COMPOSTING FOR FIELD AND CONTAINER GROWING

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Composting of organic wastes for mixing with soils has been a fundamental principle of land use since farming began. Our nursery and many others have always applied manures or other decomposed organic materials to fields before planting new crops. Even though adding organics to soils has been long-practiced, it is only within the last couple of decades that the composting process has been defined, quantified, and documented in a manner every farmer can use.

More than 20 years ago, the decline of dairy farming in our region was becoming obvious. And because our business was expanding rapidly, we were forced to search for new sources of organic material to supplement the declining supplies of cow manure, our primary soil additive. Every B&B plant we harvested from our land took with it some of our topsoil; without the addition of new organic matter to each field before replanting, our already thin New England soils would soon consist largely of clay or gravel and consequently be of diminishing crop value. Additionally, we were beginning to grow many crops in containers and were trying to determine the optimum container medium. The various container-growing mixes we had tried lacked uniformity and failed to effectively support good growth or allow proper drainage. It was thus imperative that we find new economically feasible ways to increase our supply of dependable organic raw materials.

About 1970 we established an arrangement with one of the larger towns next to us that operated a municipal leaf collection program. We took all of their leaves every fall in exchange for a nominal credit for purchases of our plants. While this arrangement worked well, the 2000 to 3000 cubic yards we composted annually was never enough to meet our needs. We were unsuccessful in attempts to get leaves from other towns primarily because the cost of separating leaves from other waste was not economical for them. In order to stretch our meager supply, we began decreasing the amount of compost and organics we added to our soils. As a substitute, we increased our use of chemical fertilizers in combination with summer and winter cover crops. For several years this appeared to be a successful strategy.

The advent of environmental awareness in the 1970's was extremely timely and fortuitous for our nursery. The availability of organic products began to increase dramatically as disposal costs escalated. Within a very few years it became an economic necessity for more towns to separate leaves and other products (newspaper, wood chips and grass clippings) from their waste stream. In many areas it had even become illegal to dispose of leaves and other organics in a landfill. The opportunities to get these organics at low cost increased and incentives to compost waste were created. At the same time, our creative use of organic waste products helped the public perceive that we offered a solution to a major trash disposal problem.

Our composted leaves soon proved to be a superior medium for most container crops when mixed with equal parts sand and composted bark. This mixture is consistent year to year, is rendered largely weed-free from the heat of the composting process, retains sufficient moisture to allow good root growth, drains quickly to prevent root damage, has a pH of about 6.0, accepts fertilizer and herbicide applications properly, and creates minimal ''interface'' problems for the customer when the roots are set into the landscape. We began to use this medium exclusively in the 1970's, and still rely upon it as our basic mix.

Thanks to these changes we have increased our supply and usage of compost products four to five fold over the past dozen years. Weston Nurseries currently composts over 40,000 cubic yards of various materials every year; our leaf composting operations have grown to nearly 20,000 cubic yards including the grass clippings and yard sweepings we accept from landscapers throughout the year. We still buy all the cow, horse and large animal manure we can get, and mix it with leaves or wood/paper waste to stretch the final product. Wood chips and sawdust are compostable by themselves, and we buy all the reasonably-priced material available that we have space for. We have also bought finished compost from commercial and municipal sources and have experimented with hen manure.

But the variability of these materials and the sheer volume available have created some new and unexpected situations. In an effort to quickly add organics to our soils, we recently began spreading upwards of two to three inches of compost on the ground and plowing it in to a depth of about ten inches prior to planting our crop. The situations we have encountered undoubtedly result from our fervor to rapidly improve the organic content of our depleted soils.

Using these newly-available composts we have experienced some remarkable changes on a number of crops. We have produced a dramatic improvement in the root quality of juniper, *Euonymus alata* and *E. alata* 'Compacta', *Forsythia*, most *Viburnum*, *Syringa*, and many other types of deciduous shrubs. Shade trees also respond well, especially *Acer rubrum* and the normally fast-growing species. Even some of our lepidote rhododendrons have responded with improved root and shoot growth, provided the pH is properly maintained. Regulation of pH with compost can be effective and theoretically can eliminate the need to add limestone, although we have had some difficulties doing it consistently.

On the negative side we have observed two types of problems: those of soil-structure (physical), and the chemically-related ones. Physically, excess soil aeration and soil-moisture saturation both result when too much compost is added all at once or when the organic materials are incorporated too close to the time the crop is planted. The air spaces in excessively-aerated soil reduce the ability to provide proper support for the plant and cause inadequate mating of roots to the soil. This results in rapid dehydration of roots of the new plants, especially if conditions are dry. By the time the soil settles, many roots are dehydrated and the plants are weakened. Application of additional water would normally help stabilize and rejuvenate drought-stressed plants. But the overly-large proportion of organic matter added to the soil retains too much water for effective support, promotes decay in the damaged tissue, and can cause further injury by depriving the roots of air. The weakened plants that do survive are susceptible to damage from insects and disease as well as the normal transplanting and environmental stresses.

The chemical-type problems we have experienced involve mostly ericaceous plants such as *Rhododendron, Kalmia, Pieris, Enkianthus*, and *Vaccinium*, along with a few crops of *Pinus* and *Taxus, Viburnum sieboldii*, and *Hamamelis*. These problems include unexpected pH elevations, abnormally high levels of potassium, phosphorus and calcium, apparent deficiencies in iron, manganese, and zinc, and a number of others that still defy definition. These became evident as crops began to show chlorotic foliage, inferior root systems, and general lack of vigor. Using soil tests and tissue sample analysis our nursery Extension advisors recommended a number of corrective actions including applications of urea and sulfur or ammonium sulfate to the soil, and spraying iron, magnesium and zinc chelates on foliage. The problems still appear unresolved because the growing season had ended by the time we had finished the treatments, so we expect to apply chelates of iron, manganese and zinc to the soil the following spring.

Another chemical situation occurs when partially-composted organics are incorporated in soils. The addition of water to these soils causes heat buildup, generates ammonia toxicity to roots, or creates deficiencies of nitrogen and other elements. Often the effects are unnoticed until damage to the crop has occurred. To further complicate the issue, it is often difficult to determine whether or not the compost has stabilized.

As we become increasingly involved with these adjustments, a number of conclusions became apparent. It is very difficult to get an accurate and representative soil sample in the field; the results of the tests are open to diverse and often contradictory interpretations. There are very few guidelines for proper fertility standards for many crops. It is expensive and time-consuming to apply corrective treatments after the crop is planted, and monitoring progress is extremely difficult. Perhaps the clearest lesson of this situation is that we should have properly tested the soil and refrained from planting until the conditions were determined to be optimum for the specific crop. Most clearly, any profit we may have made on these crops has disappeared, and we will consider ourselves fortunate if we can save part of the crop.

In our zeal to utilize our new-found organic "riches" we made a number of unfortunate assumptions. In retrospect I am glad the situation is not worse and that we have a nursery large enough to absorb the crop losses. It is also fortunate that we confined the use of the new compost products to field crops rather than risking our container production as well. I feel confident that we will resolve these problems and end up with a better understanding of compost use for future crops. I certainly hope that this discussion of our problems will help other growers to learn from our mistakes and avoid similar situations in their operations.

In no way do these problems undermine our basic conviction that composting is of utmost value to the nursery industry. The composting of organic wastes and the utilization of products that are deemed undesirable create some unique opportunities for our industry. Not only can we profit economically but we have excellent opportunities to demonstrate that we are true practicing environmentalists. We must, of course, learn how to effectively utilize these new resources that are being presented to us. When we do, not only will we vastly expand our economic well being, but we will look good in the eyes of the public and the people outside the industry who largely determine our destiny.

Table 1. pH comparisons of various composted materials at Western Nurseries, fall 1990.

Material	pH
Water	6.0
Peat moss	3.5
Sawdust	6.0
Composted wood chips	6.8
Composted mixed bark	6.8
Composted pine bark	4.2 - 6.5
Leaves composted for appx. one year	5.2 - 6.3
Container-growing media	5.6 - 6.8
Container media for ericaceous crops	4.5 - 5.0
Potting media for newly-propagated crops	4.7 - 5.5
Partially-composted cow manure	8.0
Composted cow manure/wood chip/paper mix	7.0
Partially-composted horse manure	8.4
Composted hen manure	8.8
"Merrimack" compost. brewery waste, wood chips, and municipal sludge	7.2