ALTERNATE USES OF WOOD CHIPS[1]

by B.E. Swisher

Because of environmental pressures, the reasons why we do certain things have become important to a lot of people outside our own industry. That is the reason for this talk about wood chips.

The big question is, how do we dispose of tree residues? Our best answer is, usually in accord with the property owner's wishes; i.e., logs, pulpwood, firewood, chips, piles of brush, burning, etc. In many cases, nonmarketable debris is now left in piles, both on or off the R/W.

Wood chips, the topic for today. We have had them in our business for 25 years; the first chippers began appearing in contracts about 1950. By 1955 they were in common usage. After 25 years of searching for suitable uses for our chips, we are still giving them away. Wood chips, their uses and chipping methods came into sudden prominence because of environmental pressures or regulations; principally E.P.A. dumping and burning restrictions.

Our chips, from electric utility line clearance practices, derive from three sources:

1. Our normal (and relatively constant) supply is a by-product; from well established economic and socially acceptable procedures, the chipping and removal of tree trimming debris, from urban areas.

2. Deliberate attempts to expand the procedure to solve transmission right-of-way problems in rural areas.

3. Deliberate attempts to develop new sources of raw materials (chips) to use in any one of several ways:

   a. paper pulp
   b. artificial fireplace logs, particle board
   c. erosion control — new construction sites
   d. landscape industry — nursery stock storage
   e. mulch, compost, soil amendment
   f. livestock feed, bedding
   g. energy shortage — fuel supplement

Part of the problem, especially with people from outside our industry, arises from lack of definition. What is a chip? There are five or more basic kinds:

1. Chips of white wood only, no bark, i.e. for paper pulp.
2. Chips of bark only, from debarking mills before logs are processed into poles and lumber.
3. Planing mill shavings, manufacturing operations, no bark.
4. Sawdust, composition very mixed.
5. Our chips, mixtures of bark, wood, buds, leaves, twigs. The percent of each varies with the season of the year and kind of trees involved.

A large percentage of our chips would classify as browse (food for deer, squirrels, etc.). Bole wood and whole tree chips are somewhat similar but have fewer twigs.

Several other items are important or become involved:

1. Moisture: content, absorption, retention, drainage characteristics.
2. Where the chips are, i.e., transportation costs.
3. In the fall of the year, leaves and compost.
4. Wintertime — Christmas tree disposal.
5. Natural chips or fortified with additives.
6. Chips can be fresh or decomposed. The color, texture, nutrients and other chemical factors change radically.
7. Acidity (pH).
8. CEC (cation exchange capacity) [explanation will follow].

One legal solution for our debris is in licensed sanitary landfills, which are usually too costly and not available. Current legislation reads "solid waste disposal" which is too restrictive; in the proposed new law this would be changed to "solid waste management" which would recog-

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[1]Presented at the International Shade Tree Conference in Detroit, Michigan in August 1975.

nize resource recovery operations as well as traditional disposal methods.

Where it is at all possible we are piling the material on the land where it originated (brush, logs, firewood, chips, etc.). Even though the property owner involved okays such practice the material can be declared a public nuisance and it does not have to be a neighboring property owner to make such complaint. Some fire departments rule against chip piles in cities. Some health departments rule that such piles harbor rodents.

Fireplace logs

Pres-to-logs are manufactured under a patent. The machine that makes them exerts 165,000 pounds pressure. The dust must be thoroughly kiln-dried or the steam created by this pressure causes an explosion. Their people, Harris Manufacturing, Johnson City, Tennessee, suggested that we look elsewhere for an outlet.

A company in Sebring, Ohio makes fireplace logs from chips and a petroleum waste (wax). They prefer chips from planer mills because the moisture content (13%) of those chips is more suitable than ours (up to 50%).

Wood pulp

Some woods present special problems; walnut and cedar have been shown to contain toxic materials which under certain conditions adversely affect the growth of other plants. Even though paper pulp mills are chipping and buying whole trees (progressing from 4 to 34 kinds) they do not want walnut, osage orange, or conifers. These trees contain certain of the ingredients which upset their production processes.

Paper pulp mills want only the fibrous white wood, there are few fibers in bark. Eighty percent or more of the wood chips are recoverable or useful to them, but less than 20% of the bark. The bark (to them a pollutant) has a serious effect on production costs and the quality of the finished product.

Wood harvesters reap about 100 green tons/acre and receive $12.00/ton at the mill; our costs are $600.00/acre to cut and pile or $1,600/acre to chip or incinerate. On the basis of dollars/acre only, it is easy to say that we could cooperate to each other's mutual benefit.

We've discussed and field checked:

1. prior to any cutting
2. immediately after cutting, before piling
3. after piling, before line construction
4. after roads were graded for line construction
5. after line was built and our crews were gone

Amount of salvage from R/W clearing is insufficient to pay its own way; hauling problems associated with R/W restrictions are severe. Most of the piled material we leave can be economically salvaged only in conjunction with deals to harvest adjacent property.

Our urban chip collections have too much bark and are the wrong size for paper pulp. Even so, they are not totally unsuitable; we just have not yet been able to solve the zoning, piling, screening, and transportation cost situation.

Mulch

The paper entitled *Conservation and Use of Wood Chips* by H.L. Jacobs in the 35th ISTC Proceedings, Detroit, Michigan, 1959 is an excellent report of 19 pages and photographs discussing wood chips (our kind, line clearance) as a source of organic material for mulching and direct incorporation into the soil. There is a discussion of the need for supplemental nitrogen to offset the nitrogen usage by decomposition organisms. Then, as now, Jacobs notes that our type of chip tends to be alkaline; extensive uses of chips seemed to serve the customary uses of mulch (1) to prevent extremes of temperatures in the upper layers of soil, (2) to prevent compaction and facilitate entrance of moisture, (3) to conserve moisture by preventing evaporation, and (4) to discourage weed growth, etc.

Raw chips as they come from the chipper can be used as a fillback or holding medium for stockpiling 3- to 10-inch balled trees on a continuing basis, for years if necessary. No additions other than supplemental nitrogen and water as needed and a way of controlling fermentation temperatures in the decomposing chips. Root growth on the stored trees was exceptional; by temperature manipulation the growing season for roots was appreciably extended. In bins of chips 2-3 feet deep, temperatures in the range of 130-140 deg. F were reached in two weeks; temperatures above 90 deg. F were noted 10 months later. Adding nitrogen to the chips increased the temperature problem; control was necessary by timely watering or aerating with punch bars.

The preliminary results indicate that hardwood bark can be successfully used as a growing media for container-grown ornamentals. It holds many advantages over other medias being used at the present time. Its advantages are that it is inexpensive, readily available, light-weight, has good water-holding capacity, well aerated, and well drained. Precautions to be taken when using hardwood bark are the addition of an adequate supply of nitrogen, thorough mixing, and thorough watering at the beginning.

Soil Amendments

A soil amendment (in theory) changes only the physical characteristics of the soil and usually requires that substantial quantities be added (30% to 70% by volume are commonly effective). A true soil amendment should not be rated on the basis of its fertilizer content. On the other hand, a soil amendment that causes problems with soil chemistry or soil nutrients should be criticized or corrected.

The cost of soil amendments has been a serious limitation in their use. The need for organic matter in soil and the large quantity of sometimes wasted wood by-products suggest an obvious relationship. There has been a substantial increase in the use of such material resulting from research and practical application of those findings. However, much of the research is very specific and difficult to correlate into something broadly useful.

Aeration. An important asset of any plant-growing medium is the ability to provide ready access to air for root respiration. Particle size, structure, and arrangement are all important. The greatest porosity is when the medium is dry, minimum air availability occurs after rain or irrigation. In a proper medium excess water quickly drains away and "air space after drainage" or free porosity should be 8% or more. Roots of various plants differ in their requirements. Coarse-textured materials provide the greatest air space after drainage; however, such materials retain relatively little water.

Moisture retention. It is usually desirable to use products which hold a large volume of water as long as there is sufficient air present. This is usually expressed as "volume percent", i.e. if 100 gallons of sawdust holds 50 gallons of water, the moisture capacity is 50%.

Fine-textured organics, minerals, and soils hold fairly similar quantities of water. When the particle size is larger than 1/8 inch, water retention is markedly reduced. The mixing of coarse and fine particles tends to create a product with properties like those of the fine-textured compound.

Bulk density. The mixing of sawdust and/or chips provide widely differing properties to the soils. The size of the particles have a major effect on aeration, water retention and drainage.

The heaviest components of a potting mix are the sand and soils while the lightest are organic materials. For shipping plants in containers and for roof gardens light weights are preferred. At other times the weight of the growth medium must serve as ballast and keep large plants from toppling over.

Soluble salts. Toxic concentrations are not normally found in wood chips unless they have been added in one form or another.

Nitrogen needs and decomposition rates. Compared to pine bark (50% in 160 days) hardwoods (oak, hickory, etc.) have a relatively high decomposition rate, 40-50% in 60 days, and a nitrogen requirement of 1.0% by weight.

Loss of nutrient nitrogen, needed by plants, to the needs of the decomposition microorganisms can be compensated for by proper application of additional nitrogen. The utilization of such nitrogen is slow and the addition of too much nitrogen can create a toxicity or salinity (excess of soluble salts) problem. The quantity of soluble nitrogen available at any one time must not exceed the tolerance of the growing plants.

Acidity (pH). Most of our literature says that natural organics such as bark chips are slightly acid, pH 6-7. The wood chips we have do not fit this norm; our tests run slightly alkaline.

Cation exchange capacity. CEC is closely correlated with acidity. Organic amendments in comparison with a typical loam soil have a relatively low nutrient retention capacity. In comparison with sand the nutrient retention capacity is fairly substantial.

Livestock or Cattle Feed

The prices of the two basic protein supplements for cattle food (soybean meal and fish meal) have more than doubled recently. The hunt for suitable substitutes is worldwide.

A search of the literature will produce many articles and abstracts dealing with the feeding of hammermilled, steamed, or otherwise prepared wood chips as feed for livestock. Most references deal with wood pulp or delignified wood; the goals are roughage and/or a digestible energy source. In a general way wood, as such, is considered to be almost indigestible by animals. On delignification (expensive to accomplish) the wood pulp is highly digestible.

Fuel

Scarcity of energy is relative rather than absolute. Its high cost (scarcity) can devour our potential for economic progress. Wood is a proven low-cost, clean, plentiful, renewable, acceptable fuel. The critical problem is to provide enough chips on a continuing basis.

Fossil fuel at $1.50/million B.T.U. is equivalent to wood chips at $10.50/ton; $26.00/cord. A cord (green wood) weighs about 5,000 pounds. Chips at $10-$17/ton can compete with coal. Conversion rates: Two and one-half pounds of chips are needed to produce 1 KW of electricity. Seven and one-half tons of chips per year are required for a 1 KW plant. Green chips (35% moisture) contain 8.1 million B.T.U. per ton. Air-dried chips (20% moisture) contain 13 million B.T.U. per ton or about one-half the heat value of coal. Three B.T.U.'s of wood produces 1 B.T.U. of electricity.

All moisture in wood must be converted to steam before the wood will burn. 1,100 B.T.U.'s are required to convert 1 pound of moisture to steam. It requires 44,000 B.T.U.'s to burn 1 air-dried ton (20% moisture) of wood.

Bark

A meeting October 2-5, 1975 in Key Biscayne, Florida will feature leaders in the bark industry discussing their specialties: merchandising and packaging, marketing of bark products, and bark packaging techniques. It is sponsored by National Bark Producers Association, 1750 Old Meadow Road, McLean, Virginia.

F.S. Trocino of Bohemia, Inc. (Eugene, Oregon) has in operation (5 months) a $4.25 million plant to extract two products from Douglas fir bark: a vegetable wax used in carbon paper, polishes, cosmetics, and plastics and a powder used to extend plywood adhesives. Within a year, they expect to also be extracting and marketing cork and a phenolic compound useful in adhesives. Also in the works is a slow-release nitrogen fertilizer. To Trocino, bark is much like crude oil in the richness of its chemical nature.

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ABSTRACT

Smith, Elton M. 1975. **Mice are choosy—like euonymus best!** Nursery Notes, 8(4): 5-6. Cooperative Extension Service, Ohio State University, Columbus.

Producers of container-grown nursery stock have long known that unless they take precautions to control field mice, considerable plant losses can be expected during the over-wintering season. Since low structures are used, what plants can be stored in these units with the knowledge that mice are not as likely to feed on them? To evaluate the susceptibility of a number of woody ornamentals to damage from mice was one of the objectives of a 1974-75 over-wintering study at OSU. The results indicate that mouse damage occurred in all houses and was most severe on *Euonymus sarcoxie* and *vegetus*, Japanese holly, Spring Glory forsythia, Royal Beauty cotoneaster, and slender Deutzia.