COMPOSTED BARK MEDIA FOR CONTROL OF SOIL-BORNE PLANT PATHOGENS[1]

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During the last decade composted hardwood tree bark has partially or completely replaced peat in nursery potting media in the Midwest. One striking effect of this change has been the disappearance of various types of root diseases. With ericaceous plants, which are very susceptible to *Phytophthora* and *Pythium* root rots, significant increases in growth have been obtained in mixes consisting largely of composted bark rather than peat. Recently, research at the Ohio Agricultural Research and Development Center has focused on the basic mechanisms underlying this suppression of root diseases. It has been found that composting, with frequent turning of stacks (once every 2 weeks), eradicates plant pathogens. The temperature of compost stacks reaches 120° to 160°F for a period of 6 to 12 weeks, depending on the type of bark being composted. Pine bark generally requires 1 lb actual N per cubic yard, to avoid nitrogen deficiency on plants subsequently produced in the mix. Fresh hardwood bark in the Midwest, requires at least twice as much N. Fresh pine bark can be composted in stacks (15 ft wide × 8 ft high) in 6 weeks, whereas fresh hardwood bark requires 12 weeks before all the nitrogen is utilized. Heat produced during composting is generated by microorganisms involved in breakdown, mostly of cellulose.

Large quantities of pine bark are utilized in the U.S. without composting. It has been found that plant pathogens can survive in bark stacks to which nitrogen has not been added. The temperature in large areas of such stacks seldom exceeds 80°F, although the center of these piles, frequently, may self-heat to higher temperatures. Pathogens, therefore, may survive in this non-composted bark and cause problems in production if used without adequate precautions.

Other factors, in addition to pathogen reduction or elimination, that contribute to the absence of root diseases on plants produced in bark compost are antagonistic microorganisms and chemical(s) with properties similar to fungicides. Controlled laboratory tests now have shown that *Phytophthora* root rot is

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suppressed in composted hardwood bark. This means that if a low inoculum level of *Phytophthora cinnamomi* is introduced, plants are not killed in compost. Identical levels would kill plants in peat media. In another study it was found that *Fusarium* cutting rot and wilt of chrysanthemum also is controlled in compost. Those plants became infected when high inoculum levels were used, but they were not obviously damaged. Control of *Fusarium* in compost is equal to control in sterilized peat after two drenches with Benlate (Figures 1 and 2). Research at the University of Illinois has shown that com-

Figure 1. *Chrysanthemum* × *maritalium* 'Yellow Delaware' (received from Yoder Bros., Barberton, Ohio) in a peat-sand-perlite medium inoculated with *Fusarium oxysporum* f. sp. *shrysanthemi*: 1) Uninoculated; 2) low inoculum level, (note some wilting); 3) high inoculum level, (noted dead plants); and 4) high inoculum level drenched with Benlate (note chemical control).

Figure 2. *Chrysanthemum* × *morifolium* 'Yellow Delaware' (received from Yoder Bros., Barberton, Ohio) in composted hardwood bark-sand medium inoculated with *F. oxysporum* f. sp. *shrysanthemi*. Note absence of disease symptoms as compared to plants in Figure 1.

posted hardwood bark also is suppressive to nematodes. In Japan, composted tree bark and sawdust is used to control *Fusarium* diseases of field and greenhouse vegetables and ornamentals. Findings discussed here are reminiscent of results obtained by various plant pathologists with sterilized peat mixes that were amended with microorganisms antagonistic to plant pathogens.

Present research at the OARDC is focusing on the role and identity of microbial antagonists and chemicals involved in suppression of root pathogens. Antagonists have been isolated from various soils and composts and will be added during the composting process, hopefully, to yield a final product with predictable disease suppressive properties. Another study involves the composting process itself. The effects of nitrogen source, pH, temperature, aeration and other factors are being tested to reduce the length of time for composting.

Although composted hardwood bark is used successfully by some nurserymen, specific guidelines for successful production of floral crops are lacking. Physical properties of composted bark, fertilizer amendments (particularly nitrogen) and the overall economics of bark as opposed to peat need to be investigated before final recommendations can be made to these growers. Composted hardwood bark also needs to be compared with pine bark that presently is more widely distributed.

Hardwood, and contrary to a commonly held opinion, some softwood barks contain substances that are toxic to various plants. Research at the OARDC, in Norway, and at the University of Illinois has shown that these inhibitors can be destroyed by composting. These chemicals in fresh bark are most toxic to germinating seeds and seedlings. Bedding plant producers therefore, should be particularly careful and test the bark for inhibitors to their plants. These inhibitors appear to be the major limiting factor for successful use and is an area that we expect to study in greater detail. Hardwood bark available in Ohio needs to be composted (2 to 3 lbs N per cubic yard fresh bark) for at least 10 weeks during the warmer months in the year. In the winter, larger piles and a longer composting period is required to destroy the inhibitors.