

Availability of Mulch Material for Orchards in Central Washington – 2002

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Mulches can improve irrigation efficiency, provide weed control, build soil organic matter, and supply nutrients. This report provides general information on the availability and cost of materials that might be used as orchard mulch in the tree rows. The report is intended to identify affordable materials that are available locally and which could, potentially, treat a significant number of acres. The focus is on waste materials suitable for surface mulch (wood chips, crop residues, paper, yard waste etc.) rather than soil amendment materials used primarily for nutrition such as compost. This report provides rough numbers based on many estimates and assumptions. It is not intended as a recommendation to growers that they use any of these materials.

Cost estimates and number of acres that could be treated are based on the calculation that 123 cubic yards of mulch material are needed per acre. This amount covers a 4' wide area under the tree row, 3" deep, assuming a 13-foot tree row spacing. Bulk density measurements for the materials were used to determine cubic yards per ton of each material (Tables A1 and A2).

Cereal straw is available from growers, primarily in irrigated areas of Adams, Grant, Walla Walla, and Yakima Counties, at a cost of \$30-\$35/ton. Where straw was formerly burned, growers now bale the straw on an estimated 90% of their irrigated small grain acreage. Some straw is still incorporated. Typically, the straw is baled in either big bales or 3-string bales. Estimating that irrigated winter wheat yields an average of 2 ton/ac of straw, and that spring wheat and barley each yield 1.75 ton/ac of straw, (J. Kugler, personal communication), approximately 185,000 tons of straw would have been available in Adams and Grant Counties in 2001 based on Washington Agricultural Statistics acreages (1,2,3,5). Grant and Adams Counties had over 108,000 acres of irrigated cereals in 2001. Using the above assumptions, an estimated 44,000 tons and 22,000 tons of cereal straw were baled in Walla Walla and Yakima Counties, respectively, which had a total of 28,000 acres in irrigated cereals. Production acreage statistics for 2002 are similar to 2001, although county acreages are not available.

Some oat straw is also available. Kittitas County produced grain oats on 2000 acres in 2001, and again, assuming that straw is baled on 90% of those acres, and that irrigated oats yield 2.5 tons/acre of straw, a potential 4,500 tons of straw would be available from Kittitas producers. Another 2000 acres of oats is grown in Okanogan County, but the yields are about half that of Kittitas Co., so there is probably not much straw available there (4).

Straw is a lightweight material, around 60 lbs/ cu yd when moisture content is minimal. Assuming a needed 123 cu yd mulch/acre, cost is determined as:

$$60 \text{ lbs/cu yd} * 123 \text{ cu yd/ac} = 7380 \text{ lbs./ac (3.7 tons/ac)} * \$30 - \$40/\text{ton} = \$111 - \$148/\text{acre treated.}$$

With a total estimate of 255,500 tons of straw being baled in the mentioned counties, a potential 69,000 acres could be treated with cereal straw mulch, depending on affordability. While it appears that adequate straw material is available, there are disadvantages to using straw since it is flammable and often contains weed seeds.

Grass seed straw is typically available in 1- ton bales. Adams and Franklin County growers produce grass seed on over 8000 acres (6). Although this straw is sold for cattle feed for \$30-\$40 and is also exported to the Pacific Rim, there is still availability. Assuming that 1.5 ton baled straw is produced per acre on 8,000 acres, a potential 12,000 tons of grass seed straw would be available in these counties. Cost per acre to treat with mulch would be similar to using cereal straw. A potential 3000+ acres could be mulched with grass seed straw.

Seed screenings are available from seed cleaners and seed services. They are sometimes free or they can be purchased for up to \$20.00 per ton. It is necessary to call at least a month in advance to have the product reserved. The seed cleaner will most likely not know the chemicals and treatments used on the seeds prior to being harvested. They may contain detrimental substances.

Hop straw is the residue (chopped vines, leaves and string) left after hop cones are separated from the vines. Typically, the chopped straw has been piled at harvest and then spread back onto the fields and disked in as time permits during October and November. On no-till operations residue is spread and left as a surface mulch. Economist H. Hinman estimates cost of spreading at \$10 to \$20 per acre (11). Because there is a lot of material to deal with, and powdery mildew is a growing concern, growers are open to off-farm disposal solutions such as marketing it for mulch or having it hauled away to a local composting facility. Most of the cone separation is done on-farm. Growers have differing methods of chopping, so the material will vary farm to farm. Vines are cut and chopped while still green, and then piled so the moisture content is also going to be variable. Nutrient content of hop waste is high in N and K, reported at 43 and 35 lbs/ac, respectively, per ton hops dry matter. P content was reported at 5 lbs/ac per ton (dry weight) hops (S. Kenny, personal comm.).

Washington state growers produce 75% of the hops grown in the U.S. Estimated Washington hop acreage for 2002 was 20,000 acres, with approximately 80% produced in Yakima County and 20% in Benton County (7,10, 12). A Mabton, WA hop grower estimates he has 300 truckloads of residue (approx 17 cu yd/load) from 400 acres amounting to about 12 cubic yards of straw produced per acre, or 4800 cu yd total residue. Vines are chopped into approx. 6" pieces at this operation. This could treat around 50 acres of orchard. The grower is willing to sell the hop straw for \$10/load, without delivery, and would load the residue for \$4/load. At a cost of \$10 /load (17 cu yd), the price per acre is \$72 not including transportation. If figures are comparable for other farms, with 20,000 acres of hop ground, up to 240,000 cu yd might be available, enough to treat over 1900 acres of orchard.

Stephen Kenny (WSU, Prosser) estimates that hops produce 1.7 tons dry weight of residue per acre, with a bulk density of ~60 lbs/cu yd. With 20,000 acres of hops in production, and a potential 1,122,000 cu yds of dry residue, over 9000 acres could be treated:

$$20,000 \text{ acres} * 1.7 \text{ tons} = 34,000 \text{ tons} * 33 \text{ cu yd/ac} = 1,122,000 \text{ cu yds}$$

assuming that 123 cu yds of mulch is required per acre,

$$1,122,000 / 123 \text{ cu yd/ac} = 9122 \text{ acres}$$

The variation in estimates of acres that could be treated probably reflects varying moisture content of the material. In the first example, residue is likely to be at a higher moisture content (65-75% is typical at harvest) that would give a corresponding higher bulk density value. The second example uses air-dry bulk density measurements.

Mint slugs is the material left following the distillation of mint hay for oil. Where growers and distillers need to dispose of slugs, this material could be used as mulch in orchards, and also provide potential nutritional benefits. Currently, growers pile slugs until they can spread and incorporate the material on fallow ground, at an estimated cost of \$20-\$30/acre (13). Some growers would prefer not to have to spread the residue, and would appreciate having off-farm disposal options. Other growers feel they can handle the material on-farm and appreciate its nutrient value. Oregon State University Cooperative Extension studies measured nutrient content of slugs and mint hay, and found them to be the same or comparable for N (3%), P (0.4%), K (2-4%), and S (0.28%). This is similar to alfalfa hay nutrient values (14).

Mint was produced on 33,800 acres in Yakima, Grant, Adams and Benton Counties (there is very little mint grown in Franklin County), with an estimated production of 50,700 tons of mint hay, assuming an average harvest of 1.5 tons/acre (J. Kugler, personal comm.). Yakima and Grant Cos. are the major mint producing areas, with approximately 16,000 tons and 9,550 tons, respectively, hay harvested in 2001. Another 8,000 tons were produced in Adams and Benton Counties, combined. Total mint oil production for 2000-2001 in Washington State was 3,776,000 pounds (8).

With 33,800 acres of mint producing an estimated 1.25 tons/ac of slugs, assuming some loss of material in the distillation process, a total of 42,250 tons of slugs are potentially available on an annual basis. Assuming a mint slug bulk density of 424 lbs/cu yd (at minimal moisture content) then there are 4.7 cu yd/ton of slugs, and

$$42,250 \text{ tons} * 4.7 \text{ cu yd/ton} = 198,575 \text{ total cu yds of slugs available,}$$

and assuming that 123 cu yds of mulch is required per acre,

$$198,575 \text{ cu yd} / 123 \text{ cu yd} = 1614 \text{ acres, could be treated.}$$

Sawdust is available from some mills. Pulp, pellet, and agricultural producers, including orchard and dairy operations, already provide a market for the sawdust. At local sawmills, orchardists are requesting the dust for use as mulch and for building soil organic matter. Availability, cost and texture vary.

A mill in Chelan County could provide 30 tons (approximately 140 cu yd) per day above and beyond their current contracts. The price ranges from \$4.50/ton to \$6.50/ ton depending on if contracted or occasionally purchased. Growers need to provide or hire a walking trailer, or one suitable for loading from bins. Assuming a bulk density of 424 lbs/cu yd (similar to wood chips and mint slugs) at 30-40% moisture, 30 tons/day for 260 days/year, 36,660 cu yards are available from the Winton mill. This would treat about 300 acres at a cost of \$117-\$169/acre, not including delivery. Various growers are already purchasing more than twice this amount for use

in their operations. In addition, truckloads go to the Lewiston Pulp mill and to the west side for bedding and other uses.

A Yakima mill can supply 120 cu yd truckloads, for \$150 including local delivery, and has about 100 loads available each year. This would treat an additional 100 acres of tree fruit at a cost of \$154/acre. Sawdust is not readily available at all mills as a waste product because many use all their dust or have it contracted to other wood product companies. An Omak mill has only about 5 pick up loads every other month, and growers are on a waiting list. An Oroville lumber company has no surplus of the sawdust which they sell for around \$4/ green ton. They supply around 90 green tons of dust per month.

There are also two Boise-Cascade mills in the Yakima area that may have sawdust and shavings available. A farmer contact mentioned that he was buying dust from Boise-Cascade, but cost and availability information was not known at time of report. However, since this company does purchase dust from other mills, it appears that they would only have the dust that hits the ground as surplus.

Used sawdust is either given away or sold for \$10.00 per load at horse stables. When locating stables, look for ones that advertise indoor boarding or arenas. They have the most on hand. Used sawdust contains manure, which in turn can have weed seeds.

Wood chips provide affordable, long-lasting mulch and are easily located through tree service businesses in the yellow pages. Chips are often available for no charge or for a delivery charge. Call services in advance to see if they have a job in your area and arrange for delivery. Tree services typically use trucks with a 12 cu yd box. Orchardists who are taking out trees could hire a chipper, and use those chips on other blocks, or make them available to other growers.

It is difficult to estimate available wood chip quantities. A Milton-Freewater tree service owner estimates that his company chips 3000 cu yds each year in the Walla Walla, Dayton, and Tri-Cities areas and will deliver chips at no charge. Another company chips 1200 to 2000 cu yds annually in the Omak, Oroville, Chelan, and Grand Coulee areas, and will deliver close by for no charge or growers can haul chips from areas where he stockpiles. Check with the local P.U.D.'s for information on who they contract tree work with. There are at least 25 additional tree service companies operating in central Washington. Assuming each of these companies chips at least 1000 cu yds annually, and the other 2 chip 5000 cu yds, a potential 30,000 cu yds of chips could treat 243 acres of orchard.

There is a market already for wood chips as fuel and for manufacturing other products. Clean, high quality chips available from lumber mills are expensive for mulch. An Oroville lumber company sells its high quality chips for \$30 -\$135 per dry ton, depending on the market. Hog fuel, which consists of bark and unfiltered sawdust sells for \$4/green ton loaded, not including transport. A private Kennewick recycler estimates that he would have 1000 cu yd per month of untreated chips available and is able to deliver 100 cu yd loads. These chips could treat nearly 100 acres annually. Costs are not yet determined but will likely exceed a minimum of \$150/load.

Some landfills have chippers and recycle various wood products. Chips may run \$17-\$18/ton to cover costs of chipping from wood recycling companies. When buying from wood recycling companies, be sure to avoid chips made from chemically pre-treated wood. Wood recyclers are listed on the Washington State Recycling Association website at www.wsra.net. The Washington

State Department of Ecology (DOE) estimated that Benton and Franklin counties disposed 2660 tons of wood waste in 2000 (15). An estimated 2843 tons of wood was recycled in Benton and Kittitas counties in 2001, as well as 3900 tons of land clearing debris in Benton and Chelan counties (personal communication, DOE staff). These figures indicate that there may be further wood sources available for use as an economical orchard mulch.

Paper and yard waste are generated from commercial, residential and educational sources throughout central Washington. About 35% of the waste in Washington is recycled. According to DOE estimates, 4,631 and 5448 tons of paper and newsprint, and 1350 tons of yard waste were recycled in 2001, in the orchard counties, not including Yakima and Douglas (personal communication, DOE staff). Assuming three times that amount is actually generated, a substantial supply of mulching material might be available. If 15,000 tons of newsprint were available in central WA, with a bulk density of 225 lbs/cu yd, there would be 9 cu yd/ton, or 135,000 cu yd available, which could treat 1097 acres. If this same amount of newsprint was shredded, with a bulk density of 60 lbs/cu yd, there would be 33 cu yd/ton, or 495,000 potential cu yds available, which could treat 4000 acres of tree fruit. The similar amount of high grade and mixed waste paper available could treat additional acres.

Recycled paper is accessible throughout Washington. There are nine recycling facilities in the orchard regions of central Washington that are listed on the Washington Department of Ecology Solid Waste Program website. Average cost is \$110.00 per ton (a one foot stack of newspaper weighs 35 pounds). Phone numbers are listed on the website and the facilities can be contacted for further information. A limited number of facilities accept shredded paper. Growers might be able to obtain paper from sources before it is delivered into the waste stream, from paper shredding companies, schools, offices, and other businesses, at a more economical cost.

Composted yard waste, agricultural residues, and animal manure are available at both private and public facilities at variable cost. According to DOE estimates, 4,545 tons of yard waste and 6,670 tons of manure were composted at licensed facilities in Adams, Yakima, Grant, and Walla Walla counties in 2001 (16). Some landfills have special sections where compost and chipped yard waste are sold or given away.

Hay is easily found throughout most of eastern Washington, however, it is too expensive for mulch, running at \$95-\$110/ton and higher from the growers. It is available directly from producers or brokers, in big bales, and 2 or 3-string bales. Grant and Franklin Counties produce the highest amount per year (9). Some years rain-damaged hay is available at a slightly reduced price (\$75-\$95/ton). For 2002, Keith Rupprecht, grower/broker, estimates there will be little damaged hay available for alternative uses. Damaged hay is not generally considered a waste product. Hay available at cheaper prices may indicate a problem such as high weed seed content. Depending on the time of year, spoiled hay may be available for a discounted price, sometimes up to a 50% discount. The Washington State Hay Growers Association website has a complete listing of growers and amounts available.

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Appendix

Table A1. Estimated Cost and Availability of Selected Mulch Materials in Central Washington. 2002.

Material	Mulch Required (ton/acre)	Cubic Yards Available	Cost (\$/cu yd)	Cost (\$/ton)	Range of Cost (\$/acre)	Area that could be treated (acres)
Mint Slugs	26	198,575		0-25	0-650	1,614
Hop Straw	3.7	240,000	.59-.82		72-101	1,900-9,000
Wood Chips	26	30,000	0-3.60	0-17	0-442	200-400
Cereal Straw	3.7	8,431,500	.90-1.20	30-40	110-148	68,548
Grass Seed Straw	3.7	399,600	.90-1.20	30-40	110-148	3,243
Mixed Paper	3.7	135,000	0-3.30	0-110	0-407	1,000-4,000
Newsprint	3.7-13.5	135,000	0-12	0-110	0-1476	1,000-4,000
Sawdust/shavings	26	48,600	.96-1.38	4.50-6.50	117-169	395

123 cu yds of each material is required to mulch 1 acre of orchard, based on a 13' tree row spacing, with mulch applied over a 4' wide area in the tree row to a depth of 3".

Table A2. Mulch Material Bulk Density Measurements*.

Material	Moisture	Bulk Density (lbs / cu yd)	Bulk Density (cu yd / ton)
Mint slugs	low	424	4.7
Alfalfa Hay	low	202	9.9
Hop Straw	low	60	33.0
Wood Chips	~30%	424	4.7
Cereal Straw	low	60	33.0
Shredded paper	low	60	33.0
Newsprint	low	220	9.1
Sawdust/Shavings	~40%	424	4.7

*Bulk density values for mint, alfalfa hay, wood chips, straw, shredded paper were measured values. Hop straw measurements were reported by S. Kenny. Sawdust was estimated as similar to wood chips and mint slugs; this is similar to average value listed in the *On Farm Composting Handbook* Table A.1. Newsprint values came from *On Farm Composting* Table A1 (17).

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Other Resources

Washington Department of Ecology Solid Waste Program:

<http://www.ecy.wa.gov/programs/swfa>

Eastern WA Generation of Paper and Wood Waste 1992

<http://www.ecy.wa.gov/programs/swfa/solidwastedata/ewpaprwd.asp>

Washington State Hay Growers Association

www.wa-hay.org/Other Links/Hay For Sale/hay_for_sale.html

Internet Hay Exchange

<http://www.agdaq.com/default.asp>

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