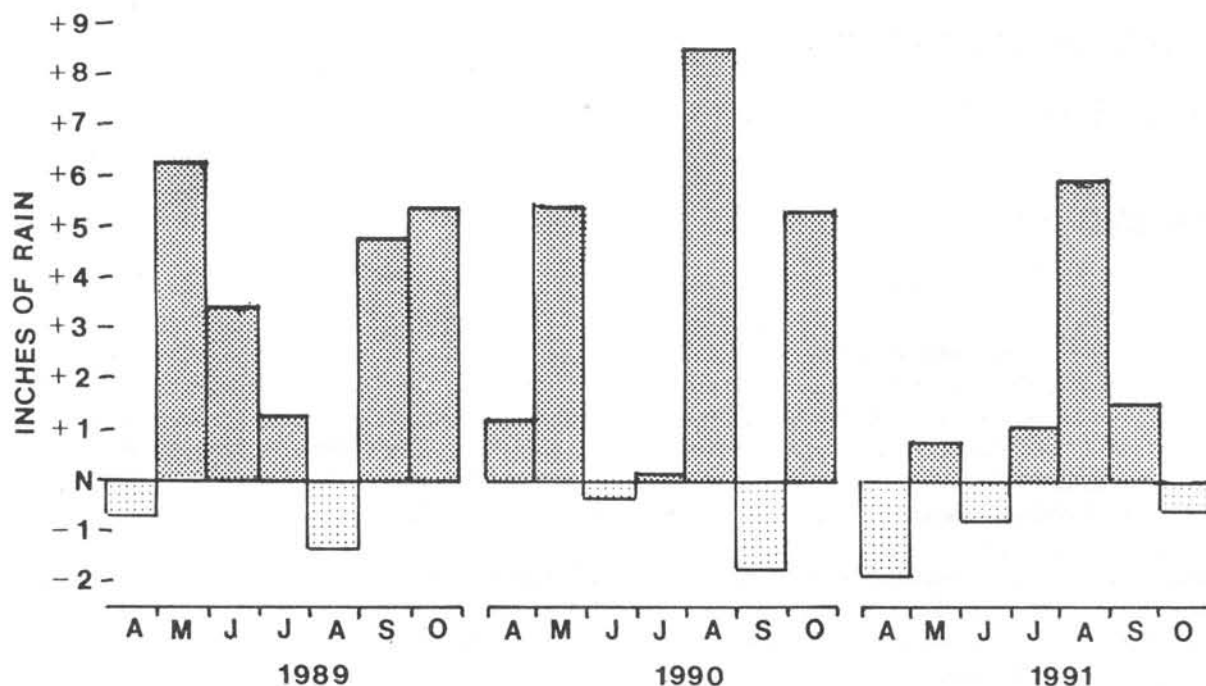


Figure 1. Inches of rain departure from normal (N) during growing seasons 1989-1991.

cultivars. Summer savory and marjoram, grown in 1990 and 1991 as annuals, were harvested only once when flowers first appeared in late August. Dill was grown from transplants in 1990 and direct seeded in 1991. The feathery leaves were harvested in early August as flower heads began to form. Thyme, oregano, sage, and tarragon, grown as perennials, were harvested lightly in August 1990, their first year, to allow sufficient growth for winter survival. In 1991, fresh shoots of oregano were harvested in May, July and October while plants of tarragon, sage and thyme were harvested once in early October by trimming to one-half their height. Spring and summer harvests were avoided during droughty periods. The details of management of soil and crops and pertinent dates are listed in Table 1.

RAINFALL

Rainfall distribution throughout the growing seasons (1989-1991) is shown in Figure 1. Each monthly bar represents the departure from the mean monthly rainfall reported by the U. S. Weather Service for the weather station at Mt. Carmel. In 1989 and 1990, rainfall during the growing season (April-October) was much above average for most months. Total rainfall during the period was 47.6 inches in 1989 and 42.4 inches in 1990 compared to a mean of 23.8 inches. Soil moisture reserves were

adequate for crop needs throughout the period. In contrast, total rainfall during the 1991 growing season was 30.2 inches compared to an average of 23.8 inches, but most of the surplus was provided by Hurricane Bob in a single day. Soil moisture reserves were inadequate for plant needs from April through mid-July as evidenced by stunted growth.

YIELD OF PARSLEY

The average total yield/plant from four harvests in 1989 of six curled types was 14.9 oz, or 28,800 lb/A (Table 2). Yield/plant in each harvest increased as the crowns enlarged by resprouting. Only 9% of the total yield/plant was obtained in the first harvest. In the second and third harvests, the yield doubled to 20 and 22%, respectively. Fully 49% of the total yield/plant was obtained in the final harvest. It is noted, however, that 8 weeks elapsed between the third and fourth harvests. The average yield of plain types was 9.7 oz/plant with a similar distribution among harvests.

The yield of curled types, Forest Green, Unicurl, and Afro exceeded 15 oz/plant or 28,000 lb/A. Based on a 4-oz bunch, yields would exceed 112,000 bunches/A. Among the plain types, Plain Italian and Gigante, yield exceeded 9.5 oz/plant or 17,500 lb/A or 70,000 bunches/A. No plants were lost to crown rot during the harvest season.

Table 1. Soil and crop management of herbs 1989-1991.

SOIL FERTILIZATION

10-10-10 (preplant)	1000 lb/A
Ammonium nitrate (side dress only parsley after first cutting)	90 lb/A
Lime (to attain pH 6.5)	None

PLANTING DATES

Seeding in greenhouse	Parsley March 15-30 All others April 10
Transfer to cold frame	May 10-20
Transplant to field	May 20-June 5

PEST CONTROL

Thrips (greenhouse)	Sevin 4F
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NUMBER OF IRRIGATIONS

1 (1991 only)

WEED CONTROL

Cultivations	2
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WINTER MULCHING FOR PERENNIALS

Straw, 450 bales/A	November 15
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In 1990, in four harvests, the average total yield of six curled types was 22.1 oz/plant or 33,300 lb/A. In 1990 the total yield/plant was 48% greater compared to 1989. Increased yield was due to above average rainfall throughout the growing season despite an average 21% loss of plants due to crown rot by the end of the fourth harvest. In contrast to 1989, 39% of the total yield/plant was obtained during the first harvest. In the second and third harvests the average yield/plant declined to 32% and 28%, respectively. The fourth harvest, 4 weeks after the third, only yielded 4% of the total harvest. Yield reduction was due to plant loss and depletion of nitrogen applied as a sidedressing after the first harvest. The average yield/plant of plain types was 29.4 oz/plant, a three-fold increase compared to 1989.

Among the curled types, Sherwood yielded 25.5 oz/plant or 41,600 lb/A or 166,400 bunches/A. Yield of Unicurl and Afro exceeded 22 oz/plant, 34,000 lb/A or 136,000 bunches/A. The higher yields of Sherwood and Afro were due to higher yields/plant and higher plant survival (percentage of plant survival was 86 and 89% respectively). The high yield of Unicurl was based on a high yield/plant despite a 26% loss of plants to crown rot.

In 1991, in three harvests, the average total yield was 11.0 oz/plant or 18,300 lb/A. The total yield/plant was

50% less than the yield in 1990 and 26% less than the yield in 1989. Low yields were due to very slow growth during droughty periods in June and July. The first harvest, August 1, provided only 12% of the total yield. Over 52% of the total yield was obtained in early September as moisture supplies improved harvest and the remaining 36% was harvested late in October. The average yield of the plain types was 18.2 oz/plant, a decrease of 38% compared to the 1990 harvest.

Among the curled types, the total yield of Forest Green and Afro exceeded 12.0 oz/plant or 20,000 lb/A or 80,000 bunches/acre. Lower yields in 1991 were due to fewer harvests. Plant mortality was only 8% compared to 21% in 1990, a wet year.

YIELD OF FLORENCE FENNEL

The yields of florence fennel and all other annual and perennial herbs are reported in Table 3. In 1989, the average yield of two fennel cultivars planted in spring for summer harvest was 17.2 oz/plant or 30,650 lb/A. The yield of Zefa Fino was 20.9 oz/plant or 36,750 lb/A. In 1990, the average yield of the same two cultivars was 19.8 oz/plant, an increase of 15% compared to 1989. Yield of Zefa Fino was 29,350 lb/A compared to only

Table 2. Yield of parsley at Mt. Carmel, CT during 1989-1991.

	1989			1990			1991		
	%Hvst	Oz/Plant	Lb/A ^a	%Hvst	Oz/Plant	Lb/A ^a	%Hvst	Oz/Plant	Lb/A ^a
CURLED TYPES									
Afro	100	15.6	28,280	89	21.9	36,120	94	12.5	21,310
Bravour	100	13.8	25,140	72	21.0	30,100	94	9.3	15,860
Darki	100	13.9	25,230	86	19.9	31,580	91	10.7	17,720
Forest Green	100	16.4	29,780	68	20.7	26,210	90	12.8	20,800
Sherwood	100	13.6	24,680	86	25.5	41,640	85	11.6	18,150
Unicurl	100	16.4	29,710	74	23.4	34,380	95	9.3	16,010
AVERAGE	100	14.9	27,140	79	22.1	33,340	92	11.0	18,310
PLAIN TYPES									
Gigante	100	9.5 ^b	17,320	72	32.4	44,330	84	20.3	30,960
Plain Italian	100	9.7 ^b	17,540	80	26.3	39,640	91	16.2	27,500
AVERAGE	-	-	-	76	29.4	41,980	88	18.2	29,230

^a Based on 12" x 21" spacing or 29,040 plants/acre.

^b 3 pickings

Table 3. Yields of annual and perennial herbs at Mt. Carmel, CT during 1989-1991.

	1989			1990			1991		
	%Hvst	Oz/Plant	Lb/A ^a	%Hvst	Oz/Plant	Lb/A ^a	%Hvst	Oz/Plant	Lb/A ^a
ANNUALS									
FENNEL									
Florence Fen.	100	13.5	24,540	30	21.3	11,580	100	4.3	7,770
Zefa Fino	97	20.9	36,760	89	18.4	29,360	100	6.5	11,720
Fennel Fino	-	-	-	-	-	-	100	6.7	12,200
Romy Fennel	-	-	-	-	-	-	100	5.9	10,780
DILL	-	-	-	100	1.7	3,050	-	-	-
SUMMER SAVORY	-	-	-	100	17.0	30,860	100	2.8	5,120
MARJORAM	-	-	-	100	2.3	4,180 ^b	100	4.1	7,440
PERENNIALS									
OREGANO	-	-	-	100	1.9	3,520 ^b	100	7.9	14,265
SAGE	-	-	-	100	2.9	5,340 ^b	98	6.2	11,070
TARRAGON	-	-	-	100	1.4	2,460 ^b	100	1.6	2,880
THYME	-	-	-	100	2.0	3,700 ^b	100	6.9	12,560

^a Based on 12" x 21" spacing or 29,040 plants/acre.

^b Light fall picking before winter dormancy.

11,600 lb/A for Florence Fennel. The low yield of Florence Fennel was due to 70% loss of plants to bolting before the bulbs formed. In comparison, bolting in Zefa Fino was only 11%.

In 1991, the average yield of four cultivars was 5.8 oz/plant or 10,600 lb/A. In 1991 yield/plant was 70% less than 1990 due to droughty conditions in late spring and early summer. Yield of Fennel Fino and Zefa Fino exceeded 6.5 oz/plant or 11,700 lb/A.

YIELD OF DILL

In 1990, fresh dill yielded 1.7 oz/plant in a late-August harvest as flower heads began to form. Dill seed failed to germinate in 1991.

YIELD OF SUMMER SAVORY

In 1990, yield of summer savory was 17.0 oz/plant or 30,800 lb/A in an August harvest. In 1991, drought in late spring and early summer retarded growth and yield was only 2.8 oz/plant or 5,100 lb/A in a mid-October harvest.

YIELD OF MARJORAM

In 1990, marjoram was grown as a perennial. Yield/plant was 2.3 oz with one light picking in October. All plants died during the winter of 1990-1991. In 1991, it was grown as an annual and yield/plant improved to 4.3 oz.

YIELD OF PERENNIAL HERBS

In 1990, yield of all perennial herbs ranged from 1.4 - 2.9 oz/plant or 2,400-5,300 lb/A. This low yield was the result of an intentional light picking to provide sufficient time for the accumulation of plant mass to insure their survival during the winter. All perennial herb plants survived, after mulching in November, except one sage plant. In 1991, yield of perennial herbs was 2 to 3-fold greater than in 1990.

The yield/plant of oregano, the sum of three pickings, was the greatest. Among all perennials tested, it displayed drought resistance. Its prostrate growth habit carpeted the surrounding soil and conserved moisture. Yield of tarragon was lowest because of winter injury to the uppermost portions of the plants.

MANAGEMENT STRATEGIES

Selection of Cultivars

Only parsley and florence fennel provided opportunities for cultivar trials. Among the curled types no single cultivar had consistently higher yields throughout the 3-year study. Unicurl and Forest Green had the

highest yield/plant in 1989, Sherwood in 1990, and Forest Green and Afro in 1991. The average 3-year yield/plant, was higher for Sherwood, Afro, Forest Green and Unicurl than Bravour and Darki. Among the plain types the yield/plant of Gigante was greater than Plain Italian in two of three years.

Among the florence fennels, the yield/plant of Zefa Fino was clearly superior to Florence Fennel in all three years. Fennel Fino, grown only in 1991, yielded slightly more than all others. Both of these hybrids resisted bolting when grown in spring. In comparison, 70% of Florence Fennel bolted in 1990. I tested florence fennel as a fall crop in 1991. A mid-August transplanting failed to produce marketable bulbs by late-October when damaging frost occurred.

Site selection

In 1989, trials of annual herbs were conducted on Cheshire fine sandy loam, a well-drained soil. There were no losses of plants due to disease. In 1990, the trials were conducted on Watchaug loam, a moderately well-drained soil. This soil has a finer texture than Cheshire fine sandy loam and lay in a flat area that was artificially drained. Heavy rains in 1990 temporarily flooded the field and the soil was saturated for periods of several days. An average of 21% of all parsley cultivars was lost to crown rot beginning in mid-September. In 1991, trials were repeated on this soil and the early part of the growing season was somewhat droughty. In 1991, an average of 8% of each cultivar was lost to crown rot. It is, therefore, important to consider raising plants on well-drained sites and soils for maximum production of herbs.

Fertilization and irrigation

Maximum production of edible leafy plants requires optimum nitrogen supplies and moisture throughout the growing season. On the fine sandy loam and loam soils, high nitrogen levels could be maintained with application of 100 lb N/A at planting and 30 lb N/A as a side dressing after the first or second picking. On sandy, more readily leached soils, 70 lb N/A at planting followed by a side dressing of 20 lb N after each picking should provide adequate levels of nitrate for leaf production. Application of 1 inch rainfall or equivalent irrigation each week will ensure adequate moisture needs for the growing plant. In 1991, plants were stunted because of inadequate water early in the development of the plants. Only three pickings were possible in this drier-than-normal growing season.

Harvests

Annual yield measured in oz/plant is highly dependent upon rainfall, fertilization, and survival of plants. Although yield/plant was high in 1990 because of adequate rainfall, total yield/acre suffered because of 21% plant loss.

Inadequate rainfall in 1991 resulted in one less harvest and reduced yield/plant.

Parsley transplanted in mid-to-late May was first harvested mid-June through July with successive pickings 4 weeks apart. Ideally, five pickings are possible with early May plantings, adequate nitrogen fertilization, and water supply. Parsley and other herbs tested survived early frosts when temperature fell to 28 F. Final pickings ranged from October 28 to November 19. Although one harvest of perennial herbs occurred late in the growing season, earlier harvests of tender shoots from mid-July through October are possible and desirable. Limited pickings throughout the growing season promotes side branching. Repeated multiple harvesting of oregano is especially useful to delay flowering.

REFERENCES

- Davidyuk, L.P., Baranova, S.V. and Vinogradov, B.A. 1981. Biologically active substances of some promising aromatic plants for the food industry. *Trudy Gosudarstvennogo Nikitskogo Botanichskogo Sida* 83:33-42.
- Deans, S.G. and Svoboda, K.P. 1989. Antibacterial activity of summer savory (*Satureja hortensis* L.) essential oil and its constituents. *Journal of Horticultural Science* 64:205-210.
- Mabberley, D. J. 1990. *The Plant Book*. Cambridge University Press. New York. 707 p.
- Page, M. 1971. Herbs. *Journal Royal Horticultural Society*. 96:526-536.
- Ryder, E.J. 1979. *Leafy salad vegetables*. AVI Publishing Company, Westport, Connecticut. 266 p.
- Steinmetz, M.D., Moulin-Traffort, J. and Regli, P. 1988. Transmission and scanning electromicroscopy study of sage and rosemary essential oils and eucalyptol on *Candida albicans*. *Mycosis* 31:40-51.
- Sutton, S., Humphries, C. and Hopkinson, J. 1985. Tarragon. *The Garden, Journal Royal Horticultural Society*. 110:237-240.
- Vyroдова, A.P., Andryushchenko, V.K. and Zatuliveter, V.J. 1988. Content of B-carotene in various vegetables. *Fiziologiya i Biokhimiya Kul'turnykh Rastenii* 20:167-171.



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