



Orchard Chipping Grant Report

for EPA Grant #BG-99086004

Performance Partnership Grant

June 2007
Publication no. 10-02-047



DEPARTMENT OF
ECOLOGY
State of Washington

Publication and Contact Information

This report is available on the Department of Ecology's website at www.ecy.wa.gov/biblio/1002047.html

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Orchard Chipping Grant Report

**for EPA Grant #BG-99086004
Performance Partnership Grant**

by

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Air Quality Program
Washington State Department of Ecology
Olympia, Washington

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Table of Contents

| | |
|--|-----------|
| List of Figures and Tables..... | 1 |
| Executive Summary..... | 2 |
| Introduction..... | 4 |
| Success Measure 1..... | 6 |
| Success Measure 2..... | 7 |
| Success Measure 3..... | 9 |
| Success Measure 4..... | 10 |
| Success Measure 5..... | 12 |
| Success Measure 6..... | 13 |
| Finances..... | 15 |
| Conclusions..... | 16 |
| Recommendations..... | 17 |
| Appendices..... | 19 |

List of Figures and Tables

Page

Figures

| | |
|----------------|---|
| Figure 1. | 6 |
| Figure 2. | 7 |
| Figure 3. | 8 |
| Figure 4. | 8 |
| Figure 5. | 8 |
| Figure 6. | 8 |

Tables

| | |
|--------------------|----|
| Table 1. --- | 7 |
| Table 2. --- | 12 |

Executive Summary

Report purpose

This report evaluates and provides information about the successfulness of EPA Grant #BG-99086004, Performance Partnership Grant for chipping of orchard debris.

Background information

The agricultural burning of field crop residue and orchard tear-out residue (debris from fruit tree orchards) can directly affect the health and safety of people that breathe the smoke-filled air. The Washington Department of Ecology (Ecology) regulates agricultural burning through a permit program to reduce the smoke's effects on public health.

Many Washington farmers burn orchard tear-out after pruning or removing trees. This is done to prevent disease and pest infestations. In 2001, depressions in the apple industry led to a rapid increase in orchard tear-out, and the resulting accumulation of organic solid waste.

The grant

The Environmental Protection Agency (EPA) awarded Ecology a grant to provide cost sharing for chipping rather than burning this waste. The goal was to avoid health effects from smoke while also preventing pest infestations, conducting research, and gathering data.

As a result of this grant:

- 141 applicants chipped 3,012 acres of material, which resulted in 15,451 tons of chips from whole trees and prunings.
- An estimated 34 tons of PM_{2.5} air pollution was prevented by chipping instead of burning.
- Because this grant occurred during an energy crisis, a substantial amount of chips went toward power production. Much of the remainder was used for ground cover.
- Media articles about chipping and participation in this grant increased the level of awareness around chipping as an alternative to burning.
- The project received a "Governing for Results" award from the office of Washington State Governor Gary Locke.

Fast Facts

\$144,004 total budget spent

- \$115,000 direct cost-share for chipping
- \$ 20,540 pest inspector expertise
- \$ 12,464 administration, education, and outreach

\$115,000 for Direct Cost-Share

- \$150 per acre for chipping whole trees
- \$ 15 per acre for chipping orchard prunings

141 applications approved to participate in the Cost-Share program

- 55 applications to chip whole trees
- 86 applications to chip orchard prunings

3,012 acres of orchard material chipped

- 617 acres of whole trees

15,451 tons of chipped material generated

- 12,957 tons from chipped whole trees
- 2,494 tons from chipped orchard prunings

34 tons of PM_{2.5} air pollution prevented

- 27 tons prevented by not burning whole trees
- 7 tons prevented by not burning orchard prunings

617 acres of whole trees sent to beneficial end-use

- 462 acres of chipped whole trees used for power generation
- 155 acres of chipped whole trees used for ground cover
- 2,395 acres of orchard prunings

Introduction

The problem

In 2001, there was a sudden economic downturn in the apple industry in north central Washington. This led to a rapid increase in orchard tear -out and the resulting accumulation of organic solid waste.

The downturn occurred because older apple varieties were less valuable, offering little to no return at market. Landowners were uncertain about the future use of their land and many could no longer afford to farm. Some farmers were clearing trees to convert the land to a different use. Others that were able to continue farming were tearing out their trees to plant newer, popular, profitable varieties. Several farmers simply abandoned their orchards, causing concern from local officials that neglected trees would attract and host pests. The pests could spread to healthy orchards, resulting in extensive infestations.

At the time, burning was the most common practice for disposing of orchard debris. Ecology realized that burning this debris would lead to a large and acute impact from smoke on people living nearby. Smoke is harmful for people to breathe. In addition, in north central Washington the orchards are commingled with small communities in steep, deep river valleys where smoke tends to collect and linger. These conditions worsen the effects of the smoke because the smoke is concentrated and cannot disperse.

Finding a solution

Community leaders worked with Ecology's Air Quality Program, Solid Waste and Financial Assistance Program, and the Washington State Department of Agriculture to propose a solution to the problem. Because farmers might be willing to chip orchard debris instead of burning it if they could get help with chipping costs, Ecology applied for and received EPA PPG Grant #BG-99086004. Grant monies were reprogrammed in a record 90 days from the time that the idea was thought of to the time chipping started. Through the grant, Ecology offered to share the cost of chipping with the farmer in order to reduce smoke impacts, conduct research and gather data. Ecology worked with local government agencies in Okanogan, Chelan, and Douglas Counties. When farmers applied for the grant, the information they submitted on their applications was recorded and evaluated.

Evaluating the grant

The grant was originally to last for three years, but due to the success of and interest in it, it was extended in 2004 and again in 2005. In 2006, the grant evolved to subsidize flailing (separating) of prunings. The grant increased the visibility of chipping in the region and interest in chipping grew.

Ecology assumes that without the grant assistance, most of the orchard debris would have been burned. This assumption is based upon these facts:

- The most common method of orchard debris disposal was to burn it in large outdoor fires.
- The downturn in the apple industry was leading to economic hardship.
- Chipping was not a well known or widely used technology at the time.
- Burning is cheaper than chipping.

The costs associated with burning include machinery to remove, stack, and stoke trees, and employing someone to remain in attendance. For chipping, a farmer must obtain a chipper, and in most cases, a contractor to run the chipper. The idea behind the grant was to close the gap, making the cost of chipping more comparable to the cost of burning.



Image of Wood Waste Chipping from the Regional District Okanagan-Similkameen
www.rdos.bc.ca/typo3temp/pics/5ebbd60428.jpg

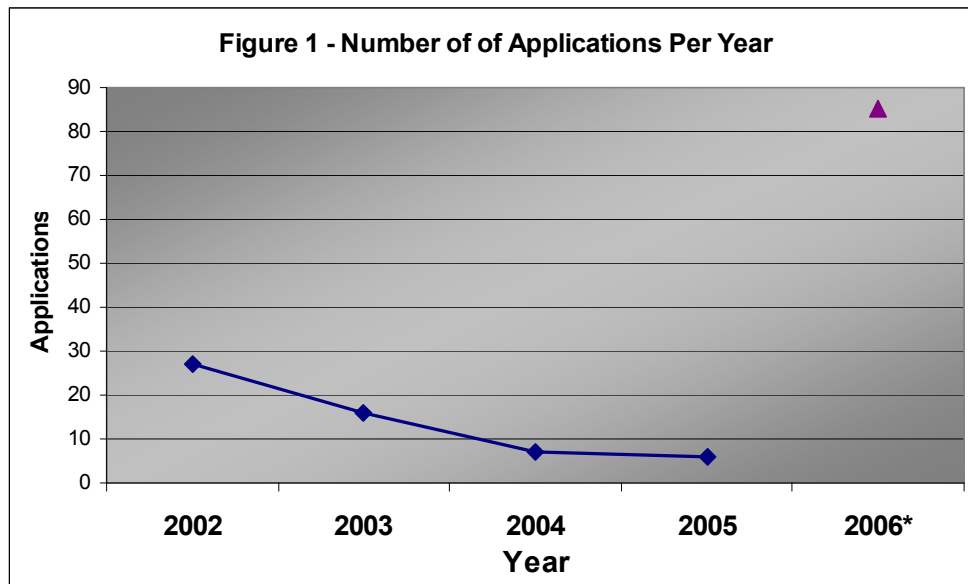
In setting up the grant, EPA and Ecology identified six success measures to use in evaluating the project:

1. Some orchards are chipped that would have otherwise been burned.
2. Resulting chips are directed toward a beneficial use.
3. Chipping becomes more widely known as an alternative to burning.
4. Knowledge is gained about how chipping works as a pest management tool.
5. Knowledge is gained about how much solid waste is generated per acre of torn-out orchard.
6. Partnerships are formed and enhanced among government, stakeholders, and industry.

Success Measure #1

Some orchards are chipped that would have otherwise been burned.

Through this grant, a total of 55 applicants received funding for chipping 617 acres of whole orchard trees, and 86 applicants received funding for flailing 2,395 acres of orchard prunings, bringing the total number of applicants receiving assistance to 141 for using alternatives to burning for 3,012 acres of material. (Figure 1)



*An increase in applications was observed in 2006. Farmers were applying for subsidization to flail prunings.

Ecology estimates that chipping whole trees instead of burning resulted in:

- 27 tons of PM_{2.5} air pollution was prevented (22 tons of PM_{2.5} from apple wood and 5 tons of PM_{2.5} from other orchard varieties, mostly pear wood).
- An additional 7 tons of PM_{2.5} air pollution was prevented by chipping instead of burning orchard prunings.
- In total, an estimated 34 tons of P PM_{2.5} smoke pollution was prevented through this grant.

The chipping process also creates air pollution in the form of wood dust and chipper exhaust. Ecology did not attempt to calculate these emissions for this report.

Success Measure #2

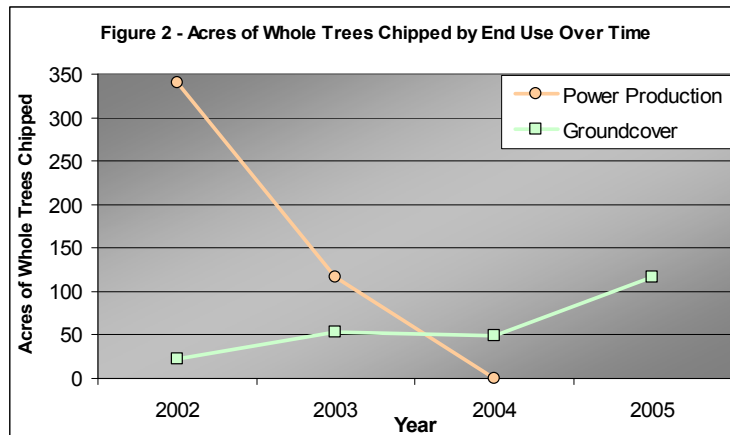
Resulting chips are directed towards a beneficial use.

The applicants were required to plan for and specify in advance the intended end use for the chips, as part of the selection process. Under the grant, chips were not to be burned or directed towards landfills. Several end uses were reported, which have been separated into two basic categories: power production and ground cover. The Power Production category consists of material being sent to Avista Corp.'s Generating Station in Kettle Falls and the Colville Indian Power & Veneer, Inc. in Omak for power generation, and chips used as hogfuel. The ground cover category consists of material used as beauty bark, mulch, dust control, livestock bedding, and mine reclamation.

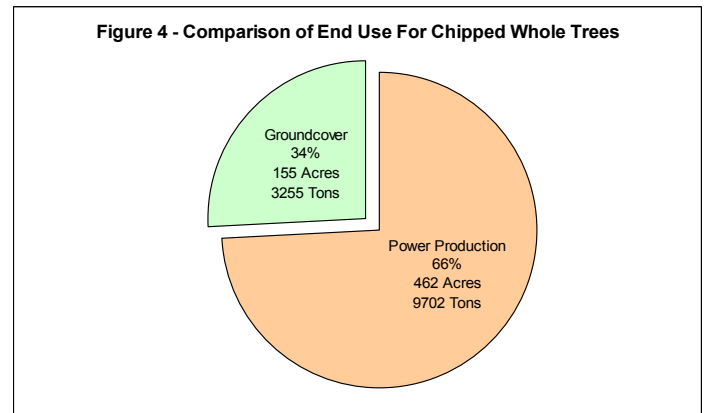
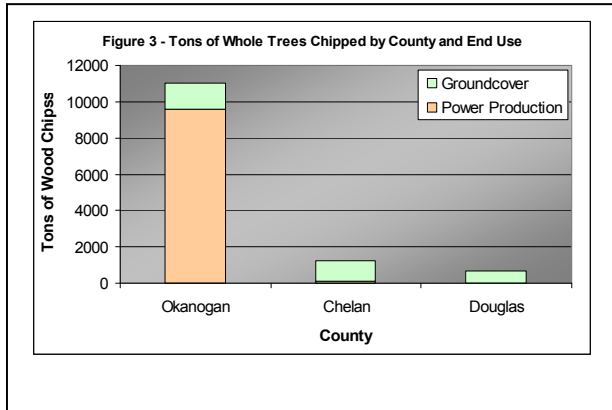
| End Use of Chips* | 2002 | 2003 | 2004 | 2005 | Total | Grand Totals: |
|---------------------------|------------|------------|-----------|-----------|------------|-----------------------------|
| Avista Generating Station | 290 | 0 | 0 | 0 | 290 | Power Production: 462 |
| Colville Power & Veneer | 51 | 117 | 0 | 0 | 168 | |
| Miscellaneous Hogfuel | 0 | 0 | 0 | 5 | 5 | |
| Mulch | 4 | 4 | 45 | 7 | 60 | Ground Cover: 155 |
| Livestock Bedding | 18 | 23 | 0 | 0 | 41 | |
| Beauty bark | 0 | 27 | 0 | 0 | 27 | |
| Dust Control | 0 | 0 | 4 | 10 | 14 | |
| Mine Reclamation | 0 | 0 | 0 | 13 | 13 | |
| Total | 362 | 171 | 49 | 35 | 617 | 617 |

*Values have been rounded to the nearest whole number

This grant came into play during an energy crisis. A substantial amount of chips went towards power generation the first two years of the grant, then power production as an end use dropped sharply and most chips were used for ground cover (Figure 2). The chips were valued as an energy source for a short time, until the cost of transporting the chips exceeded the benefit of using the chips as a power source. When power generation facilities would no longer take chips, other alternative uses became attractive.



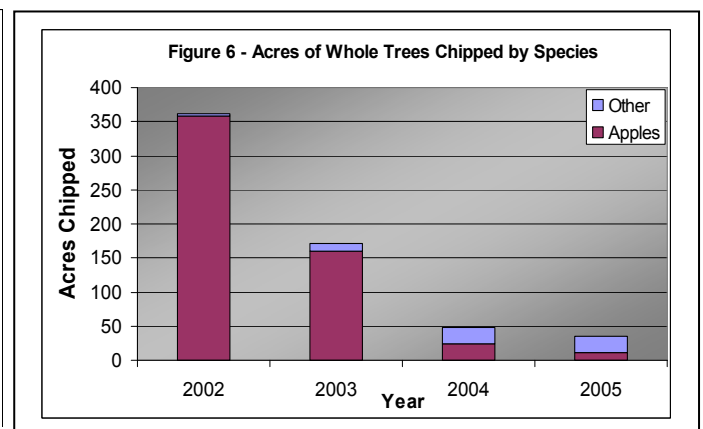
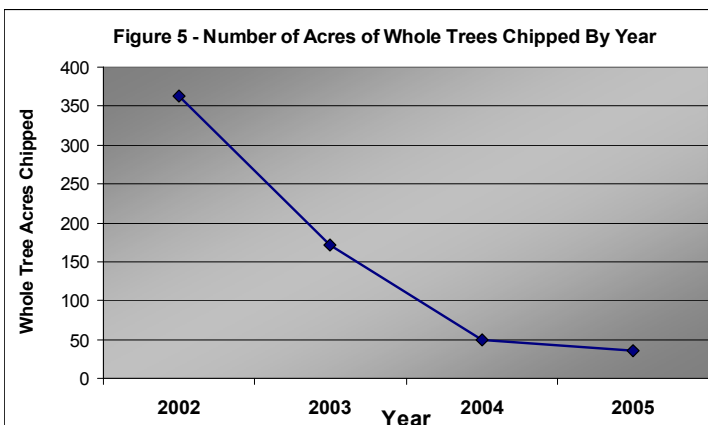
Okanogan was the only county that sent material to power generation facilities, and only during the first two years (Figure 3 & 4). In spring 2001, California suffered massive black outs and the Pacific Northwest experienced an energy crisis. As the energy crisis dissipated, the demand for chips for power production decreased. Ground cover was the only end use identified in all three counties, and used every year, thus, groundcover is potentially the most stable end-use identified during this grant. Power production has great potential as a continuing end use, and can be fully utilized when obstacles such as transportation costs are overcome.



The data shows that as time progressed, the amount of acres chipped went down (Figure 5). This trend shows the need for orchard removal declined over time; the greatest need for orchard disposal occurred at the beginning of the grant cycle, when most of the orchards were torn out. As the apple market stabilized, fewer orchards were in need of removal.

As time progressed, Okanogan County chipped fewer acres while Chelan and Douglas Counties chipped more. People in Okanogan County met their debris disposal needs thus the amount of orchards needing removal in Okanogan decreased. Participation in Chelan and Douglas Counties increased as more people became aware of the grant.

The majority of orchard material chipped was apple wood. The grant was initiated during a downturn in the apple market. During the first year of the grant, nearly all orchard wood chipped was apple. As time progressed, chipping of additional crops increased (Figure 6).



Success Measure #3

Chipping becomes more widely known as an alternative.

Farmers and government agencies gained experience with chipping by participating in the grant. We assume that additional farmers learned about chipping by word of mouth from grant participants. Media articles about chipping and participation in this grant increased the level of awareness around chipping (see Appendix 2). When Okanogan received the initial grant in 2001, two magazines catering to the orchard industry printed articles about chipping, as well as local newspapers. Dan McCarthy, the Okanogan Pest Inspector who was operating the grant, went to meetings and on radio shows to promote the chipping grant. A link was placed on the Okanogan County Commissioners' web-page advertising the chipping cost share program. According to Dan, during the first year of the grant, many additional acres were chipped that were not compensated by cost share. This demonstrates that chipping gained in popularity and notoriety.

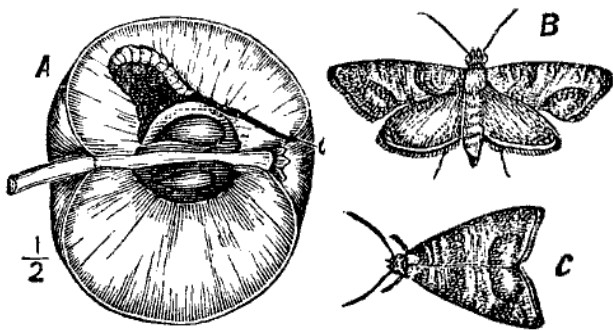
When the grant was in its initial stages, Ecology created a list of available wood possessors to assist farmers in locating a contractor to remove and chip their trees. This list has evolved with time to reflect current companies providing chipping and mulching services, and is still being used by Ecology to encourage alternatives to burning. One example of the success of the wood processors list occurred in 2006, when an applicant withdrew their burn permit application from Ecology due to competitive pricing from a contractor on the list.

Success Measure #4

Knowledge is gained about how chipping fits as a pest management tool.

When Ecology suggested chipping as a method for debris disposal, one of the considerations was whether chipping was an effective way of reducing infestation and eliminating the pest spreading potential of abandoned trees. Debris from an abandoned orchard must be removed or it attracts pests. The pests then infest adjacent orchards. The prime pests of concern were codling moths, spider mites, aphids, and scale insects. Codling moth over-winters on trees, emerges in the spring, and can fly long distances to lay eggs in host trees. Spider mites, aphids, and scale insects are less capable of traveling as far, but are able to migrate short distances to infest nearby orchards. Burning has been the traditional method for removing pest problems, as it was economic, convenient, and successful.

‘Chipping has been identified as the only alternative to burning that disposes of large amounts of orchard trees; and would probably destroy codling moth, but may leave mites and aphids on the chipped orchard residue. If this residue is kept in a pile or transported from the orchard, the chance of the remaining pests infesting nearby orchards is limited. If the material is spread as mulch, re-infestation could occur.’ (Letter to the Washington State Horticultural Association from Jay E. Brunner, Entomologist, WSU Tree Fruit Research and Extension Center; April 2, 2001)



Codling Moth

<http://srufaculty.sru.edu/david.dailey/public/Webster1911/insects/insects.html>

Local pest boards used criteria from Department of Agriculture & Ecology as guidance when evaluating and selecting orchards for chipping. The authorized pest inspector determined infestation status and documented results. The following conditions were considered when determining if chipping was an effective pest management strategy for orchard removal:

- Orchard is standing and recently maintained, but at risk.
- Orchard is standing and not maintained, but for less than a year.
- Orchard is standing and not maintained for more than one year, but not infested.
- Orchard is down and piled, but not infested.

- Standing or downed orchard is infested with organisms that won't survive chipping.

If orchards were infested with organisms or disease that would survive chipping, burning was the recommended method of disposal. Pest inspectors were to provide applicants with technical assistance and applications for burn permits. Ecology is not aware of this occurring, which leads us to believe that of the pest problems encountered, none warranted a burn permit.

No problems were reported by orchards authorized for chipping, including orchards with potential pest problems. During the grant chips from some orchard tear outs were stored in piles until they could be utilized, which did not appear to exacerbate pest problems. This demonstrates that chipping can be an effective method for managing risk from pests.



Image of coddling moth: <http://gardenutah.org/images/uploads/codlingmothIPM.jpg>

Success Measure #5

Knowledge is gained about amount of solid waste generated per acre of torn-out orchard.

Ecology estimates an acre of whole, mature orchard trees generates 21 tons of chipped material , and an acre of orchard prunings generates 1 ton of chipped material. We derived these estimates by comparing the number of orchard acres chipped with the weight of the chips delivered to Avista Generating Station. Only chips weighed at Avista were used in weight to acre analysis calculations, because actual weights and moisture samples were taken when the chips were delivered to this facility. Weights of orchard chips not going to power generation facilities were not used in our weight to acre calculations.

The average weight of orchard chips per acre was derived from a sample size of 26 chipping locations. The average fuel moisture of sampled orchard chips was 25%. Moisture samples were taken from orchard biomass loads delivered to Avista between April 2001 and January 2002. The mean age of orchard trees from the weighed samples was 30 years. Chipped material from orchard blocks with tree ages spanning over 10 years were not used in the weight to acre analysis. Orchard pruning biomass weights assumed an average pruning time of 1.5 years. This assumes even tree growth, as we divided the average tree age of 30 years, by 1.5 years of average pruning growth and divided the number into the average 21 green tons per acre to obtain the estimated value of 1 ton of prunings per year.

| | Okanogan | Chelan | Douglas | Total |
|--|----------|--------|---------|-------|
| 2002* | 7596 | 0 | 0 | 7596 |
| 2003* | 3020 | 147 | 419 | 3586 |
| 2004* | 398 | 496 | 126 | 1021 |
| 2005** | 0 | 587 | 147 | 734 |
| 2006*** | 1457 | 761 | 297 | 2515 |
| Totals | 12471 | 1992 | 989 | 15451 |
| *Whole Trees Only **Whole Trees and Prunings *** Only Prunings | | | | |

Success Measure #6

Partnerships are formed and enhanced among government, stakeholders, and industry.

Several government agencies participated in developing this cooperative proposal for reducing smoke from orchard debris burning. Specific contributions from participants included:

- **County Pest Boards** supplied pest inspectors to review applications, evaluate, select, and prioritize orchards for participation in program, using best professional judgment in selecting orchards suitable for chipping. Once selected, the pest inspectors put farmers in contact with chipping services by providing them with an Ecology generated, non-preferential list of available contractors. Additionally, they agreed to supply information to applicants who were turned down for grant funds, including notification of burn permit requirements and additional technical assistance. They conducted post chipping inspections, and provided documentation to Ecology for tracking and evaluation. They were on the front lines taking complaints about abandoned orchards and making decisions about which orchards must be removed and when. They made sure alternatives to burning supported orchard pest management concerns.
- **Okanogan County Conservation District** administered the grant for a three county area, reimbursed farmers and collected data, maintained records, and prepared reports on grant progress. Additionally, they provided technical assistance and education to landowners about the program.
- **Ecology's Air Quality Program** collaborated with other agencies to create the grant proposal and worked with communities to get the grant running; drafted and coordinated facilitation of contracts; responsible for data roll-up and final report. Ecology's smoke management team educated farmers about the grant opportunity and encouraged alternatives to burning.
- **Washington State Department of Agriculture** established orchard evaluation criteria for selection process, addressed pest management issues, informed other agencies about concerns arising from rapid widespread orchard clearing, and brainstormed possibilities for addressing those issues.
- **Environmental Protection Agency's Region 10: Pacific Northwest** reviewed and commented on grant application, approved of application, and awarded grant.
- **Local elected officials in Okanogan, Chelan, and Douglas Counties** made Ecology aware of the situation occurring in their counties, met with state agencies and worked towards a beneficial solution.
- **Chipping companies** contracted with farmers to chip orchard material.
- **The organizations and private citizens that took the chips** provided for removal of chipped material from orchards where they were processed.
- Most important, **the horticulture community** was willing to take a chance and try something new to keep the air clean. They participated in the decision of whether to chip or burn. Those selected for the grant coordinated with local agencies and chipping service providers on scheduling of chipping and financial assistance. Many participants needed to remain flexible in order to participate and complete their commitments.

Congratulations to county pest officials, the Okanogan Conservation district, and Ecology, who formed a most notable and long lasting relationship through interactions facilitated by this grant proposal and implementation process, and who look forward to fostering their relationship.

Finances

To offset the expense of chipping, the grant provided a cost share rate of \$150 per acre for chipping whole trees, and \$15 per acre to flail prunings. The Okanogan County Conservation District, who facilitated the grant, was initially awarded \$56,500: \$50,000 for cost share reimbursement and \$6,500 for administrative costs to run the project. \$11,000 was awarded to the Okanogan Pest and Disease Board for their expertise in identifying orchards suitable for chipping. In 2003, the grant award increased due to interest in the project. The Okanogan County Conservation District was awarded an additional \$65,000 for cost sharing and \$5,964 for administrative costs; the Okanogan Pest and Disease Board was awarded \$4,790 to complete their commitments. Also in 2003, the Chelan-Douglas Horticultural Pest and Disease Board was awarded \$4,750 to participate in the grant.

The amount reimbursed for chipping whole trees came to \$87,198; the amount reimbursed for flailing prunings came to \$27,802, bringing the total amount reimbursed for the life of the grant to \$115,000, all that was allotted. The total amount spent during the life of the grant, including administrative costs for all three agencies and cost share amounts came to \$144,875.

| Financial Evaluation of Funds Distributed by Category | | | |
|---|-----------|-----------|---------|
| | Awarded | Spent | Balance |
| Chipping Cost Share | \$115,000 | \$115,000 | \$0 |
| Pest Inspector Expertise | \$20,540 | \$18,141 | \$2,399 |
| Administration and Outreach | \$12,464 | \$11,733 | \$731 |

| Financial Evaluation of Funds Distributed by Contractor | | | | |
|---|--|-------------------------------------|--|-----------|
| | Okanogan County Conservation District | Okanogan Pest & Disease Board | Chelan-Douglas Horticultural Pest & Disease Board | Total |
| 2001 | \$56,500 | \$11,000 | \$0 | \$67,500 |
| 2003 | \$70,964 | \$4,790 | \$4,750 | \$80,504 |
| Amount Dispersed | \$127,464 | \$15,790 | \$4,750 | \$148,004 |
| Amount Spent | \$126,733 | \$15,790 | \$2,351 | \$144,875 |
| Unspent Balance | \$731 | \$0 | \$2,399 | \$3,129 |

Conclusions

This grant was successful in meeting its goals:

- Government, stakeholders, and industry formed a partnership that identified a problem and mitigated its impact.
- Farmers chipped orchards instead of burning them.
- The partnership utilized a valuable organic resource by directing orchard chips towards a beneficial end-use, specifically towards power generation during an energy crisis.
- Through media and outreach, more communities learned about chipping as an alternative to burning.
- The partnership learned that chipping is a viable alternative to burning. The chipping process can effectively remove and mitigate potential pest infestations.
- The partnership obtained valuable data by tracking how many and what kind of acres were chipped. Ecology estimated how much solid waste an acre of orchard land generates and how much air pollution the partnership prevented.

Recommendations

Continue research into solving the cost of hauling

Through the grant, the partnership observed that use of chips as a power source is viable, but limited by the cost-benefit ratio and fluctuations in the power market. The amount of power the chips produce must be greater than the energy cost to haul the chips. Higher energy costs may increase the need for energy from organics, improving likelihood of chips used for power as an end-source. (See Good Fruit Grower article, page 34.)

- Research the economics of hauling chipped material.
- Continue to look for ways to utilize chips as energy; work towards finding an energetic use of chips that is valuable enough to outweigh transport costs.

Continue researching and using chips as ground cover

Ground cover appears to currently be the most sustainable end use for orchard chips. The demand appears steady; all three counties used chips for ground cover throughout the chipping project. Studies by the Washington State University indicate that orchard chips, when used as mulch, may be successful as a weed deterrent, and is convenient as it is low maintenance¹. Additionally, it may reduce pest issues in orchards, which is one of the education criteria of this grant.

- Collect research and educate farmers about the benefits of applying chips as ground cover.

Continue researching and using chips as paper pulp

Studies done by the University of Washington (UW) indicate that orchard chips are useful for paper pulp. (See Good Fruit Grower article, page 45.)

- Support additional research into this area.
- Use materials made from orchard wood chips.

Continue promoting chipping as an alternative to burning

- Use the wood processor list to advocate chipping instead of burning.
- Research additional viable end uses for chips and opportunities to advocate chipping.
- Educate communities about chipping and beneficial uses of chipped wood such as mulch¹.
- Encourage communities to use wood chips for composting.
 - R Wood chips are an efficient way to obtain essential amounts of carbon needed for healthy compost.

Continue developing productive relationships with government agencies, stakeholders, and the orchard industry

Ecology formed successful partnerships with other government agencies. We need to strive to establish additional relationships and strengthen the ones we currently have.

Appendices

Appendix A. Assumptions

In figuring tons of PM_{2.5} air pollution prevented, calculations were arrived at based upon these assumptions:

- When different crop acres were reported as combined value, equal parts per crop were assumed. {i.e 20 acres apples and pears = 10 acres apples; 10 acres pears};
- Calculations were made using measurements from chipping whole trees, as we have biomass information for whole orchard trees.
- Orchards are pruned an average of every 1.5 years.
- Green weight values were obtained from calculations based on material sent to the Avista Generating Station, for apple wood and other species, as these values for other species was unknown.
- Green weights were used when figuring PM_{2.5} values, based upon the understanding that the material was burned immediately after removal to expedite the process of selling the land or planting newer varieties. Most farmers were trying to deal with the tear out as quickly as possible to reduce further economic hardship and possible pest problems.
- When calculating pollution in 'other' the emission factor for pear was used because most of the material in 'other' was pear.
- Emissions from equipment and other sources were not included in figuring how much PM_{2.5} pollution was prevented; only smoke emissions from burning orchard material were considered in these calculations; and emission factors were calculated based on amount of material that would have been burned but was chipped instead.

Appendix B. Emission Factor Document



Winston H. Hickox
Agency Secretary

Air Resources Board

Alan C. Lloyd, Ph.D.
Chairman

2020 L Street • P.O. Box 2815 • Sacramento, California 95812 • www.arb.ca.gov



Gray Davis
Governor

MEMORANDUM

TO: Beverly Werner, Manager
Regulatory Assistance Section
Stationary Source Division

FROM: Dale Shimp, Manager /s/
Emission Inventory Analysis Section
Planning and Technical Support Division

DATE: August 17, 2000

SUBJECT: Agricultural Burning Emission Factors

This memo is in response to your request for our assistance in compiling the best available emission factors for the open burning of agricultural residues such as crop stubble and orchard prunings. We understand that these factors will be used for estimating emission reduction credits, and we also expect that they will be used as needed for Title 17 smoke management efforts.

The emission factors included in the attachment to this memo are based on results from ARB sponsored emissions tests. To encourage statewide consistency, we encourage the use of these emission factors, however, districts have the flexibility to use other factors if they have data which can be shown to be more applicable or relevant to their specific region.

The attachment includes background information about the emission factors, the rationale for selecting them and their limitations, and a table of the factors and their sources. Except for a few examples, this summary does not include emission estimates for burning grasslands, chaparral, and forest materials. These will be provided in a separate analysis. If you have any questions regarding the provided factors, please contact Patrick Gaffney of my staff at 916-322-7303 or pgaffney@arb.ca.gov.

Attachment

cc: Patrick Gaffney
Staff Air Pollution Specialist
Planning and Technical Support Division

California Environmental Protection Agency

Printed on Recycled Paper

Emission Factors for Open Burning of Agricultural Residues

California Air Resources Board

Introduction

Within California substantial quantities of agricultural residues are burned in the field as a way to dispose of the material. The materials typically burned include orchard prunings, straw stubble, and other biomass. To estimate air emissions from these burning activities, typically a limited number of emission tests are performed under either field or laboratory conditions, and the emissions are measured. These measurements, combined with knowledge of the quantity of material burned, are used to develop emission factors, which are an *estimate* of the quantity of emissions per amount of material burned. Emission factors for agricultural burning are generally expressed as pounds of pollutant per ton of material burned.

Open burning of agricultural materials provides a diverse mix of pollutants. At this time the pollutants that are most commonly quantified are particulate matter (PM), oxides of nitrogen (NO_x), oxides of sulfur (SO_x), volatile organic compounds (VOCs), and carbon monoxide (CO). In addition, some information is available providing information on the individual toxic species and organic compounds produced during open burning, but they are not provided in this summary.

Prior to this analysis, the emission factors used in California for agricultural burning were typically from the U.S. EPA's "Compilation of Air Pollutant Emission Factors"¹, which is often referred to as AP-42. These factors are based on ARB sponsored tests performed in 1974 and 1977. This summary provides some new emission factors based on more recent measurements by Jenkins² at the University of California at Davis in 1992 and 1993. When these more recent data were not available, then the default AP-42 factors were used or emissions.

Using These Emission Factors

The emission factors summarized here are recommended for use in California under "typical" conditions. Because of the nature of the testing used to measure the open burning emissions, it is unlikely that these factors will exactly quantify the emissions from any specific fire. However, it is assumed that the factors will generally provide a reasonable overall estimate of emissions. In those cases when region specific, fuel specific, or condition specific emission factors are available, they may be used when it is clear that they are more representative of the emissions than the generic factors.

If it is necessary to refer back to the original literature citations used for this emission factor summary, it is important to note that there is a reporting inconsistency in the reports which was rectified here. Specifically, the AP-42 emission factors, based on the work of Darley,

are reported on the basis of field condition fuel moisture (i.e., lbs of pollutant/ton of field dry fuel). But, the newer emission factors by Jenkins are reported in terms of bone dry fuel mass, which is zero percent moisture (i.e., lbs of pollutant/ton bone dry fuel). These distinctions and the corrections applied are described fully in the emission factor notes, which follow, and the notations included with the emission factor table.

General Notes for Agricultural Burn Emission Factors

Emission Factors. Where available, the emission factors from Jenkins² were used in preference to AP-42¹ or values from Darley³. This is because the Jenkins data are more recent, they were fully quality assurance and quality control checked, complete documentation of the testing and results are readily available, and all relevant pollutants were measured using the current best available methods. When Jenkins data were not available, AP-42 values or averaged Jenkins and Darley values were used, as described in the emission factor table notes for each specific material burned.

PM₁₀ and PM_{2.5}. Where possible, the directly measured Jenkins data were used for the PM₁₀ and PM_{2.5} emission factors. For those crops not tested by Jenkins, AP-42 values were used. Because AP-42 provides only PM₃₀, ARB size scaling factors (based on averaged Jenkins data) were used to scale the PM₃₀ values to PM₁₀ and PM_{2.5}. For field crops, the PM₁₀ scaling fraction is 0.9835; for PM_{2.5}, the scaling fraction is 0.9379. For orchard and vine crops, the PM₁₀ scaling fraction is 0.9814 and for PM_{2.5} the scaling fraction is 0.9252.

NO_x and SO₂. These pollutants pose special problems because of the variations in measurements between Jenkins and Darley (1979), and because AP-42 does not include NO_x and SO₂. For NO_x, there are significant differences between the Darley and Jenkins measurements.

Darley states that his testing in 1978 was one of the first attempts to measure NO_x from the actual burning of agricultural residues. Jenkins performed his testing in 1992 and 1993. The Jenkins data were selected as the default NO_x values for the following reasons: 1) the Jenkins combustion process more accurately simulate field burning conditions; 2) the Jenkins data were performed more recently using modern equipment and full QA/QC processes; and, 3) Jenkins data are used for the other pollutants, so using the Jenkins NO_x provides a consistent data set.

For comparison, the average Darley NO_x value for prunings is 3.1 lbs/ton burned versus the 7.0 value from Jenkins. For field crops, the average Darley NO_x value is 4.1 lbs/ton burned versus 4.9 from Jenkins.

The SO₂ measurements also vary significantly between Darley and Jenkins. For SO₂, Darley acknowledges (pgs. 20, 43) that his estimates are biased high because it was not possible to directly measure the SO₂. Instead he computed the difference in sulfur between the unburned fuel and the ash, and assumed that all of the sulfur lost to combustion was converted to SO₂. Because these estimates are not based

on measurements of the combustion gases, they are viewed less robust than the Jenkins stack measurements.

For the Jenkins SO₂ measurements, the report states that the SO₂ emission estimates may be low by a factor of 2 to 3 (pg. 102). However, with the understanding that these estimates may be biased low, they are the current best available data, and are provided as an initial estimate based on combustion gas measurements.

For comparison, the average Darley SO₂ value for prunings is 0.6 lbs/ton burned versus the 0.2 value from Jenkins. For field crops, the average Darley SO₂ value is 2.8 lbs/ton burned, versus 0.7 from Jenkins.

Computation of VOCs from Jenkins and AP-42. The Jenkins report provides several measurements of hydrocarbons. For example, Table 4.1.3, and 4.5.1 provides the following:

| Species | Name | Notes |
|-------------------------|-----------------------------------|---|
| THC | total hydrocarbon | continuous measurements, best hydrocarbon value (section 2.2.2.1) |
| HC (by GC) | hydrocarbons by gas chromatograph | includes only CH ₄ , C ₂ H ₂ , C ₂ H ₄ , C ₂ H ₆ , C ₃ H ₈ (section 2.2.2.2) |
| CH ₄ (by GC) | methane by gas chromatograph | grab sample |
| NMHC | non-methane hydrocarbons | this is THC – CH ₄ (by GC), some round-off variations occasionally |
| NMHC (by GC) | non-methane hydrocarbons by GC | used primarily as THC check, not primary measurement |
| VOC | volatile organic carbon | Includes a selected set of VOCs that were evaluated using GC (section 2.2.3); not all species of VOCs were identified |

There are two possible ways to compute the VOC values. The first approach is to sum the individual emission factors for the species provided in Table 4.5.1 of Jenkins. Because not all VOC species were identified and quantified in this analysis, this estimate would tend to be lower than the actual level of VOCs produced. (Ref. email from Jenkins 1/11/00, and letter 7/29/97)

The second approach is to use the total hydrocarbon value (THC) and then use the existing ARB fraction of reactive gas profiles (FROGs) to estimate the fraction of THC that is considered reactive (or volatile) for agricultural burning. Currently, this is the preferred approach because using only the Jenkins emission factors for the measured VOC species will underestimate the total VOC.

In AP-42, values for Total Organic Carbon (TOC) are provided which are assumed to be equivalent to THC. Therefore, VOC is computed as either THC (Jenkins) or TOC (AP-42) multiplied by the ARB fraction of reactive gas (FROG) which is 0.5698 for agricultural residue and prunings burning.

Computation of EFs from Jenkins. The Jenkins emission values are provided as Average Emission Factor (% dry fuel). The 'Average All Tests' values were used. The % dry fuel values were converted to pounds/ton (i.e., % dry fuel x 2000 lbs/ton ÷ 100% = lbs emitted/ton burned). This applies to data in Jenkins Tables 4.1.1 to 4.1.8.

Moisture correction. After the Jenkins emission values were converted to pounds/ton, they were then adjusted for fuel moisture levels. This was needed because the Jenkins emission factors were reported in terms of emissions per bone dry fuel mass (0% moisture). Because most users of these emission factors generally do not have access to bone dry fuel loading values, the Jenkins emission factors were converted to a field condition fuel moisture basis. The AP-42 emission factors are published on a field condition fuel basis so no conversion was needed.

The Jenkins factors were converted by subtracting the average percent moisture for each fuel from the emission factors, thereby reducing the emission factor by the amount of moisture in the fuel, and putting them on a moist fuel basis. Looked at another way, if a ton of wet material was burned and the Jenkins factors were applied to this wet ton, the emissions would be overestimated. Because of the water in the fuel, the mass would be artificially elevated for use with the Jenkins dry fuel factors. As an example, for wheat straw, the wet fuel loading is 1.9 tons/acre. But, 7.3% of that is water, so the bone dry fuel loading is actually 1.9 tons/acre - 7.3% = 1.8 tons/acre, so only 1.8 tons of dry fuel are burned. For these factors, rather than adjusting the fuel loadings, the emissions factors were reduced to allow the moist loadings to be used.

Fuel Loading. For nearly all cases, the default fuel loading values for field crops are from AP-42. Other fuel loading values were not readily available. Using knowledge of local conditions and practices, fuel loading values can be adjusted as needed to more completely reflect actual conditions. The fuel loading values are provided as field condition fuel loadings which include varying degrees of moisture in the fuel. For example, the percent weight of moisture for wheat straw prior to burning averaged 7.3%. The default fuel loading and fuel moisture levels are provided in the emission factor table. Using the default fuel moisture, bone dry fuel loadings can be calculated if needed.

Emission Factors for Chaparral and Forest. These values are provided primarily for comparison purposes and they are not recommended for use to compute official emission estimates. Instead, more region specific data should be identified and used if available. The ARB will evaluate the current emission factors and prepare a companion to this report which addresses emissions from grass, brush, and forest burning.

References

- ¹ 'Compilation of Air Pollutant Emission Factors'. Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, January 1995, U.S. EPA. Table 2.5-5.
- ² Jenkins, B., 'Atmospheric Pollutant Emission Factors from Open Burning of Agricultural and Forest Biomass by Wind Tunnel Simulations', April 1996, UC Davis. Tables 4.1.1 to 4.1.8.
- ³ Darley, E.F., Hydrocarbon Characterization of Agricultural Waste Burning, April 1979. Statewide Air Pollution Research Center, UC Riverside, under contract to the California Air Resources Board, #A7-068-30.

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Emission Factors for Open Burning of Agricultural Residues (Revised 9/12/00)

| Crop | PM ₁₀ ^a (lbs/ton) | PM _{2.5} ^a (lbs/ton) | NO _x ^b (lbs/ton) | SO ₂ ^b (lbs/ton) | VOC ^c (lbs/ton) | CO (lbs/ton) | Fuel Loading ^d (tons/acre) | Fuel Moisture ^e (% weight) | Source of Data |
|-------------------------------|--|---|---|---|-------------------------------|-----------------|---|---|---------------------------|
| Row Crops | | | | | | | | | |
| Alfalfa | 28.5 | 27.2 | 4.5 | 0.6 | 21.7 | 119.0 | 0.8 | 10.4 | AP-42, Jenkins NOx & SO2 |
| Barley | 14.3 | 13.8 | 5.1 | 0.1 | 15.0 | 183.7 | 1.7 | 6.9 | Jenkins (EF) ^f |
| Corn | 11.4 | 10.9 | 3.3 | 0.4 | 6.6 | 70.9 | 4.2 | 8.6 | Jenkins (EF) ^f |
| Oats | 20.7 | 19.7 | 4.5 | 0.6 | 10.3 | 136.0 | 1.6 | 9.6 | AP-42, Jenkins NOx & SO2 |
| Rice | 6.3 | 5.9 | 5.2 | 1.1 | 4.7 | 57.4 | 3.0 | 8.6 | Jenkins (EF) ^f |
| Safflower | 17.7 | 16.9 | 4.5 | 0.6 | 14.8 | 144.0 | 1.3 | 14.1 | AP-42, Jenkins NOx & SO2 |
| Sorghum | 17.7 | 16.9 | 4.5 | 0.6 | 5.1 | 77.0 | 2.9 | 17.2 | AP-42, Jenkins NOx & SO2 |
| Wheat | 10.6 | 10.1 | 4.3 | 0.9 | 7.6 | 123.6 | 1.9 | 7.3 | Jenkins (EF) ^f |
| Orchard and Vine Crops | | | | | | | | | |
| Almond | 7.0 | 6.7 | 5.9 | 0.1 | 5.2 | 52.2 | 1.0 | 18.3 | Jenkins (EF) ^f |
| Apple | 3.9 | 3.7 | 5.2 | 0.1 | 2.3 | 42.0 | 2.3 | 53.5 | AP-42, Jenkins NOx & SO2 |
| Apricot | 5.9 | 5.6 | 5.2 | 0.1 | 4.6 | 49.0 | 1.8 | 33.7 | AP-42, Jenkins NOx & SO2 |
| Avocado | 20.6 | 19.4 | 5.2 | 0.1 | 18.5 | 116.0 | 1.5 | 29.3 | AP-42, Jenkins NOx & SO2 |
| Bean/Pea | 13.7 | 13.0 | 5.2 | 0.1 | 14.2 | 148.0 | 2.5 | 11.4 | AP-42, Jenkins NOx & SO2 |
| Cherry | 7.9 | 7.4 | 5.2 | 0.1 | 6.0 | 44.0 | 1.0 | 36.2 | AP-42, Jenkins NOx & SO2 |
| Citrus | 5.9 | 5.6 | 5.2 | 0.1 | 6.8 | 81.0 | 1.0 | 29.3 | AP-42, Jenkins NOx & SO2 |
| Date palm | 9.8 | 9.3 | 5.2 | 0.1 | 3.8 | 56.0 | 1.0 | 13.3 | AP-42, Jenkins NOx & SO2 |
| Fig | 6.9 | 6.5 | 5.2 | 0.1 | 6.0 | 57.0 | 2.2 | 30.1 | AP-42, Jenkins NOx & SO2 |
| Grape | 4.9 | 4.6 | 5.2 | 0.1 | 3.8 | 51.0 | 2.5 | 31.5 | AP-42, Jenkins NOx & SO2 |
| Nectarine | 3.9 | 3.7 | 5.2 | 0.1 | 2.3 | 33.0 | 2.0 | 32.0 | AP-42, Jenkins NOx & SO2 |
| Olive | 11.8 | 11.1 | 5.2 | 0.1 | 10.3 | 114.0 | 1.2 | 33.5 | AP-42, Jenkins NOx & SO2 |
| Orchard | 7.8 | 7.3 | 5.2 | 0.1 | 6.3 | 66.0 | 1.7 | 28.8 | Average all tree EFs |
| Peach | 5.9 | 5.6 | 5.2 | 0.1 | 3.0 | 42.0 | 2.5 | 15.7 | AP-42, Jenkins NOx & SO2 |
| Pear | 8.8 | 8.3 | 5.2 | 0.1 | 5.1 | 57.0 | 2.6 | 34.3 | AP-42, Jenkins NOx & SO2 |
| Prune | 2.9 | 2.8 | 5.2 | 0.1 | 4.6 | 47.0 | 1.2 | 25.3 | AP-42, Jenkins NOx & SO2 |
| Walnut | 4.2 | 4.0 | 4.5 | 0.2 | 4.8 | 67.0 | 1.2 | 33.1 | Jenkins (EF) ^f |

Emission Factors for Open Burning of Agricultural Residues (continued)

| Crop | PM ₁₀ ^a (lb/ton) | PM _{2.5} ^a (lb/ton) | NO _x ^b (lb/ton) | SO ₂ ^b (lb/ton) | VOC ^c (lb/ton) | CO (lb/ton) | Fuel Loading ^d (tons/acre) | Fuel Moisture ^e (% weight) | Source of Data |
|-----------------------------------|---|--|--|--|------------------------------|----------------|---|---|---|
| Other Biomass Open Burning | | | | | | | | | |
| Grassland ^g | 15.9 | 15.2 | 4.5 | 0.6 | 10.7 | 114.0 | 2 to 3.2 | 10.3 | Average of field crops |
| Chaparral ^h | 20.1 | 17.3 | 3.5 | 0.1 | 14.4 | 153.7 | 7 to 23 | 27.2 | Hardy, 1996, NOx & SO2 avg. Jenkins fir & pine |
| Forest ^h | 19 to 30 | 17 to 27 | 3.5 | 0.1 | 8 to 21 | 154 to 312 | 7 to 23* | 27.2 | Peterson, Ward, AP-42 |

Notes and Revision History for Emission Factor Table

Revision History

| | |
|----------|---|
| 08/17/00 | Original Release |
| 09/12/00 | Orchard category changed to remove vines, bean/pea; averaging corrected |

Notes

- a. AP-42 does not include listings for PM₁₀ and PM_{2.5}, so ARB PM size profiles derived from Jenkins were used to scale the AP-42 TSP (PM₃₀) values. For field crops the TSP < PM₁₀ = 0.9835; TSP < PM_{2.5} = 0.9379. For orchard prunings TSP < PM₁₀ = 0.9814; TSP < PM_{2.5} = 0.9252. Because the Jenkins values were reported as PM₁₀ and PM_{2.5}, scaling was not needed for these data.
- b. AP-42 does not include NO_x or SO₂ values, therefore for these crops, NO_x and SO₂ were set to either the average moisture adjusted Jenkins field crop or orchard crop values. SO₂ values are included in Darley, but they were not used for SO₂ because of known overestimates due the method used. Also see general notes.
- c. Where Jenkins test data were available, VOC was derived from the Jenkins THC values. When AP-42 data were used, VOC was derived from TOC values. In both cases, these values were multiplied by the ARB fraction of reactive gas (FROG), which is 0.5698 for agricultural residue and prunings burning, to get the reactive, or volatile portion of the THC or TOC. Jenkins VOC values in table 4.5.1 were not used because it does not include all volatile species. Also see general notes.
- d. All fuel loadings are from AP-42, except, the fuel loading for almond prunings which are based on estimates received from Jack Rabbit Chippers, Pacific-Ultra Power Co Generation, and the Almond Hullers Association. SJV Ag. Technical Group minutes, May 25, 2000. These are average generic values only and local data should be used where available.
- e. For the Jenkins data, fuel moisture is from the average fuel moisture reported in the Jenkins report. For the fuels not tested by Jenkins, the material specific fuel moistures from Darley were used. Note that in both cases, these moistures were for the fuels burned by the researchers, who attempted to approximate typical moistures during field burning. However, under actual field conditions, the fuel moisture may vary widely from the values provided here based on drying times and several other factors.
- f. The emission factors are from Tables 4.1.1 to 4.1.8 of the Jenkins report. For field crops the 'Average All tests' values were used. For wood (almond, walnut, pine, fir) the emission factors were computed using the 'Estimated velocity' results. Page 110 of the Jenkins report that states that these values are superior for almond, pine, and fir. For consistency, the estimated velocity results were also used for walnut. The Jenkins report provides emission factors in terms of bone dry fuel mass. The factors were converted here to provide them on a field condition, wet fuel basis, based on the reported fuel moistures in Jenkins. Also see the general notes.
- g. Until specific grassland emission factors are compiled, these factors, an average of all of the field crop emission factors, are provided as a temporary surrogate for grassland emissions.
- h. Provided for comparison only, these factors show the relative quantities of emissions produced by chaparral and forest burning. Any realistic emission estimate for forest burning must be made in consultation with experts knowledgeable with the local fuel types, environmental conditions, and burn behavior. The emissions are summarized from the cited documents. However, the documents do not include SO_x and NO_x, so for these pollutants the values shown are the average of measurements performed by Jenkins for pine and fir. These values are provided primarily for comparison purposes and using them to compute official emission estimates is not recommended.

References

Jenkins, B., '*Atmospheric Pollutant Emission Factors from Open Burning of Agricultural and Forest Biomass by Wind Tunnel Simulations*', April 1996, UC Davis.

Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, January 1995, U.S. EPA. Table 2.5-5. Fuel loadings and EFs. AP-42 values are used where Jenkins data are not available. Section 13.1 used for forest burning.

Hardy, C.C., et al., *Smoke Emissions from Prescribed Burning of Southern California Chaparral*, February 1996, USDA Forest Service, Pacific Northwest Research Station. These values are provided primarily for comparison purposes and their limitations should be understood if they are used for computing official emission estimates.

Peterson, J., Ward, D., *An Inventory of Particulate Matter and Air Toxic Emissions From Prescribed Fires in the United States for 1989, Final Report*. USDA Forest Service, Pacific Northwest Research Station, Fire and Environmental Research Applications, Seattle, WA.. IAG #DW12934736-01-0-1989.

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August 2000

Appendix C. Media Articles on Chipping and Grant Participation

| | |
|--|----|
| Good Fruit Grower: Recycling Old Trees a Better Option than Burning..... | 30 |
| Good Fruit Grower: Chipping Old Trees is Alternative to Burning..... | 32 |
| Ecology Intra-agency Success Stories: Chipping Orchard Debris to Reduce Smoke... | 33 |
| Good Fruit Grower: Pest Boards Get Funds for Removing Orchards..... | 34 |
| Ecology News Release: Orchard-Chipping Projects Prove Successful..... | 37 |
| Okanogan Valley Gazette-Tribune: Debris Chipped Instead of Burned..... | 39 |
| The Wenatchee World: Orchard Wood Sent to Power Plants..... | 39 |
| Good Fruit Grower: Old Orchards Make Renewable Energy..... | 40 |
| Okanogan Conservation District Resource Quarterly: Orchard Chipping Cost Share... | 42 |
| Okanogan County Chronicle: Growers Can Tap Grant for Tree Removal..... | 43 |
| Good Fruit Grower: Counties Receive More Funding For Chipping Orchards..... | 44 |
| Okanogan Conservation District Resource Quarterly: Orchard Chipping Grant Extended..... | 45 |
| Okanogan Conservation District Resource Quarterly: Additional Orchard Chipping Funding Available..... | 46 |
| Okanogan Valley Gazette-Tribune: Grant Available for Area Growers..... | 47 |
| Okanogan County Chronicle: Cost Share Offered for Brush Disposal..... | 47 |
| Good Fruit Grower: Grants Available for Mowing Prunings..... | 48 |



Recycling old trees a better option than burning

By Geraldine Warner

February 15, 1996

Burning old orchard trees is still an option in eastern Washington, but it may not be the best option, some people think.

Requirements of the federal Clean Air Act, which have limited burning in urban areas, have not affected rural areas to the same extent, but traditional burning practices are in question, says Preston Horn-Brine, director of business assistance for the Clean Washington Center, a division of the Department of Community, Trade and Economic Development.

Horn-Brine is encouraging orchardists to consider recycling the trees they remove when they replant an orchard. In recent years, paper mills have recognized fruit wood as a good potential source of fiber for making corrugated cardboard. Restrictions on logging have reduced supplies of chipped wood from traditional sources, and mills are becoming more efficient at using recycled wood from urban and fruit industry sources.

He said studies show that waste wood from orchards, including prunings, averages three to ten tons per acre per year. Multiply that by the acreage in Washington, and it adds up to a big pile and a lot of smoke.

Boise Cascade Corporation, which has a paper mill at Wallula, near the Tri-Cities, Washington, is one of the companies that would love to take that wood off growers' hands.

Nick Jagelski, Boise Cascade's fiber coordinator for the Pacific Northwest area, said he has used apple wood and is interested in using more. It is used to make the fluted part in the middle of corrugated paper.

A requirement is that the wood is chipped, rather than tub ground. Ground wood becomes too stringy for the plant to use. Orchard wood could be chipped with a portable chipper.

Jagelski, who is based at the company's office in La Grande, Oregon, said an orchard would probably not generate enough pruning wood to make chipping worthwhile, but it would be feasible to chip the trees and trunks when an orchard is removed.

Boise Cascade works on the basis of a delivered cost. The orchardist would have to figure out if the price would cover transportation and chipping.

Prices change continually, according to the world market, he said. Currently, the price for urban or orchard wood is relatively low at \$62 per bone dry unit, which is 2,400 pounds. Water content of green wood varies by species, but apple wood tends to be more dense and is probably a little drier than some species. White fir has a 55% moisture content. Pine is 45% water.

"If people have it, they should certainly call, because it doesn't take anything for someone from our company to come and look at it and pencil it out," Jagelski said.

He said it may work out that the prices don't justify the cost of chipping and hauling, and the grower may decide not to do it. However, there is a public relations value in recycling rather than burning, and that is one of the reasons Boise Cascade is using recycled wood.

According to Tom Gash, manager of respiratory care at Central Washington Hospital, Wenatchee, medical research shows that wood smoke can cause lung damage. Often in winter, there are temperature inversions in the Wenatchee Valley that trap cold air near the ground under a layer of warm air, notes Mikael Montague,

spokesperson for the Wenatchee Valley Clean Air Coalition. The cold air acts like a lid that traps smoke near the ground.

Karen Maib, Washington State University Cooperative Extension horticulturist in the Columbia Basin, said. even if the grower could barely break even on the deal, recycling would be preferable to burning.

She said. some wood from old orchards is chopped up and sold and given away for firewood, but usually most of it, especially the trunks, is burned, and the fires can smolder for weeks.

It may also be in the orchardist's own interest to get the wood off the property as quickly as possible. Often, firewood is stacked in piles and can become a breeding ground for pests. She said a wood-boring insect that became a pest in a Columbia Basin orchard was believed to have moved into the orchard from a nearby wood pile.

"To get it off your place and make use of it would be a good deal, even if you were only one penny on the plus side," she said. "I think it would be super."

Tree fruit nurseries sometimes have to burn excess stock, but Roger Adams of Willow Drive Nursery, in Ephrata, Washington, said. he doubted if a nursery would have enough volume of wood to make recycling worthwhile because of the small size of nursery trees. Removing twine and plastic tags from the trees might be another obstacle, he said.

GOOD FRUIT GROWER *online*

February 1, 1997

Chipping of old trees is alternative to burning

Instead of removing trees and burning them, growers have the option of grinding them up and returning them to the ground as humus.

Dennis Quesinberry of Sunnyside, Washington, is using a machine that was developed to finish off logging operations to remove old orchards. The trees are uprooted whole, put through the machine, and it spits out chips that go into the ground. "It takes seven to twelve seconds to take a 25-year-old tree and turn it into wood chips," said Quesinberry, who is a field representative for Oregon Cherry Growers.

He said the logging industry began using such machines because of restrictions on burning, which may become a concern in the tree fruit industry.

Although chipping the trees seems more expensive than burning them, Quesinberry said ultimately chipping may be cheaper if the man hours it takes to haul trees from the orchard into burn piles is considered.

Guy Witney, Washington State University Cooperative Extension agent for north central Washington, said such machines are used to remove orchards, including citrus, in central and southern California, where burning is restricted because of pollution.

"There's talk that as pollution laws get stricter and stricter, that's probably the way a lot of orchardists are going to have to go in terms of tree disposal," he said.

"It leaves very little behind," Witney said. "The way I've seen it done, they will go through with a bulldozer and pull over the trees. This [machine] comes up behind and gobbles them up and spits them out as little chips."

David Granatstein, who works on sustainable agriculture projects with the Northwest Food Alliance, said returning the trees to the soil is not likely to cause any replant disease problems as long as the roots are killed. Although it will add organic matter to the soil, wood chips are an inert form, and it will take a long time for them to break down, he said.

Intra-agency Success Stories April-June, 2001

http://ecystage.ecy.wa.gov/quality/reg_improvement/success_stories/Year2001/aprjun.htm

Chipping Orchard Debris to Reduce Smoke

Due to a decline in the tree fruit industry, thousands of acres of orchard trees are being pulled out in North Central Washington. The most common method of disposal for orchard debris has been to burn it in large outdoor fires, similar to forest slash burns. The orchard growing region is generally along the river bottoms in steep valleys that experience frequent air stagnation. Chipping is one alternative that appears to be viable for removing the debris, however, in many cases it is more expensive than burning.

Ecology was able to work with the federal government to reprogram air quality grant money in an innovative way to pilot an effort to chip orchard trees rather than burn them. In addition, Ecology approved a one-to-one air quality mitigation plan with Chelan County. Chelan County is offering free chipping to orchardists to mitigate the air quality impact of a diesel generating station.

Results

- Grant monies were reprogrammed in a record 90 days, from the time that the idea was thought of to the time chipping started. Approximately 281 acres are in the process of being chipped in Okanogan County.
- Ecology approved an innovative mitigation plan with the Chelan Public Utilities Department for the operation of their diesel generating station. The PUD offers free chipping to offset the impact of smoke from burning orchard debris. Approximately 441 acres are in the process of being chipped in Chelan County.
- Ecology has forged local partnerships with the Agriculture community at a time when we have strained relationships with this industry.
- The wood chips are currently being used as an energy recovery source in Okanogan County. In Chelan County the orchardist has the option to use the chips on their property or have them hauled to a co-generation plant. However, given the uncertainty of this market, other potential sources for use of the chips are being explored.

Team Name: Chipping Incentives Project

Team Members: Ecology: Susan Billings, Laura Lowe, Katherine Ann Scott, Sue Simms, Robert Swackhamer, Gary Zeiler; Okanogan County Pest Inspector: Dan McCarthy; Okanogan Conservation District: Laura Clark; Chelan County PUD: Keith Truscott



Pest boards get funds for removing orchards

Pest boards will be reimbursed only if the owner fails to pay the bill.

BY GERALDINE WARNER

November 2001

"There's a list of people who want to participate as soon as they get harvest over."

Dan McCarthy

Washington State's tree fruit industry has received some financial help to remove unprofitable orchards.

Below-cost returns for apples for the past three seasons have led to a number of orchards being unsprayed or abandoned. Several counties have horticultural pest and disease boards that encourage landowners to control pests in their trees. If the owners are unwilling or unable, the pest boards have the authority to take care of the problem at the owner's expense.

Washington's legislature has made available up to \$900,000 in funding for this biennium to reimburse counties for pest control efforts, including orchard removal, when the owners do not pay. However, the pest boards still must follow through the lien process in an effort to collect the money.

Clinton Campbell, pest program manager at the Washington State Department of Agriculture, said half the funding comes from the state's toxics control account and the other \$450,000 from fruit and vegetable district funds, which are derived from fees that producers pay for produce inspections. Pest boards are the only entities that can receive the funds.

Campbell said most counties have estimated the cost of removing orchard to be at least \$350 per acre, although some estimates were lower.

Disappointment

Dr. Mike Bush, Washington State University Cooperative Extension agent in Yakima County and a member of the Yakima County Pest and Disease Board, said there was some disappointment among growers that the funding would not help them pay for tree removal.

It's been estimated that 20,000 acres of trees in the Yakima Valley will be removed this year or next spring.

Most of those will be replanted, Bush said, but he is worried that there also could be a number of abandoned orchards that have not been designated as such.

"Growers are reluctant to complain about their neighbors," he said. "It's not a good situation. You know he's just about on the brink of bankruptcy and the reason he's not taking care of the orchard is because of that."

Marlene Gurnard, field horticulturist with the Chelan and Douglas Counties Pest Board in Wenatchee, said some growers initially thought it would be a good idea to have the pest board remove their orchards, but changed their minds when they heard there would have to be a lien on their property if they didn't pay for the removal.

"Some went ahead and paid for it themselves," she said.

She estimates the cost at between \$350 and \$500 per acre.

Mitigation

In Chelan County, the local utilities district has paid for some orchards to be removed and chipped so they would not be burned.

The Chelan County Public Utilities District (PUD) did the removal and chipping as mitigation for emissions from the diesel generators that it installed during a power shortage earlier this year. The Washington State Department of Ecology made mitigation measures one of the conditions of a temporary one-year permit that it issued for the generators.

PUD's Keith Truscott said the district agreed to chip a certain amount of wood for each pound of particulate matter emitted by the diesel generators. When the permit was issued, the generators were expected to run 24 hours a day, seven days a week, but because there is no longer a power shortage, they are not operating. The PUD arranged to remove 352 acres of orchard free of charge, on a first-come first-served basis, to mitigate for when the generators were running.

The PUD is paying contractors between about \$370 and \$500 per acre, depending on the age and density of the trees. Some of the chips are being hauled to an electrical generator plant at Kettle Falls, in north central Washington.

Gurnard said some of those trees had already been pushed over and were awaiting disposal, but said she knew of one grower who had a good orchard and took the opportunity to have the trees removed because he didn't want to farm it any longer.

"It was a wonderful program, and some of the properties I had received complaints on ended up on the PUD list," she said.

Most of the unmanaged orchards people complained about have been removed by the owner, the lending agency, or the PUD, without the need for the county to be reimbursed by the state, she said.

However, growers in Douglas County aren't able to benefit from the PUD program. Gurnard, who covers that county also, said she's had several complaints about orchards there, and some still had to be removed. Church members came to the aid of a woman with a 25-acre orchard in Bridgeport and cut down her trees.

Gurnard expects more orchards will be removed in the coming year.

"I think there are a lot of growers that are still barely hanging on but still farming," she said. "I'm sure we will see more abandonments and bankruptcies in the next year or two," she said.

Okanogan County

Dan McCarthy, field horticulturist for the Okanogan County Pest Board, said for the past three years he has had to remove untended orchards, and there are more than ever this year. He expects the state funding to reimburse pest boards to be useful in cases where the county has difficulty getting payment from property owners.

McCarthy said orchard removals have been hampered by a burning ban during the summer. In addition, heavy equipment such as excavators and chippers could not be used in orchards bordering areas owned by the Department of Natural Resources or U.S. Forest Service because of the dry conditions and high fire risk.

Chipping

In Okanogan County, chipping is an economical way to dispose of the trees, McCarthy said, as the chips go to the electrical generator at Kettle Falls. The plant used to depend on wood waste from sawmills but is looking for alternatives because of a downturn in timber harvesting.

Chipping contractors are able to charge only \$250 per acre for removing and chipping the trees--the same as it would cost to pull and burn the trees--and subsidize that with the profits they receive from the electrical plant.

In addition, the county received a grant of \$50,000 to encourage orchardists to chip, rather than burn, which McCarthy and the Okanogan Conservation District are administering at a rate of \$150 per acre. That brings the cost of removal to the grower down to a very reasonable \$100 per acre.

Half spent

Up to harvest, McCarthy had used about half the grant money. "There's a list of people who want to participate as soon as they get harvest over," he said. "It will be on a first-come, first-served basis. I can't hold the money for anybody, but as these people get done and signed up with the contractor to get their orchards taken out, I will continue with the rest of the money.

"It's helping out those growers that are financially strapped, and it's making it a reasonable price for their orchard removal," McCarthy said.

In addition, it's encouraging growers to have the wood hauled out of the orchard rather than burning the trees.

"It's been really good for everybody," McCarthy said. "I can't think of any negative."



News Release

FOR IMMEDIATE RELEASE -- April 19, 2002

02-063 Orchard-chipping projects prove successful

YAKIMA - More than 700 acres of debris from orchards that were torn out last year were chipped instead of burned in Chelan and Okanogan counties, thanks to a couple of incentive programs coordinated by the state Department of Ecology (Ecology).

"Instead of going up in smoke and causing air quality problems, the chips were used to generate power at combustion plants in Washington and Idaho," said Sue Billings, an air-quality manager with the Department of Ecology's Yakima office.

Some 25 farmers participated in a pilot project sponsored by the Chelan County PUD that chipped 350 acres, according to a report submitted to Ecology by the PUD. Chipping services were free to the orchardists participating in the PUD project.

Another 350 acres were chipped in Okanogan County through a cost-sharing grant program coordinated by the Okanogan Pest Control Board. An acre of orchard produces about 20 tons of chips.

"It was a good pilot," said Dan McCarthy, with the pest board. "It does work. Because the price of energy was high last year, the chip market was high."

During last year's energy crunch, the Chelan PUD sought emergency permission from Ecology to operate up to 26 diesel generators to produce additional electricity. As part of the expedited permitting process, the PUD submitted a plan to offer chipping services to orchardists as a way to offset emissions that would result from the diesel generators.

At the same time, Okanogan's grant project helped to make up the difference between the cost of chipping and burning. The project was so popular McCarthy hopes to secure another grant for future chipping programs.

While most of the chips were used at power-generating facilities, chips also can be used as bedding at feedlots, for trails and landscaping, and for other innovative uses. Interested parties hope that more markets for the chips will open up as more people learn about the projects.

"These were 'win-win' projects," Billings said. "It gave farmers an opportunity to try chipping over burning and allowed the PUD and pest board to provide a needed community service. And residents benefited with overall cleaner air."

Contact: Joye Redfield-Wilder, public information manager, (509) 575-2610, or pager, (509) 574-0490

Oroville, WA
(Okanogan Co.)
Okanogan Valley
Gazette-Tribune
(Cir. W. 3,200)

APR 24 2002

Debris chipped instead of burned

YAKIMA — More than 700 acres of debris from orchards that were torn out last year were chipped instead of burned in Chelan and Okanogan counties under incentive programs coordinated by the state Department of Ecology.

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The Wenatchee World

Sunday - May 5, 2002

Okanogan

Orchard wood sent to power plants

Instead of going up in smoke, about 350 acres of torn-out orchard trees in Okanogan County were chipped and sent to power generators last year.

The project, coordinated by the Okanogan County Pest Control Board with a grant through the state Department of Ecology, helped farmers remove their orchards while reducing air pollution caused by burning.

"It was a good pilot," said Dan McCarthy, the county's pest control agent. "Because the price of energy was high last year, the chip market was high."

The chips were taken to a generating plant at Kettle Falls, he said.

Selling the chips helped to make up the difference in cost between the chipping and burning, he said. An acre of orchard produces about 20 tons of chips.

McCarthy said he and pest agents from Chelan and Douglas counties are working to secure a tree-chipping grant for this year.

He said he is working with the Colville Indian Tribes to use the chips from Okanogan County in generators at Colville Indian Power and Veneer in Omak, which would reduce shipping costs considerably.

Chips also can be used as bedding at feedlots and for trails and landscaping.

— K.C. Mehaffey, World staff



Old orchards make renewable energy

Chipping costs more but is an environmentally friendly way to dispose of an orchard.

BY GERALDINE WARNER



Orchard wood is dropped into the chipper. Photo by G. Warner

October 2002

Like a hungry monster, the machine grinds its way through more than an acre's worth of uprooted old Red Delicious trees, swallowing some of them whole and regurgitating them as a fine stream of wood chips.

Within an hour, the huge woodpile is gone and the chips are hauled by truck to a sawmill cogeneration plant where they'll be used to produce electricity and steam. All that's left are the bits of metal irrigation pipe that the machine screens out.

The scene is a former ten-acre apple orchard in East Wenatchee, Washington, that was repossessed from its owner by the bank. Marlane Gurnard, field horticulturist with the Chelan and Douglas Counties Pest Board, said the orchard had been harboring pests, and the trees were removed in the summer of 2001.

Disposal of orchard trees can be a problem. Trees can be burned, but there's concern about air pollution, and burning is not allowed during the summer or when inversions would prevent the smoke from dispersing.

Efficient

Another, but more expensive method, is to chip the trees. That's where people in the renewable energy business like Doug Roberts, who is with Grant Teton Enterprises, Spokane, come in.

Roberts said there are about five cogeneration plants in the Pacific Northwest that use wood chips. Cogeneration is considered an efficient way to produce both electricity and useful heat from one fuel source, and to reduce air emissions. An acre of orchard produces about 20 tons of chips.

Chips from the East Wenatchee orchard were destined for Colville Indian Power and Veneer in Omak, where they are used to produce steam and electricity. The plant uses steam to make logs easier to process, Roberts said. Over the past few years, there's been greater demand for chips because of the closure of many sawmills that used to be sources.

Roberts, who has just invested close to \$500,000 in a new grinding machine, also grinds up slash piles for the U.S. Forest Service, but says cogeneration plants prefer orchard chips because the wood has a higher BTU value. At the plant, the wood is burned in a controlled environment, and the emissions go through a scrubber to remove pollutants.

In general, the plants pay enough to cover the cost of the hauling and something towards the grinding, which Roberts said is an expensive process. Prices for chips fluctuate, tending to decline in the summer when fewer supplies are needed.

Funding

Roberts has been grinding up orchard trees year round, and did 2,000 acres last year. Some were orchards that would be replanted.

"I went through all winter long last year," he said. "I didn't stop. One of my biggest months was in November." He expects to chip as many acres this year.

The orchard owner has to pay for tree removal and grinding, and for growers who are in financial difficulties, that can be a problem.

Dan McCarthy, fieldman for the Okanogan County Pest and Disease Board, received state funding last year to subsidize removal and chipping by \$150 per acre. The aim was to encourage Okanogan County orchardists to take the more expensive option of chipping trees, rather than burning them. About 350 acres were chipped last year under his program.

Last year, the Chelan County Public Utility District (PUD) subsidized 350 acres of orchard removal and chipping in that county as mitigation for emissions from diesel generators that it used temporarily during a power shortage. That program has ended.

Gurnard said the Washington State Department of Agriculture has funds to help pest boards remove orchards that are creating pest problems, but property owners have to repay the money. She is hoping to receive funding from the Washington State Department of Ecology for tree removal and chipping in both Chelan and Douglas Counties.

Okanogan Conservation District Resource Quarterly

VOLUME 6, ISSUE 3

FALL 2002

Orchard Chipping Cost Share

By Laura Clark

The Orchard Chipping grant is funded by the Environmental Protection Agency through the Department of Ecology. This grant was begun in order to help apple growers dispose of torn out blocks and improve the air quality issues created by burning downed-orchards.

When orchards are pushed over, they must be removed or they can still attract pests. These pests can then infest adjacent orchards.

The current grant was for a total of \$50,000 in cost share money. Landowners are given cost share of \$150 per acre to chip these trees. The cost of having an acre chipped is approximately \$250 to \$350 per acre. This left a cost of \$100 to \$200 per acre to the landowner. The cost to burn an acre is \$250.

Some chips were then removed from the site and taken to various companies that used them as fuel for their generator. These companies would then pay for the chips and further offset



the costs of chipping for the landowner. Some chips were put out as mulch in the landowner's remaining orchards or to fill in the ruts created by center pivots. This worked well, but they found that as mulch it was actually too much material to work into the ground. In the future, fewer chips would be used as mulch in the orchards. The remain-

ing orchards used the chips for feed lot bedding. The feed lot bedding was a great success as it reduced the mud problems and stabilized the ground for the livestock and for runoff issues.

A total of 27 landowners took advantage of the orchard chipping cost share. A total of 333 acres were chipped in Okanogan County during 2001 and 2002.

Additional grant funding is currently being pursued. However, this next grant would cover a three county area; Okanogan, Chelan and Douglas Counties. If additional funds become available, we will let you know.

JAN 8 2003

Allen's P. C. B. Est. 1888

Growers can tap grant for tree removal

By Susie Ives
Chronicle staff

In an effort to improve air quality, federal money is available to help growers who have pulled out their orchards.

The state Department of Ecology recently awarded Okanogan, Chelan and Douglas counties \$70,000 in federal money for tree removal by means of tree chipping.

Because there is a limited amount of money, Okanogan County Horticultural Pest and Disease Control Board manag-

er Dan McCarthy encourages growers to sign up for grants as soon as possible.

The DOE will pay growers \$150 per acre for tree removal. McCarthy said tree chipping generally starts at about \$350 per acre. The grower will be responsible for hiring a contractor, he said.

According to McCarthy, the DOE is making the program available as an alternative to burning trees in an effort to improve air quality throughout the region.

A maximum of 50 acres

worth of assistance is available per grower. McCarthy said he could provide orchardists with a list of tree chipping contractors.

Funding for the program will be available within a week or so, as soon as the Okanogan County commissioners and DOE officials sign the grant, said McCarthy. The funding cycle will run until June 30, he said.

Interested growers in Okanogan County may contact McCarthy at 322-1286. Orchardists in Chelan and Douglas counties can call Marlane Guernard, pest control, 677-7766.

GOOD FRUIT
GROWER

Counties receive more funding for chipping orchards

April 01, 2003

The money gives growers an incentive to chip rather than burn trees.

Five years ago, much of the apple acreage in Okanogan County was involved in areawide codling moth control programs, and a codling moth was a rare find--a curiosity, even.

But difficult times economically since then have led to most of the areawide projects breaking down, Dan McCarthy, Okanogan County Pest and Disease Board fieldman, said during a recent symposium on codling moth.

In the mid-1990s, there were almost 30,000 acres of orchard in Okanogan County. Since then, between 6,000 and 7,000 acres have been removed, and about 4,000 of those acres have not been replanted.

McCarthy said the pest board has been aggressive in dealing with abandoned orchards, and obtained grants to help with the cost of orchard removal and chipping.

Last year, the Washington State Department of Ecology made \$50,000 available to Okanogan County, which provided incentives for 27 growers to remove and chip 333 acres of orchard rather than burn the trees.

This year, the department made another \$70,000 available for Chelan, Okanogan, and Douglas Counties. Growers can receive \$150 per acre towards the cost of removal and chipping, up to a maximum of 50 acres. Those who have had orchards chipped since the first grant expired are grandfathered in to receive funds from the new grant. By early March, 13 Okanogan growers with 120 acres had signed up for the new program.

The advantage of chipping is orchardists could get the orchard removed and cleaned up in time to plant this spring without needing to wait for burn permits, he said. It's also an opportunity for growers to remove orchards in areas where burning is not allowed.

The cost of removing and chipping an orchard varies, McCarthy said. Last season, it cost about \$350 per acre, but it is more expensive now because the value of the chips, which offsets the chipping process, is lower.

"We're not finding the value in the chips, which is making the whole process more expensive," he said.

The Colville Indian Power and Veneer plant at Omak, Washington, is the only place locally that uses chips, but it is receiving large supplies of chips from Canadian sawmills. The chips are waste, and the sawmills are shipping them for the cost of haulage.

McCarthy said he talked to a person who has a chipper and is using chips for mulching and making compost, which is working out well. However, even an acre of orchard produces a large amount of chips, and transportation is expensive.

"I think we could find some uses for the chips, but it's the haul that kills you," McCarthy said. "It's very expensive to haul that volume."

Okanogan Conservation District Resource Quarterly

VOLUME 7, ISSUE 4

FALL 2003

Orchard Chipping Grant Extended

By Laura Clark

The Orchard Chipping grant closed earlier this year with remaining funds. With the agreement of the Environmental Protection Agency and the Department of Ecology, this grant has now been extended to June 30, 2004.

This grant allows Okanogan, Chelan and Douglas County orchardists financial assistance to pull out orchards and chip them up rather than burning them. The landowner receives \$150 per acre in cost share funds to help offset the cost of downing and chipping the trees.

There is approximately \$45,000 cost share funds remaining in the grant to distribute by the June 30, 2004 deadline. If you are interested in having this work done or in further information, please contact Dan McCarthy at the Okanogan County Pest Control Board at (509) 322-1286.



Anyone can learn to thrill to everything in the world; to the miracle of a leaf, to the amazing controlled future that resides in a seed, to the wonderful potential for all manner of things in children, to the colors and shapes and patterns in the landscape and the town, to the human ingenuity of a fine machine or the delicate sensitivity of a poem, to the way our marvelous hands pick up a pen and write, to all the thousands upon thousands of delightful wonders that surround us constantly on every



Okanogan Conservation District Resource Quarterly

VOLUME 7, ISSUE 1

WINTER 2003

Additional Orchard Chipping Funding Available

By Laura Clark

There are additional orchard chipping cost-share funds available. The new funding is \$65,000 for the tri-county area; Okanogan, Chelan and Douglas Counties.

The Orchard Chipping grant is funded by the Environmental Protection Agency through the Department of Ecology. This grant was begun in order to help apple growers dispose of torn out blocks and improve the air quality issues created by burning downed-orchards.

When orchards are pushed over, they must be removed or they can still attract pests. These pests can then infest adjacent orchards.

Landowners are given cost share of \$150 per acre to chip these trees. The cost of having an orchard chipped is approximately \$350 per



acre. This leaves a cost of approximately \$200 per acre to the landowner. The cost to burn an acre is \$250.

In some cases the chips can be sold to additionally offset

the cost of chipping. Some other uses for these chips have been; to place them on animal feed lots to add stability, to place them around center pivots to help with erosion issues or to use them as mulch in orchards. Additional creative use ideas are always welcome.

If you are interested in this program, please contact Dan McCarthy at the Okanogan County Pest Control Board at (509) 322-1286.

Grant available for area growers

SUBMITTED BY DAN MCCARTHY

The Washington Department of Ecology (DOE) is offering a cost share grant to growers in Okanogan, Chelan and Douglas Counties for the disposal of annual pruning brush by non-burning methods. The cost share grant is an incentive to growers to mow or flail their orchard pruning waste, instead of burning. Reducing the acreage of pruning brush that is burnt will help to improve air quality in North Central Washington. The DOE has made \$27,800 available to growers in Okanogan, Chelan and Douglas Counties for this project.

The grant will cost share \$15 per

acre to growers who mow or flail orchard pruning brush without burning. A maximum of 25 acres per grower will be cost shared. Trees must be eight or more years old. The cost share will be on a first come first serve basis after pruning and mowing has been completed. The grant will be offered until June 30, 2006. The cost share will be administered and documentation performed by County Pest Control Boards. For more information contact your local County Pest Control Board: in Okanogan County, Dan McCarthy 509-322-1286. In Chelan and Douglas Counties, Marlane Gurnard 509-667-6677.

Oroville, WA
(Okanogan Co.)
Okanogan Valley
Gazette-Tribune
(Cir. W. 3,200)

NOV - 3 2005

Allen's P.C.B. Est 1888

Cost share offered for brush disposal

OLYMPIA — The state Department of Ecology is offering a cost share grant to growers in Okanogan, Chelan and Douglas counties for the disposal of annual pruning brush by non-burning methods.

The grant is an incentive to growers to mow or flail their orchard pruning waste, according to an announcement from the DOE.

Reducing the acreage of pruning brush that is burnt will help to improve air quality in north central Washington, according to the announcement. The DOE has made \$27,800 available to growers in Okanogan, Chelan and Douglas counties for the project.

The grant will provide cost share money of \$15 per acre to

growers who mow or flail orchard pruning brush without burning. A maximum of 25 acres per grower is offered; trees must be eight or more years old.

Cost share money will be available on a first come first served basis after pruning and mowing has been completed, according to the department. The grant will be offered until June 30, 2006.

County pest control boards are responsible for administering and documenting the program.

More information is available from Dan McCarthy, Okanogan County pest control agent, 322-1286, or Marlane Gurnard, Chelan and Douglas counties' pest control agent, 667-6677.

Omak, WA
(Okanogan Co.)
The Omak-
Okanogan County
Chronicle
(Cir. W. 6,093)

NOV 16 2005

Allen's P.C.B. Est 1888



Grants available for mowing prunings

March 1, 2006

Cost-share grants are available to growers in north central Washington State for disposing of their annual pruning by means other than burning.

The Washington State Department of Ecology has \$27,800 available to share among growers in Okanogan, Chelan, and Douglas Counties. The money was originally intended for a program to encourage growers to chip removed orchards, rather than burn them, but Dan McCarthy, fieldman for the Okanogan County Pest and Disease Board, said chipping did not prove economically feasible, and the firms that were doing it are no longer in the business.

Under the new program, growers can receive up to \$15 per acre for mowing or flailing their prunings, rather than burning them, up to a maximum of 25 acres per grower. The funds will be distributed on a first-come-first-served basis after pruning and mowing has been completed. The grant will be offered until June 30 this year. The trees must be at least eight years old.

McCarthy acknowledged it's not a large amount. "But it will buy a new set of mower blades or put diesel in the tractor," he said. "It's not a big thing, but every little thing helps."

The program is administered by the county pest boards. McCarthy said growers need to fill out a one-page form, which should take about five minutes.

Okanogan County growers should contact McCarthy at (509) 322-1286. In Chelan and Douglas Counties, contact Marlane Gurnard at (509) 667-6677.