require temperature and/or light control, and possibly more attention to time of establishment.

Members of the florist industry that were asked to evaluate were surprised at the size and quality of locally produced flowers. They were especially impressed with the freshness and encouraged us to proceed with other studies and with production for the local market.

Conclusions

Several factors became obvious during this 3 year study. Some might seem obvious, but others could have only been revealed by such a long term project.

1. The species, and even the color of flowers that are marketed are dictated primarily by trends within the wholesale florist industry. However, florists are constantly interested in unusual flowers.
2. Growers must offer a consistent year-round supply of quality flowers when dealing with wholesale or retail florists.
3. Marketing should be to either wholesale or retail florists, not both within the same region. A potential grower should make this decision early when planning for a cut flower operation.
4. Florists can tolerate no insects, even beneficials, on flowers. Producers will therefore need to concentrate on preharvest and postharvest practices that eliminate any insects.
5. Growth is rapid under the black plastic mulch system. However, some spring planted species suffered from heat, which was possibly due to the mulch.
6. Fertility requirements for cut flowers in these trials were relatively low, when compared to vegetables grown under a similar system. Injection of nitrogen and potassium as a supplemental application was provided only once during each crop cycle.
7. The time of establishment is critical for both the cool season and warm season flowers.
8. Greenhouse production will be necessary in order to supply a wide variety, and a consistent supply of quality specialty cut flowers. Though many can be grown under field conditions, extreme weather conditions (hail, heavy rains, high winds and freezes) affect the quality and consistent quantity required by florists.
9. Most flowers are best started in the field by transplanting plugs. Sunflowers and zinnias however, are best direct seeded.

Literature Cited

Armitage, A. M. 1993. Specialty Cut Flowers. Varsity Press/Timber Press, Portland, OR. 372 pp.

Stevens, A. B. and K. L. B. Gast. 1992. Specialty Cut Flowers - A Commercial Grower's Guide. Coop. Ext. Serv., Kansas State Univ. MF-1034, p. 11.

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ORGANIC SOIL AMENDMENT STUDY WITH IRISH POTATO

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Abstract. **Since the spring of 1990 an on-going study has been conducted at the University of Florida's Organic Gardening Research and Education Park, Gainesville, on the effects of various organic soil amendments on selected vegetables. One dozen 5 × 10 ft "grow-boxes" were amended annually with a variety of organic materials. The purpose was to determine and demonstrate optimum amounts of these amendments as a source of fertility for growing garden vegetables. Results and data in previous years have been reported. The spring, 1997 study with potatoes constitutes the subject of the current paper. None of the organic soil amendments and fertilizers added in previous years was applied in 1997. Therefore, the objective of this year's study was to observe the *residual* effects of previously applied amendments on the yield of two potato varieties: 'Kennebec' (white) and 'Red LaSoda'. The most recent applications were made in the spring of 1996 in a trial with 'Celebrity' tomato and 'Jupiter' pepper (data not presented). Over the course of the seven year period from 1990-1996, the following amendments were applied at both a low and a high rate: oak leaves; yard waste compost (YWC); YWC plus organic fertilizer (Fertrell 3-2-3); organic fertilizer (Fertrell 3-2-3); chicken manure; composted chicken manure (Red Rooster 2-3-2 and 3-5-3); and combined amendments (sheep manure + RR + YWC). Other materials were also tested, but are not included in this paper. Potatoes were dug 14 May 1997 and the yield results are reported as number and weight of tubers per plant. Top yields of both varieties came from the mixed-amendments box, which had received approximately 560 tons/acre (28 lb/sq ft) of organic amendments. This result has been the case with all crops grown in previous years.The box receiving the higher rate of Red Rooster (4.70 lb/sq ft) gave a relatively good yield of 'Red LaSoda' tubers, but only fair yield of 'Kennebec'. Other amendments gave fair to poor results. Surprisingly, yields from the box receiving oak leaves alone (6-12 lb/sq ft) were as substantial as those from all but the two highest yielding treatments mentioned.**

Organic wastes should be used liberally in vegetable gardens for at least three very good reasons: 1) they contribute

valuable benefits as soil amendments and fertilizers; 2) they serve well as mulching material; and 3) these waste products present quite a disposal problem for society. About 20 million tons of solid waste were produced in Florida in 1992, constituted in part by 3 million tons of yard waste and ½ million tons of animal manures (Smith, 1994). Since this organic waste is not allowed in landfills, an obvious viable option is to incorporate it into good agricultural practices. Amending garden soils has shown to be one excellent way to recycle these waste products effectively. Previous trials at the Organic Gardening Research and Education Park have strongly indicated that 20 to 40 tons/acre of yard waste compost, supplemented with organic fertilizer or animal manure and incorporated annually, resulted in very satisfactory production of several garden vegetables (Stephens and Kostewicz, 1992). Even higher yields were obtained when these materials were applied at much greater rates. In a spring 1995 test, highest yields of tomatoes (9.30 lb/plant) were recorded for a plot which had been amended over a five-year period the equivalent of 520 tons/acre, or about 104 tons annually (Stephens and Kostewicz, 1996). Since as much as 1.6 million tons of in-state yard waste compost are available annually (Smith, 1994),with an estimated 10,000 acres of vegetable gardens in Florida (Gallup, 1986), at least half of this composted yard waste could be utilized in vegetable gardens. Likewise, the application of livestock manure has been a standard agricultural practice for decades, and remains a viable soil improvement option for home gardeners. Part of the beneficial effects accruing from the use of organic amendments on Florida's coarse sands is increased fertility, while other improvements are also important. With fast diminishing water supplies, researchers are investigating various water-conserving techniques, such as irrigation scheduling (Locascio and Smajstrla, 1996). Water applied at any time and in various quantities is held longer by the organic fraction in soils amended with organics, for more efficient plant use.

The purpose of this current study is to observe the residual effects of organic amendments previously applied at relatively high rates, and to look at the response of Irish potatoes to organic sources of fertility.

Materials and Methods

Irish potatoes was used as the test crop, utilizing two common garden varieties: 'Red LaSoda' and a white variety, 'Kennebec'. Plots consisted of seven "grow-boxes", each measuring 5 × 10 ft (50 sq ft), and constructed of four 6-inch wide cedar boards. The boxes were established in the spring of 1990, and the sandy soil of each had been amended annually prior to this current test. Each box was halved crosswise with a center board. The eastern ½ (25 sq ft) received amendment at the low rate, while the western ½ received the higher amount (usually double the low rate).

Treatments: Organic Soil Amendments. Various organic materials were applied seasonally in a variety of ways, ranging from banding to broadcasting, then incorporated into the respective grow-boxes. The cumulative amounts are shown in Table 1. The most recent applications, as outlined below, were made on 5 March 1996, by banding the materials two weeks prior to setting tomato and bell pepper plants into the boxes (Table 2).

Spring, 1996 Applications. Box A. Chicken litter—Fresh chicken litter was obtained from the UF Poultry Department. The low rate of 10 T/acre (0.5 lb/sq ft) was banded on the east side, while the high rate of 20 T/acre (1 lb/sq ft) was banded on the west side of the grow-box.

Table 1. Cumulative amounts of organic soil amendments applied to "grow-boxes" during the first seven years, 1990-1996.[z]

Treatment		Amount (lb/sq ft)	
Grow-box	Amendment	low	high
A	Chicken litter	3.70	8.30
B	Poultry compost	1.75	4.70
C	Organic 3-2-3 fertilizer	0.80	1.50
D	Yard waste compost (YWC)	8.60	14.20
E	YWC + organic 3-2-3	6.60 + 0.95	12.20 + 1.35
F	Mixture	27.52	28.84
G	Oak leaves	6.00	12.00

[z]Applications made annually for seven years, none in 1997.

Box B. Poultry compost (Red Rooster 2-3-2)—This clean, granulated, composted poultry manure (prepared for retail) was applied at the following two rates: low (2 T/acre, or 0.1 lb/sq ft), and high (4 T/acre, or 0.2 lb/sq ft).

Box C. Blended organic fertilizer (Fertrell 3-2-3)—This retailed product contains a blend of such ingredients as granite dust, castor pomace, bonemeal, cocoa shells, cottonseed meal, oyster meal, phosphate rock, green sand, and chicken manure. This organic fertilizer was applied at 2 T/acre (0.1 lb/sq ft) and at 4 T/acre (0.2 lb/sq ft).

Box D. Yard waste compost (YWC)—This compost was obtained from the Jacksonville facility, and applied in the box which had been amended previously with Gainesville YWC. The two rates applied in the spring of 1996 were 10 and 20 tons per acre, (or 0.5 and 1.0 lb/sq ft).

Box E. YWC plus Fertrell 3-2-3—The Jacksonville YWC was applied at two rates. At the low rate (10 T/acre), the compost was supplemented with a low rate of Fertrell (2 T/acre). At the higher rate (20 T/acre), the YWC received a higher rate of Fertrell fertilizer supplement (4 T/acre). Previously, this box had been amended with Gainesville and Jacksonville YWC.

Box F. Mixture: Sheep manure + YWC + Red Rooster 2-3-2—Previously, this box was amended heavily with a combination of these and other materials. This year the "low" side was amended as follows: Sheep manure (10 T/acre), Jacksonville YWC (10 T/acre), and Red Rooster 2-3-2 (2 T/acre). The high side was amended as follows: Sheep manure (20 T/acre), plus Jacksonville YWC (20 T/acre), and Red Rooster 2-3-2 (4 T/acre).

Box G. Oak leaves—The "low rate"-side received an application of leaves in the amount of 10 T/acre (0.5 lb/sq ft), while the "high rate"-side received 20 T/acre (1 lb/sq ft). In 1995

Table 2. Most recent treatments. Spring, 1996.

Treatment		Amount (lb/sq ft)	
Grow-box	Amendment	low	high
A	Chicken litter	0.5	1.0
B	Red Rooster 2-3-2	0.1	0.2
C	Fertrell 3-2-3	0.1	0.2
D	Yard waste compost (YWC)	0.5	1.0
E	YWC + Fertrell 3-2-3	0.5 + 0.1	1.0 + 0.2
F	Sheep + YWC + Red Rooster	0.5 + 0.5 + 0.1	1.0 + 1.0 + 0.2
G	Oak leaves	0.5	1.0

Table 3. Effects of organic soil amendments on yield of 'Red LaSoda' potatoes. Spring 1997.[z]

Treatment		Tuber yield per plant[y]	
Amendment	Rate	no.	lb
Sheep + YWC + RR[x] 2-3-2	high	4.0	0.950
Sheep + YWC + RR[x] 2-3-2	low	5.0	0.950
Red Rooster 2-3-2	high	4.5	0.825
Oak leaves	low	4.0	0.500
Fertrell 3-2-3	high	2.0	0.500
Oak leaves	high	3.5	0.400
YWC	high	4.5	0.400
Fertrell 3-2-3	low	3.5	0.400
YWC + Fertrell 3-2-3	high	4.0	0.300
Chicken litter	high	3.0	0.290
YWC + Fertrell 3-2-3	low	2.5	0.275
Chicken litter	low	2.5	0.240
Red Rooster 2-3-2	low	3.0	0.225
YWC	low	1.5	0.100

[z]Data not statistically valid.
[y]Half of two best plants dug.
[x]RR = Red Rooster.

Table 4. Yield of 'Kennebec' potatoes. Spring, 1997.[z]

Treatment		Tuber yield per plant[y]	
Organics	Rate	no.	lb
Sheep+ YWC + RR[x]	high	5 0	1.575
Sheep+ YWC + RR[x]	low	4.0	0.800
Oak leaves	high	3.0	0.400
Chicken litter	high	4.0	0.400
Oak leaves	low	3.5	0.350
RR[x] 2-3-2	high	3 0	0.350
Fertrell 3-2-3	high	4.0	0.325
YWC[x] + Fertrell	high	4.5	0.300
Chicken litter	low	3.0	0.225
YWC[x] + Fertrell	low	3.5	0.200
YWC[x]	low	2.5	0.175
YWC[x]	high	2.0	0.175
RR[x] 2-3-2	low	3.5	0.175
Fertrell 3-2-3	low	2.0	0.150

[z]Data not statistically valid.
[y]Half of tubers dug from two plants per plot.
[x]RR = Red Rooster, YWC = Yard Waste Compost.

and 1996, the leaves were so well-aged that shredding was impractical.

Plant establishment. The following year, on 4 March 1997, 'Red LaSoda' and 'Kennebec' potato seed pieces were planted 6 inches apart in a row of each, spaced 18 inches apart lengthwise within each "grow-box". Therefore, each treatment contained ten potato plants of each variety.The un-bedded plants were watered and weeded (no pest control needed).

Results and Discussion

The potatoes were dug on 14 May 1997, utilizing the two best plants within each treatment. The yield of all tubers over 1⅞ inch diameter from the two plants were counted and weighed for evaluation and analysis. Note that the harvest data are statistically invalid and are reported for observational significance only Table 3 contains the 'Red LaSoda' yield comparisons, while Table 4 shows the yield data for the white variety, 'Kennebec'.

Potato Yield Comparisons. It was not surprising that the highest yielding box for both varieties of potatoes was Box F, which had been amended most heavily over the seven-year period. Box F had received the equivalent of about 560 T/acre organic amendment as a mixture of both carbonaceous and nitrogenous materials, compared with only ½ that much in the next most highly amended box-YWC (see Table 1). This result is consistent with all previous crop study results in these particular "grow boxes". A good yield of red tubers was also obtained with the high rate of Red Rooster 2-3-2, which had been applied at a much lesser rate of about 100 T/acre over the seven-year period.

For all other treatments, yields of both varieties dropped off considerably. Yields from "high-rate" treatments averaged somewhat higher than from the "low" rate of the same material, with a notable exception: the reasonable yields of 'Red LaSoda' (0.500 lb/plant) and 'Kennebec' (0.350 lb/plant) dug from the box amended with a low rate of oak leaves were about the same as from the "high" rate of oak leaves (0.400 and 0.500 lb/plant, respectively).

Most boxes amended with a single material at relatively low rates gave only fair to low yields. This was also true of oak leaves and yard waste compost (YWC), even though these materials were applied in larger amounts.

Yard waste compost (YWC). In our earlier tests, YWC applied alone and just prior to planting depressed yields of cucumbers (Stephens and Kostewicz,1994) and tomatoes (Stephens and Kostewicz,1996). In those tests, however, yields of both these crops were enhanced greatly by supplementing the YWC with Fertrell as a nitrogen source. This current study shows that a), YWC as a single amendment can give fair results when applied liberally and allowed to age in the soil, and b), supplementation with nitrogen may be less effective in a residual situation than when applied at planting time.

Summary. While these potato data are not statistically valid, they do continue to point to the utilization of substantially large amounts of organic waste products as a feasible way to amend soils for growing vegetables in Florida. Again, as was true in past years of these "grow-box" studies, the concept of "more is better" prevailed in this year's test. The highest yields of potatoes were obtained in the box where multiple organics were applied over a seven-year period. That particular box now contains the remnants of 560 tons per acre of various organic soil amendments. One might conclude from this study that many organic soil amendments, even those that are woody and low in N, when applied seasonally and liberally, tend to provide residual benefits for a crop like potato and perhaps others.

Literature Cited

1. Gallup Organization. 1986. National gardening survey: 1985- 1986. National Gardening Assoc., Burlington, VT.
2. Locascio, S. J. and A. G. Smajstrla. 1996. Water application scheduling by pan evaporation for drip-irrigated tomato. J. Amer. Soc. Hort. Sci. 121(1):63-68.
3. Smith, Wayne H. 1994. Recycling composted organic materials in Florida. Univ. Fla., Instit. Food Agri. Sci. BP-2. Gainesville, FL.
4. Stephens, James M. and S. R. Kostewicz. 1992. Organic soil amendments for Florida gardens. Proc. Fla. State Hort. Soc. 105:263-265.
5. Stephens, James M. and S. R. Kostewicz. 1994. Response of cucumber to organic soil amendments. Proc. Fla. State Hort. Soc. 107:382-384.
6. Stephens, James M. and S. R. Kostewicz. 1996. Organic soil amendment studies with tomato. Proc. Fla. State Hort. Soc. 109:296-298.