

Fact Sheets

Greenhouse Management / Engineering

Organic Fertilizers and Soilless Media Show Promise

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Greenhouse operators are showing great interest in “organic” or “green” growing practices and the possibility of becoming “certified organic”. Elimination of chemical pesticides, adoption of IPM methods, and the use of biorational insect and disease control methods are important steps toward reaching the goal of being organic. However, growers must also seek alternatives to current growing media which contain chemical starter fertilizers and wetting agents and the use of traditional water-soluble chemical fertilizers. The results of this study are intended to help growers with less than an acre of greenhouse space who wish to transition from traditional growing media and fertilizers to organic alternatives.

At the present time only a few commercial soilless media are approved by the National Organic Program (NOP) or the Organic Materials Review Institute (OMRI). Sungro Horticulture and Fafard have several organic formulations of peat-lite media containing no chemical fertilizers or wetting agents. Some in the organic community object to the use of sphagnum peat moss in horticulture, but the Sungro and Fafard mixes are approved for use in organic plant production at this time.

Compost is an obvious choice as an alternative to peat-containing media. Historically many types of compost have proven successful for growing greenhouse crops. However, widespread use of compost has been limited by the lack of long-term availability of large quantities of consistent product.

The only widely available water-soluble fertilizer approved by NOP and OMRI is liquid fish fertilizer (fish emulsion). Liquid fish fertilizer has a very low NPK analysis (2-4-1), a rather thick consistency, and some users object to its odor. However, it has the advantage of being compatible with most equipment and systems growers already use to apply water-soluble fertilizer. It can be successfully used to fertilize plants including greenhouse tomatoes irrigated using a drip system (Mello and Mello, 2007).

Another approach to fertilizing greenhouse plants organically, is to incorporate bulk fertilizers like dried blood, bone meal, and rock phosphate in the medium before planting. Of course this way of fertilizing limits the control of nutrition as the plants grow unlike water-soluble fertilizers. However, one interesting formulation has been developed by John Biernbaum of Michigan State University (Biernbaum, 2006). It consists of a peat- or compost-based medium amended with a commercial alfalfa meal-based 3-1-5 fertilizer as the source of nutrients. Biernbaum, in his trials, successfully grew a variety of bedding plants in this growing medium without applying any other fertilizer.

This study with marigolds is part of a larger, ongoing project supported by the New England Greenhouse Conference and the New England Florist Credit Association Endowment which will evaluate several commercial organic growing media, liquid fish emulsion fertilizer, the Biernbaum formulation, and alfalfa pellets for growing bedding plants and other annuals. This project is intended to help small- and medium-sized growers produce annual plants using commercial organic growing media, liquid fish fertilizer, or an alfalfa meal amended peat-lite medium.

How the plants were grown

Seeds of ‘First Lady’ marigold were sown in plug trays on 18 February 2009. On 11 March seedlings were transplanted to 4-inch pots filled with either Fafard 3B, Fafard Organic FOF#30, and Sunshine Organic Planting Mix SOPM. The three mixes are soilless peat-based media but they do not contain chemical sater fertilizer or wetting agent. Fafard Organic FOF#30 is the organic version of 3B and contains Perdue Organic Fertilizer as a starter charge and no wetting agent. Sunshine SOPM is the organic version of Sunshine Mix #1 and contains yucca extract as a wetting agent. The media were tested prior to planting for pH, EC, NO₃-N, NH₄-N, P, K, and Ca (Table 1).

Table 1. Soil test results prior to planting.

	Fafard 3B	Fafard Organic	Sunshine Organic
pH	6.2	5.5	6.5
Soluble salts (mS/cm)	1.52	1.46	0.73
NO ₃ -N (ppm)	29	6	7
NH ₄ -N	0	8	0
P	2	35	0
K	110	141	5
Ca	56	118	106
Mg	71	135	146

Plants were fertilizer with either Plantex 20-2-20 chemical fertilizer (200 ppm N), Neptune’s Harvest Organic Fish (emulsion) Fertilizer 3-1-5 (2.2 fl. oz./gal.), Planet Natural alfalfa pellets 5-1-2 (35 oz./ft³), or the fish fertilizer and alfalfa pellet treatments together. The alfalfa pellets (similar in appearance to wood pellets and often used as animal feed when fortified with molasses) were incorporated in the growth media before planting. Liquid fertilizers were applied at nearly every watering.

Plants were harvested on 8 May at which time foliar height (height measured to the uppermost leaves), flower height (height measured to the top of the first flower bud), first flower bud diameter, and shoot dry weight were measured.

Results

At harvest plants fertilized with chemical fertilizer, fish fertilizer, or fish fertilizer and alfalfa pellets were difficult to tell apart from each other regardless of growth medium. However, the plants fertilized with alfalfa pellets alone were chlorotic and had noticeably smaller leaves than plants in the other treatments. These difference in appearance between plants fertilized with alfalfa pellets alone and the other treatments is clearly apparent (Figures 1 and 2).

Table 2 shows the “main effects” of fertilizer and growth medium on marigold growth; there were only a couple of interactions between the two factors. Plants fertilized with chemical fertilizer were tallest, had the most developed first flower bud, and accumulated the most shoot dry weight. Plants fertilized with fish fertilizer or the combination of fish and alfalfa pellets were, from a statistical standpoint inferior to the chemical fertilizer treatment, but the actual differences were very small and of limited practical importance.

The plants fertilized with alfalfa pellets alone were obviously nutrient deficient, but oddly they were as tall as the chemical treatment and taller than the fish fertilizer and fish + alfalfa pellets treatment. However,



Figure 1. The lefthand plant was fertilized with alfalfa pellets alone.

first flower buds were much smaller and the plants accumulated much less shoot dry weight than the other treatments.

Plants grown with Fafard 3B were the tallest and accumulated the greatest dry weight. The two organic soilless media produced comparable levels of growth to each other except that Sunshine Organic plants accumulate significantly less dry weight.

Table 2. ‘First Lady’ marigold growth as affected by fertilizer and growth medium.

	Foliar hgt. (cm)	Flower hgt. (cm)	Bud dia. (mm)	Shoot dry weight (gm)
Fertilizer type				
Chemical 20-2-20	26.5a ^z	32.2a	56.8a	12.8a
Fish emulsion	25.4b	30.3b	49.7b	11.9b
Alfalfa pellets	26.6a	32.7a	34.2c	9.1c
Fish + alfalfa	25.6b	30.9b	52.3a	11.5b
Growth medium				
Fafard 3B	26.7a	32.3a	50.2a	12.6a
Fafard Organic	25.7b	31.1b	50.1a	11.2b
Sunshine Organic	25.5b	31.0b	44.5b	10.2c

^zMeans followed by different letters within fertilizer or growth medium are statistically different at P=0.01.



Figure 2. Marigolds growing in Sunshine Organic Planting Mix. fertilized (L to R) with chemical 20-2-20, fish fertilizer, alfalfa pellets alone, fish fertilizer + alfalfa pellets. In terms of appearance, Fafard 3B and Fafard Organic Mix produced the same results.

Conclusions

Overall I think the results of this study were positive and the organic materials showed promise. Since this was the first experiment in this project the main objectives were to determine the overall responses to the treatments and to use the results to establish levels of fish and alfalfa fertilizers for use in future experiments with marigold and other plants. Since there is almost no readily available information on the what levels of fish and alfalfa fertilizers to use, you’ve got to start somewhere!. So it’s likely that applying higher levels of fish fertilizer or alfalfa pellets will produce better results.

I chose the alfalfa pellet application level based on recommendations in Birenbaum’s (2006) study. He, however, used an alfalfa meal (rather than pellet) fertilizer called Bradfield Organics “Luscious Lawn & Garden” 3-1-5 fertilizer which I was unable to get in February. Many readers who operate garden centers

will recognize the Bradfield Organics brand. I intend to use it and the pellets in future work.

Marigold responses to growth medium, especially shoot dry, may have been due to the differences in nutrient levels at planting (Table 1). Fafard 3B had a much higher NO₃-N level at planting than the organic media and finished with the most shoot dry weight. Also, Sunshine Organic, which produced plants with the least dry weight, had very low P and K levels and a much lower EC level at planting compared to the other two media. Although starter fertilizers are supposed to last only 2 or 3 weeks, its surprising how much impact on future growth they can have if their levels are low during the time after transplanting when the young plants not watered with fertilizer very frequently.

References

Biernbaum, J. 2006. Greenhouse organic transplant production. Illinois Organic Conference, 12 January 2006. 13 pages.

Mello, A. and L. Mello. 2007. Organic fertilization of greenhouse tomatoes by drip irrigation. *Floral Notes* 19(6):2-3.