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World Class. Face to Face.

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Plants Chatter to Defend Themselves Against Pests and HIPPOs Can Improve the Conversation

Dr David G. James, WSU Prosser

Plants talk. Plants listen. Elegant scientific studies in Europe, Japan and the US have demonstrated that plants emit distress signals when attacked by insects and mites. These signals comprise a complex bouquet of volatile chemicals which forms the 'language' plants use to warn neighboring plants that they may too be attacked and should perhaps begin defending themselves. Predatory and parasitic insects and mites also understand plant language: it cues them to the availability of food and hosts. Plants know this and the chemical dialogue plants produce when attacked benefits the plants as well as the 'bodyguards' they recruit for protection.

Scientists have eavesdropped on plant-plant and plant-insect conversations in the laboratory for the last two decades. While by no means fluent, we do know many of the key words (volatile chemicals) used in



Mmethyl salicylate dispensers on vineyard posts.
these conversations. While different plant species appear to have their own unique languages (so grapevine talk is different than bean talk), some words appear to be fairly common among plant languages. These presumably express the same meaning whether emitted by grapes or beans. For example, different kinds of plants attacked by spider mites usually emit methyl salicylate (MeSA) while plants attacked by caterpillars often emit methyl jasmonate (MeJA).

Perfected over millennia, this natural defense system no doubt comprises a very important part of the armory used by plants to protect themselves. But can we improve upon this natural defense in managing plant pests by improving the conversation plants conduct with each other and with beneficial insects by getting the message across quicker and louder?

To answer this question, we began simple field experiments at Washington State University in 2002 to determine whether synthetic forms of 'words' plants use to signal their distress

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Sustaining the Pacific Northwest

Food, Farm, & Natural Resource Systems

This quarterly newsletter provides a discussion forum for people working towards community-based sustainable food, farm, and natural resource systems using interdisciplinary oriented research and practitioner knowledge.

This is a joint newsletter of the WSU [Center for Sustaining Agriculture & Natural Resources](#), the [WSU Small Farms Team](#), the [WSU Small Farms Program](#) and the [Water Quality Management Team](#).



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when attacked, could also be used as attractants for beneficial insects. Results indicate synthetic MeSA serves as a potent attractant for numerous predatory insects, including lacewings, ladybeetles, predatory bugs, and hoverflies. These insects play important roles in controlling pests in crops and gardens. Expanded field studies in 2003 tested the effect of controlled-release dispensers of MeSA in recruiting and retaining predators in agricultural crops. Baited crops attracted and retained all of the above insects in greater numbers than in unbaited crops. Baited crops also attracted other beneficial insects, such as parasitic wasps and predatory flies. The wide array of beneficial insects attracted to MeSA-baited hops and grapes suggested more than direct attraction was occurring since these insects had not been attracted to MeSA in the simple trapping experiment conducted the previous season. Based on what is known about MeSA as a widely occurring plant distress signal, we assume that the MeSA dispensed in the crops communicated to nearby plants that pest attack was imminent, thus starting a chemical dialogue with bodyguards



Methyl salicylate bait traps Lacewings.

In 2004, the project studied the potential signaling effect of MeSA, MeJA, and hexenyl acetate (HA) (another plant distress signal) on grapevines. The treated blocks (area with chemicals deployed via controlled-release dispensers) recruited significantly greater numbers of two species of parasitic wasps than did the control blocks. Since these wasps are not attracted to MeSA, MeJA or HA in baited trap experiments, it seems likely that grapevines emitted their own bouquet of wasp-attracting chemicals when sig-

naled to do so by the deployed compounds.

These field experiments provide strong evidence that we can use synthetic 'words' to improve the conversations plants have with each other and with beneficial insects. We call these 'words', Herbivore-Induced Plant Protection Odors (HIPPO). Utilizing HIPPOs to synthetically enhance communication between plants and natural enemies of pests to provide an earlier, more sustained and more reliable response by predators and parasitoids, could provide an important tool for improving pest control in many different crops throughout the world. While more research will be required, the potential is now clear.

Community Youth Garden Projects - Vancouver, WA

[Caitlin Blethen](#), WSU Clark County Extension

The Food \$ense and 4-H Youth Development Programs at WSU Clark County Extension (WSU CCE) collaborate to offer two youth gardening projects in the schools and in the community.

Hazel Dell Elementary School and Community Garden

The idea to build a school garden program at one of Vancouver's low-income schools sprouted last winter as a way to enhance school curriculum, improve nutrition, teach environmental stewardship, and offer summer enrichment opportunities to children attending the nearby Boys and Girls club. This idea is becoming a reality due to the dedicated efforts from WSU CCE's Food \$ense and 4-H Youth Development programs, the Clark County Solid Waste/Recycling Program (CCSWR), Hazel Dell Elementary School, the Vancouver School District, the Boy and Girls Club of Southwest Washington, and the Clark County Master Gardener Foundation.

Located on the Hazel Dell Elementary school grounds, the garden site comprises an old maintenance shop and adjacent weedy area. In September,

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School garden site - October 2004.



School garden site - January 2005.

the Vancouver School District tested the soils to confirm they were not contaminated. Clark County Solid Waste then hired a landscape company to level the site, install curbing and gravel to make the garden wheelchair accessible, and build 'raised-bed' gardening plots. In March, the group will install a 20' x 48' foot greenhouse for year-round growing, a tool shed, and compost bins with funding from Clark County Solid Waste and the Vancouver School District Foundation. The Master Gardener Foundation, community volunteers, and local businesses will provide seeds, tools, and necessary gardening supplies, while WSU CCE's 4-H Youth Development Program funds a part-time coordinator.

Beginning in March, students will grow, tend, and harvest a salad crop shared by the entire school community. Planning and preparing for a Fall Soup Festival will also take place. The WSU CCE's Food \$ense Nutrition Educator will use the garden to teach

garden-enhanced nutrition classes while the CCSWR will help students design and build a natural butterfly/hummingbird area. These activities will engage students physically while they learn about nutrition, the environment, science, and practice life skills such as planning, goal-setting, team building, cooperation, and problem-solving. During the summer months the garden and its bounty will be tended and utilized by children from the nearby Boys and Girls Club, parents, and community volunteers.

The 4-H Restorative Community Service Food Bank Garden

Motivated by a shared commitment to positive youth development, WSU CCE's 4-H Youth Development Program, the Battle Ground School District, and the Clark County Juvenile Court's Restorative Community Service Program formed a partnership six years ago to provide eligible youthful offenders with a unique way to meet court requirements for community service by growing fresh vegetables donated to a local food bank to help reduce hunger in their community.

The restorative philosophy believes when youthful offenders are integrated into their community, rather than ostracized for their wrongdoing, they are less likely to re-offend. A community garden setting provides a venue for these young people to work together and make a tangible and meaningful



Youth working in the 4-H RCS garden.

contribution to the community they harmed, while making positive connections with adult members of the community.



The garden harvest in route to the food bank.

From mid-March through October, community members, Master Gardeners, mentors from the Juvenile Court, an Americorps volunteer with the Battle Ground School District, and the 4-H Garden Program Coordinator, work weekly in the garden with juvenile offenders to grow fresh produce for the nearby food bank. Over the course of 32 weeks in 2004, 34 adult volunteers and 90 youth grew, tended, and donated 4,400 pounds of fresh produce to a local food bank which serves 400 families per month.



Planting seeds in the garden.

In addition to fostering accountability, the garden setting also provides a place to be physically active in a safe and fun environment. Each week, the group experiences and learns something new about natural systems, where food comes from, how it is grown and harvested, and how to interact with others to get tasks done.

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Working in the garden youth practice and apply critical life skills, including teamwork, communication, self-motivation, and problem solving.

Inspired by the sense of community they gained from working with others and feeling the significance of helping to grow food for needy families in the community, six youths continued to volunteer after completing their mandatory service. Several participants brought friends to work in the garden. When asked about the experiences, youth participants commented:

“The whole day was great. I really liked working with the group and making new friends.”

“We worked great as a team to get things done!”

“We often get treated like criminals. People assume we are bad kids. But you always made us feel welcome, and were kind to us. Thank you for treating us with such respect, and like we’re your equals.”

For more information about either of these projects, contact Caitlin Blethen at (360) 397-6060 Ext 7708.



*Editors’ Note: Columbia River High School students conducted the following two research projects in 2004 as part of the **International Baccalaureate Science Program (IBSP)** in Vancouver, Washington in cooperation with Carol Miles, Washington State University Vancouver Research and Extension Unit (WSU VREU). An intensive lab-based program, IBSP promotes and requires independent scientific research projects by students. WSU VREU welcomes and supports high school students interested in conducting agricultural research as part of their high school science curriculum. Four students conducted independent study projects in 2004 at WSU VREU.*

Effects of Seedling Tray Cell Size on Young Lettuce and Broccoli

Ash Byrnes, Columbia River High School IBSP student, [Carol Miles](#) & Kathryn Kolker, WSU Vancouver REU

Seedling trays come in various cell sizes although small-scale farmers and gardeners commonly use 48 cell trays (1 ½ x 2 ¼ x 2 1/8 inches) from which plants are usually transplanted directly into the field. Medium-sized trays of 72 and 98-cells per tray are also used, but their smaller cell size makes them more suitable for smaller crops or earlier transplanting. Commercial nurseries use small-sized trays of 288-cells to maximize the number of seedlings per tray. Some nurseries believe smaller cells result in earlier seedling emergence. Seedlings grown in smaller cells experience root restriction more quickly causing decreased plant growth, nutrient uptake, disease resistance, and ultimately, fruit yield. While root restriction affects some vegetables (e.g. cucumbers) more than others (e.g. tomatoes), it usually diminishes the overall health of most plants. Using smaller celled trays therefore requires earlier transplanting, and sometimes requires two transplantings, the first into larger seedling trays, and the second into the field.

This study evaluates the effect of seedling tray cell size on the growth of

vegetable seedlings. Standard sized seedling trays (53 x 27 cm) were used with four different cell sizes tested: 48, 72, 98, and 288 cells per tray. Lettuce and broccoli were chosen for their different growth rate and rooting characteristics: lettuce seedlings are shallow-rooted and fast-growing while broccoli seedlings are relatively deep-rooted and slow-growing. Pirat lettuce and Rosalind Purple broccoli varieties were seeded August 27, 2004, in organic potting mix, with 24 plants per tray, and 6 replications (Figure 1). Growth was evaluated at 2 weeks and 4 weeks after planting for 10 random plants per treatment for each cell size using the following measurements: plant height, fresh plant biomass, and dry plant biomass.

Results show significant differences in lettuce height and weight due to cell size after only 2 weeks (Table 1). Seedlings grown in the largest cells had larger fresh and dry weights than in the other cells, while seedlings grown in the smallest cells were the smallest. This contrasts with lettuce plants where the mid-sized cells produced the tallest plants. The difference between the different cell sizes was greater after 4 weeks. Lettuce was much larger than the others in height and weight and plants in the smallest cells were significantly smaller than the others.

Broccoli plants showed no significant differences at 2 weeks (Table 1). However, after 4 weeks, broccoli in the larger cells grew significantly taller and

Table 1: Broccoli & Lettuce Seedling Growth by Tray Size (Aug.-Sept. 2004)

	# cells per tray	Plant height (cm)		Fresh weight (g)		Dry weight (g)	
		2 weeks	4 weeks	2 weeks	5 weeks	2 weeks	4 weeks
Lettuce	48	2.55 (bc)	5.73 (a)	1.1 (a)	6.51 (a)	0.055 (a)	0.58 (a)
	72	2.89 (ab)	4.98 (ab)	0.64 (ab)	3.41 (ab)	0.033 (ab)	0.31 (b)
	98	3.15 (a)	4.96 (b)	0.73 (ab)	4.23 (ab)	0.04 (ab)	0.24 (b)
	288	2.14 (c)	4.17 (c)	0.44 (b)	2.21 (b)	0.025 (b)	0.21 (b)
	P Value	0.001	0.0034	0.0499	0.0979	0.0917	0
Broccoli	48	5.87 (a)	11.78 (a)	2.51 (a)	9.11 (a)	0.18 (a)	1.15 (a)
	72	5.17 (a)	10.08 (a)	1.93 (ab)	7.93 (ab)	0.14 (a)	0.8 (b)
	98	5.24 (a)	7.8 (b)	1.84 (ab)	3.61 (b)	0.14 (a)	0.49 (c)
	288	5.61 (a)	7.34 (b)	1.94 (b)	4.31 (b)	0.16 (a)	0.39 (c)
	P Value	0.3592	0.0002	0.1136	0.0594	0.1741	0.0001

Note: The letters a, b, and c denote statistical significance calculated through the Least Significant Difference (LSD) separation of means. Numbers with the same letters show no statistical difference while those numbers with different letters denote statistically significant differences.

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heavier than the others, and the smallest cells produced the smallest plants.



Four seedling tray treatments for lettuce and broccoli.

Although based on only one study, these preliminary results indicate fast-growing seedlings can be affected by cell size as early as 2 weeks after seeding, and slower-growing seedlings can be affected as early as 4 weeks. Using small-sized (288) or medium sized (72 & 98) cells will likely require transplanting into larger cells prior to transplanting into the field. The costs to farmers in extra labor for additional transplanting, and risk of decreased yields due to root restriction and/or damage, suggest that the standard 48-cell trays are best-suited for their purposes. The 288-cell trays are best suited to large-scale commercial nurseries.

Sugar Level Contents of Different Icebox Watermelon Varieties and Their Effect on Consumer Preferences

Soo Jin Yim, Columbia River High School IBSP student, [Carol Miles](#) & Gail Becker, WSU Vancouver REU

Until the introduction of icebox watermelons (fruit weight 6-15 pounds), raising watermelons in western Washington proved difficult. Several years of icebox watermelon variety trials at Washington State University Vancouver Research and Extension Unit (WSU VREU) demonstrated that several icebox varieties can successfully grow in the region. It was unclear, however, whether these melons could attain their full level of sweetness in western Washington. This study ex-

plores the sweetness (sugar concentration) levels in six icebox watermelon varieties and investigates which factors (flavor, sweetness, texture, juiciness, and color) most influenced consumer preferences.

A hand-held Brix refractometer was used to measure sugar concentration levels in the icebox watermelon varieties. Consumer surveys and taste-tests were used to determine how consumers rated the quality of these varieties and what factors most influenced their purchasing decision. Productivity field trials of 44 organically grown icebox watermelon varieties were conducted at WSU VREU in 2004 using a randomized complete block with three replications. Researchers harvested watermelons twice weekly as they became ripe, from mid-August through September. We selected six varieties for the sweetness and preference study: Extazy, Tiger Baby, Fenway, Mini Seedless, Little Boy, and Petite Perfection.

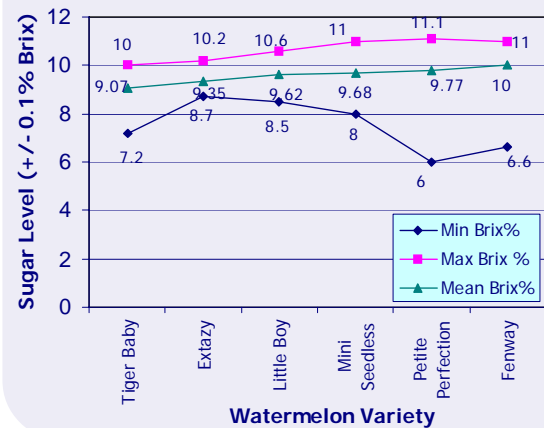
Procedures. The Brix refractometer measured the soluble solids content (soluble solids is an indirect measure of sugars) of each variety. At each harvest, one watermelon of each variety from each plot was cut longitudinally in half, and five samples (one from the center and one from each quarter) were collected with a melon-ball kitchen tool. Samples were mashed on a plate and their juices combined. Approximately 0.5ml of juice was drawn with a pipette, placed on the refractometer lens, and the soluble solids then measured to the nearest 0.1 % (Figure 1). All utensils, the pipette, and refractometer lens were thoroughly rinsed with clean tap water between each sample.

Taste test participants evaluated the flavor, sweetness, texture, color, and juiciness of the six watermelons and indicated their willingness to purchase each variety. Three varieties were evaluated at a time so that participants had only a limited number of samples to compare. Approximately 30 high school students participated in the taste test.

Thirty fruit balls from each variety were placed in separate, labeled containers. Participants rated the melon's qualities on a scale of 1 to 5, where 1 was "poor" and 5 was "excellent". Salty crackers were available to be eaten between tasting the different varieties, in order to minimize any overlap in evaluating the flavor of the melons.

Results and Discussion. The results showed only slight differences in the mean and maximum Brix values of the six varieties (Figure 1). Differences in minimum Brix values were relatively large. Although all watermelons were harvested when they appeared ripe, the ripeness of some va-

Figure 1: Watermelon Sugar Concentrations (Brix readings - 2004)



rieties, such as Fenway and Petite Perfection, was more difficult to ascertain based on their appearance, hence minimum Brix readings for these varieties were quite low. All melons in this study were considered sweet or very sweet (a mean Brix value of 8.5% can be considered sweet and values of 10 to 12% are very sweet).

To better understand the relationship between sweetness and purchasing preference, survey data was divided into two groups: ratings of participants who indicated they would purchase that variety, and ratings of those who indicated they would not. Among participants who said they would purchase a variety, all rated flavor, sweetness, texture and juiciness at 3.5 or higher (Table 1). Those who did not wish to purchase a variety

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rated these factors lower than 3.5. Flavor, sweetness, and texture appeared to be the major qualities that influenced consumer preferences while juiciness and color appeared to be less important. The survey results also showed a strong relationship between flavor and sweetness, in that the participants rated flavor and sweetness closely together.

Conclusions. Icebox watermelon can be successfully grown in western Washington and are generally sweet (8.5-10 % Brix) or very sweet (>10% Brix). Sweetness, flavor, and texture are important factors influencing consumer preference. Knowing the expected level of sweetness of each variety and understanding consumer preferences will help farmers better choose and market most desired varieties.

Table 1: Consumer Ratings for Icebox Watermelons**

Variety (mean Brix %)	% Will Buy (n)	Flavor	Sweetness	Texture	Juiciness	Color	Overall Quality
Tiger Baby (9.1%)	74% (19)	3.71	3.57	3.86	4.20	3.14	3.86
Extazy (9.4%)	47% (15)	4.29	4.00	4.43	4.29	4.57	4.43
Little Boy (9.6%)	47% (19)	4.11	4.00	3.56	4.22	1.22	3.78
Mini Seedless (9.7%)	50% (16)	3.75	3.50	3.75	3.75	3.25	3.75
Petite Perfection (9.8%)	42% (19)	4.13	4.38	4.00	4.38	3.38	4.06
Fenway (10%)	25% (16)	4.00	4.00	3.60	4.60	2.60	3.80
Average		4.00	3.91	3.87	4.24	3.03	3.95
Average for "will not buy" responses		2.78	2.86	2.88	3.24	2.60	2.79

** 1 is poor and 5 is excellent.

Tomato Yield and Late Blight Study

Dr. Carol Miles, Kathryn Kolker, Gail Becker, Martin Nicholson, Washington State University, Vancouver Research and Extension Unit, **Tom Koskinen,** WSU Master Gardener, Washington State University, [Clark County Extension](#)

Introduction. Late blight disease, a primary concern for organic tomato growers in western Washington, can be identified by dark lesions accompanied by white mold on the leaves, stem, and fruit. It is caused by *Phytophthora infestans*, a organism that thrives in moist conditions and infects tomatoes, potatoes and other members of the *Solanaceae* family. The disease causes decreased fruit production, overall decline in plant health, and eventual plant death. In 2004, a group of WSU Clark County Extension (WSUCCE) Master Gardeners conducted a research trial in collaboration with Dr. Carol Miles at Washington State University Vancouver Research and Extension Unit (WSU VREU). The study evaluates the tolerance of 35 tomato varieties and 10 breeding lines to late blight. We measured yield, time to first harvest, and late blight tolerance. Tom Koskinen, WSUCCE Master Gardener, oversaw harvest and data collection.

Methods. Tomatoes were seeded in the greenhouse on March 8, 2004, and

transplanted into the field on May 24 into a randomized complete block with three replications. One variety, Green Zebra, was seeded March 26 due to late seed arrival. The field was certified organic and managed accordingly. Rows were mulched with black plastic and drip irrigated. A clover cover crop was sown between the rows, and was mowed as needed from July through September. Tomato harvest occurred weekly from August 17 through September 21. Fruit were hand harvested and then measured for the total number harvested, total weight, average weight, and average diameter. Plots were evaluated for late blight at the end of the harvest season on September 27. At that time, all plants in the field had been exposed to a natural infestation of late blight, with extreme symptoms on many varieties (plants in some plots were dead or nearly dead). We evaluated late blight tolerance by estimating the percentage of stems and leaves that remained green in each plot.

Results. Results showed significant differences in overall yields among different varieties (Table 1). Jet Star, Mountain Delight, and Beefmaster produced the highest yields (kg/plant) among slicer varieties, while Caro Rich (9.04 oz each), Brandywine (8.16 oz), and Beefmaster (6.62 oz) produced the heaviest fruit. Beefmaster (3.57 in), Brandywine (2.88 in), Celebrity (2.85 in), and Green Zebra (2.77 in) produced the largest diameter fruit. Among cherry varieties, Gold Nugget produced the highest yields, while Red

Cherry (0.68 oz, 1.29 in), Gold Nugget (0.41 oz, 1.07 in), and Sweet Million Cherry (0.38 oz, 1.09 in) produced the heaviest and largest diameter fruit. Juliet (5.24 lb/plant) and San Marzano (4.67 lb/plant) produced the largest yields within the plum varieties, while Quimbaya produced the largest fruit (2.61 oz, 2.03 in).

All of the breeding lines produced below-average yields, including the highest yielding entries, LB 401 N (4.55 lbs/plant) and NC 03220 N. (4.22 lbs/plant). The overall mean yield was 4.59 lbs/plant while the mean yield for breeding lines was 2.19 lbs/plant, an unsurprising trend given most of the breeding lines were developed in tropical Asia and were unlikely to be well adapted to our temperate northern climate.

Varieties were considered late blight tolerant if their leaves and stems remained at least 60% green at the end of the growing season. Sixty percent was chosen since plants in this study below this level appeared greatly affected by the disease whereas plants above this level appeared to be only somewhat affected. Plants at the 80% or greater level appeared only slightly affected. Results indicate cherry tomato varieties possessed the highest level of late blight tolerance, especially Red Currant (97%), Sungold (82%) and Peace Vine Cherry (83%) (Table 1). However, Red Currant produced the smallest yields of all cherry tomato varieties (1.55 lb/plant) and among

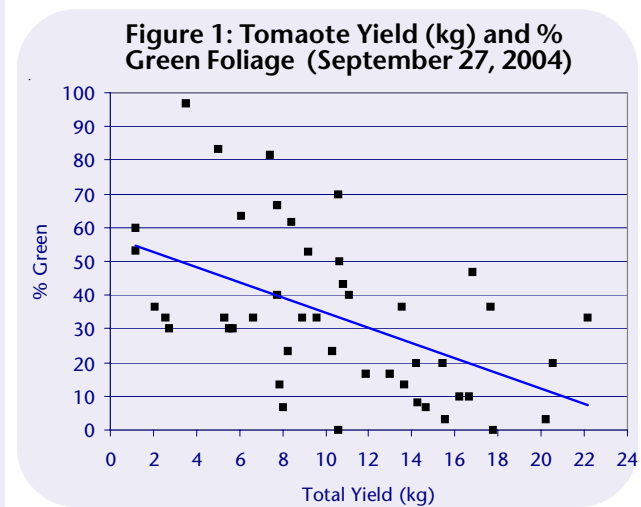
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Table 1: Trial Tomato Growth Characteristics

	Mean fruit per plant	Mean total yield (lb) per plant	Average fruit weight (oz)	Mean fruit diameter (in)	Mean % green on 9/27
Slicer Varieties					
Beefmaster	19	9.56	8.22	3.57	3
Bradley Pink	18	4.70	4.21	2.34	50
Brandywine	7	4.06	9.42	2.88	53
Caro Rich	13	3.46	4.35	2.39	13
Celebrity	26	7.15	4.42	2.85	10
Delicious	22	7.35	5.41	2.71	10
Early Cascade	40	5.98	2.37	1.97	37
Early Girl	28	5.72	3.27	2.23	17
Fantastic	29	7.43	4.03	2.23	47
Green Zebra	25	3.42	2.20	2.77	40
High Carotene	60	4.89	1.30	1.80	40
Homestead	22	5.00	3.66	2.24	0
Jet Star	34	9.78	4.54	2.64	33
Legend	30	6.81	3.60	2.20	20
Lemon Boy	26	3.62	2.24	1.99	23
Manitoba	51	7.84	2.45	1.99	0
Mountain Delight	31	9.07	4.71	2.43	20
Mountain Fresh	21	6.02	4.61	2.18	13
Mountain Pride	32	7.78	3.85	1.81	37
Mountain Spring	21	6.25	4.85	2.44	20
Northern Delight	85	6.45	1.21	1.59	7
Seattle Best	38	6.29	2.66	2.17	8
Stupice	42	4.78	1.82	1.71	43
Yellow Perfection	49	3.92	1.27	1.66	33
Average	31.95	6.10	3.05	2.28	24.08
P value	0.0000	0.0000	0.0000	0.0000	0.0354
Cherry Varieties					
Gold Nugget	265	6.85	0.41	1.07	3
Moby Grape N	135	2.44	0.29	0.94	30
Peace Vine Cherry	153	2.21	0.23	0.89	83
Red Cherry	63	2.69	0.68	1.29	63
Red Currant	327	1.55	0.08	0.56	97
Sungold	156	3.26	0.33	1.01	82
Sweet Million Cherry	106	2.50	0.38	1.09	30
Average	172.27	3.07	0.29	0.98	55.48
P value	0.0038	0.0000	0.0000	0.0000	0.0010
Plum Varieties					
Black Plum Paste	61	3.65	0.96	1.27	67
Juliet	97	5.24	0.87	1.13	17
Quimbaya	23	3.70	2.61	2.03	62
San Marzano	51	4.67	1.45	1.59	70
Average	56.89	4.25	1.20	1.51	53.75
P value	0.0011	0.1445	0.0000	0.0001	0.0432
Breeding Lines					
LB 401 N	109	4.55	1.58	4.01	23
LB 402 N	179	2.93	0.80	2.04	33
LB 403 N	255	3.53	0.85	2.16	7
LBR 19-2 AVRDC	2	0.88	n/a	n/a	60
LBR 19-3 AVRDC	6	1.14	2.27	5.76	37
LBR 44-2 AVRDC	3	1.22	2.98	7.57	33
LBR 50-2 AVRDC	9	1.81	n/a	n/a	30
LBR 80-1 AVRDC	13	2.34	2.07	5.25	33
LBR 81-1 AVRDC	3	0.51	1.92	4.87	53
NC 03220 N	8	4.22	3.17	8.05	33
Average	58.07	2.19	1.95	4.96	34.33
P value	0.0000	0.0003	0.0034	0.0000	0.3391
Overall Average	61.80	4.59	1.19	1.94	33.88
Overall P Value	0.0000	0.0000	0.0000	0.0000	0.0000

the smallest yields overall, most likely due to its extremely small fruit size (0.08 oz, 0.56 in). Three of the four plum tomato varieties grown in this study also showed late blight tolerance: San Marzano (70%), Black Plum Paste (67%), and Quimbaya (62%). Among the standard slicer tomatoes, Brandywine (53%) and Bradley Pink (50%) showed the highest levels of tolerance, but neither showed tolerance above the 60% level. All of the varieties showing late blight tolerance produced lower than average yields, except for the plum tomato variety San Marzano. Among the breeding lines, only LBR 19-2 AVRDC (60%) showed late blight tolerance (albeit very low), but it also produced low yields due to its late maturity.

Discussion and Conclusions. While we expected a positive correlation between late blight tolerance (% green) and total yield, we found a negative correlation (Figure 1). Varieties producing larger yields tended to be less late blight tolerant than varieties that produced smaller yields. This study indicates late blight may not have significantly affected the relative overall yield of different varieties. This was likely due to the late onset of the disease in 2004.



We conclude that adequate assessments of late blight tolerance must include three disease measurements during the growing season instead of just one. Therefore, future studies should include at least three evaluations of late blight in the field. Additionally, it would be important to include a known susceptible control variety to compare all other varieties against throughout the season. This becomes especially important during a years with low incidences of late blight disease when disease symptoms may not become evident until very late in the season. In this situation, varieties may appear tolerant when in fact the disease pressure is simply low.



The New Food Entrepreneur: Conference Draws Enthusiastic Crowd

[Rich Hines](#), WSU CSANR



Keynote speaker Joel Salatin, nationally known author and organic farmer, offered insights on ways that farmers and ranchers can profit by helping to restore direct connections with consumers. He encourages producers to “emancipate” themselves from commodity markets. Joel Salatin’s latest book is *Holy Cows and Hog Heaven: The Food Buyer’s Guide to Farm-Friendly Food.*”

In early April, dozens of successful food and farm entrepreneurs came to Auburn, Washington to share their insights at a conference organized by WSU’s Small Farms Team. Nearly 300 farmers and agricultural professionals attended the two-day event at Green River Community College, some from as far away as Ohio and California.

Sessions featured panel discussions with farmers and ranchers, state regulators, food processors, and university specialists. Together they addressed infrastructural, processing and regulatory barriers faced by new food businesses. Topics included meat and poultry processing, specialty milk and cheese sales, wine- and cider-making, and value-

added fruit and vegetable products. Special sessions addressed food safety, business financing, risk management, processing technologies, and product labeling and marketing. The menu for the conference was a showcase of Northwest bounty and included some of the finest wines and cheeses available anywhere in the world.

“I really went out of my way to go” to the conference, said cherry farmer Bill Razey (Naches, WA) who is contemplating a value-added enterprise using dried cherries or a wine. “It was worth it,” Razey said. “It had that magic to it.”

“Farmers love to hear the success stories of other farmers,” said Curtis Beus, WSU Clallam County Extension Director and the conference’s lead organizer. “There was a lot of great energy at this conference, and in our evaluations, we have gotten many requests for more programming on value-added processing.”

Marcy Ostrom, director of WSU’s Small Farms Program, said her research shows strong consumer demand for locally and sustainably grown farm products. “Increasing numbers of consumers ask for Washington-grown meat and dairy products, as well as other value-added farm products,” she said. “But the regulatory environment can be intimidating. Many producers don’t even know where to start, and that’s why I think this conference was such a hit.”

Conference presenter and professional food developer, Dale Nelson, led a session on how to turn ideas for value-added products into a reality. A former General Mills employee, Nelson now operates Food Concepts, a Gold Bar, WA-based company where agricultural producers comprise 25% of their client list. “A lot of people getting into this industry go through the same trials and errors,” Nelson said. “The networking when you do this kind of conference - you can’t put a price on it. The network provides conversation and opportunities for people not to make the same mistake again, to do a real analysis.”

Brett Melone, who directs the Agriculture & Land-Based Training Association (ALBA) in Salinas, California, said he attended The New Food Entrepreneur Conference because an in-depth event on value-added processing is not offered in California. ALBA’s mission is to help farm workers and other low-income people to become independent small farmers. “We are in the process of helping growers explore these questions of whether they would want to develop value-added products and how they would go about it,” Melone said. Conference sessions on incubator kitchens were especially valuable to his decision-making process, Melone said. “I came back feeling less overwhelmed, which is pretty amazing considering all of the information” presented.

Organizers plan to post conference presentations online at www.smallfarms.wsu.edu by the end of May. To stay informed about WSU Small Farms Team events, subscribe to Washington Family Farmer Resources (WFFR) by sending a blank email to wffr-join@lyris.cahnrs.wsu.edu.



Standing beside Northwest value-added products, renowned market researcher Harvey Hartman tells conference participants, “You are the real deal.” In his keynote speech, Hartman said authenticity is a strength when bringing a new product to market, and he encouraged producers to tell their stories because more consumers are looking for a personal connection with farmers and ranchers. Learn more about Hartman’s firm at www.hartmangroup.com.



Annual Farmers' Market Conference

Rich Hines, WSU CSANR

Participants enjoy a roundtable discussion on the conference lawn.

The Magic of Markets. Sponsored by [WSU Small Farms Team](#), WSU Puyallup hosted 70 farmers' market managers and market farmers from across Washington this month at the annual conference of the Washington State Farmers Market Association (WSFMA). Farmers' markets contribute over \$25 million annually to the Washington economy and have sustained annual sales increases of 20 percent. The number of markets in Washington jumped from 54 to 85 in the past ten years, creating new businesses and jobs in both urban and rural com-



munities. Research by Marcy Ostrom, WSU Small Farms Program Director, shows high consumer demand for direct relationships with farmers and 80 percent of Washingtonians would like to increase their purchases of fruits and vegetables directly from farmers, including at farmers' markets.

Participants shared information and ideas for increasing market sales, better promoting markets and market farms, and making the case for community investment. After listening to a keynote speech, "Farmers' Markets as a Driver for a New, Diversified American Food System," by Gus Schumacher, a former undersecretary of agriculture, participants shared how they successfully engage community partners to create permanent market structures, to develop new infrastruc-

ture for value-added processing, and to create public support for agriculture through relationships with schools, non-profit organizations, and media outlets.

Attendees also heard presentations on building social capital through programs such as the Farmers Market Nutrition Programs for Women, Infants, and Children (WIC) and seniors, which provide vouchers to low-income people for purchasing fresh fruits and vegetables from farmers' markets. WSU's Latino Small Farms Adviser, Malaquias Flores from Yakima, Washington, facilitated discussion on engaging immigrant and minority populations to further the growth of farmers' markets and nutrition programs.

Participants also heard Kelli Sanger, Small Farm & Direct Marketing Program Coordinator at the Washington State Department of Agriculture, lead a forum on processing rules and regulations, while Harv Singh, Food and Farm Coordinator for WSU Jefferson County Extension, lead a panel on effective financial planning and record-keeping for market managers. Vance Corum, WSU Direct Marketing Specialist, presented results from Rapid Market Assessments done in Washington, while Rich Hines, CSANR Communications & Development Specialist, presented research findings on consumer and farmer surveys.

Tasting Washington's Bounty. Participants enjoyed Washington-grown and/or -processed food and beverages during the conference, including cheeses, breads, chocolates, wines, coffee, field greens, cider, cookies, winter vegetables, and pastured-raised beef and turkey. WSFMA Director Zach Lyons and the organization's board enlisted over 25 farmers, chefs and food businesses to donate and prepare the mouth-watering meals.

Get Involved. Farmers' markets always need board members and volunteers. To be part of the energy and excitement, contact a market near you or visit www.wafarmersmarkets.com.



Farmer to Farmer Program **Tina Larson**, Winrock International

Winrock International and the Intertribal Agriculture Council will send over 225 U.S. volunteers to five Asian countries between 2003-2008 under the John Oganowski *Farmer To Farmer Program* funded by the United States Agency for International Development (USAID).

Both Native American and non-Native American volunteers will travel to India, Bangladesh, Nepal, Sri Lanka, or Indonesia. Volunteers will work to improve farmer productivity, increase rural development, strengthen agriculture sectors, and enhance administrative, financial, and political dimensions of farm organizations and agricultural enterprises dedicated to reducing rural poverty.

Volunteers are needed with experience in:



- Agribusiness
- Agricultural Sciences
- Bee Keeping
- Enterprise Development
- Farming
- Financial Management
- Food and Meat Processing
- Forestry and Natural Resources Management
- Horticulture
- Information Technology
- Management
- Marketing

Continued on next page

Non-Timber Forest Products
Organic Production and
Certification
Strategic Planning

Volunteers donate their time and knowledge for two-week long assignments. All expenses are paid with a daily per diem for meals. Upon arrival, Winrock staff greet volunteers and provide transportation, interpreting services, and serve as contacts during the assignment. The following assignments currently need volunteers:

Plant Quarantine and Phytosanitary Certification in Vegetable Crops (Nepal)

Rice Seed Production and Processing (Chuadanga, Bangladesh)

Rice Seed Marketing and Market Information System Development (Chuadanga, Bangladesh)

Glucose and Dextrose Processing (Dhaka, Bangladesh)

Poultry Processing and Packaging (Bangladesh)

Practices for UHT Milk and Milk based Products, Processing and Quality Control (Bangladesh)

Setting Up a Tissue and Culture Laboratory and a Green House (Bangladesh)



Take advantage of this opportunity to travel and help other countries in agricultural development - make a difference! If you or someone you know is interested, contact Tina Larson (406-259-3525) at the Intertribal Agriculture Council, 100 North 27th Street, Suite 500, Billings, MT 59101.



Funding

2006 Western SARE RFPs

The Western Sustainable Agriculture Research and Education (Western SARE) program seeks grant proposals that explore and promote sustainable agriculture. This program attempts to encourage farmers and ranchers to use innovative research on sustainable agriculture.

To provide more preparation time, farmers and ranchers now have until December 12th to submit their proposals. Over \$2 million in grants will be disbursed in early 2006 to applicants selected from competitive review. Four categories of grants are available:

Research and Education preproposal due June 5th

Professional Development proposals due November 15th

Farmer/Rancher proposals due December 12th

Professional plus Producer proposals due December 12th

Download calls for proposals at <http://wsare.usu.edu/grants/> or call Western SARE at 435-797-2257 or email wsare@ext.usu.edu.

Announcements

WSU's Center for Sustaining Agriculture & Natural Resources and the Small Farms Program are pleased to introduce our new Project Manager, Kevin Dugan.



Kevin comes to us from Gordon Trucking in Pacific, Washington, where he was customer service representative for the Southern California region. He brings a wealth of experience in resource planning and project administration to WSU.

Kevin will work with Cindy Murray-Armstrong to support finance and administration functions of CSANR,

suchs as the Climate Friendly Farming Project, the USDA special grant for Organic Cropping Research, and assisting the statewide Small Farms Team with its popular small farms course series around the state. His email address is ktdugan@wsu.edu and his phone number is 445-4654.

Kevin is a 2001 graduate of the University of Washington Tacoma. At UWT, he earned a bachelor's degree in Interdisciplinary Arts & Sciences, with a focus on States, Markets and Global Systems.

Events

2005 Agroforestry Conference

The Association for Temperate Agroforestry (AFTA) presents "Moving Agroforestry into the Mainstream," the Ninth North American Agroforestry Conference, June 12-15, 2005 at Rochester, MN. Learn about new agroforestry research, policy and practice.

Visualizing Food and Farm

The Joint 2005 Annual Meetings of the Agriculture, Food, and Human Values Society (AFHVS) and the Association for the Study of Food and Society (ASFS) will use this theme in their June 9-12 conference in Portland, Oregon. Look at the [AFHVS site](http://afhvs.org) for details.

A Future Beneath the Trees

The Centre for Non-Timber Resources at Royal Roads University in Victoria, BC, Canada will host an international conference, A Future Beneath the Trees, August 25-27, 2005 to discuss and assess the impact of commercial development of Non-Timber Forest Products (NTFPs) on rural livelihoods and forest conservation. NTFP topics include: production, processing, marketing and consumption, and backward and forward linkages between production and consumption. For submission guidelines and more information, contact the Centre at ntfp@royalroads.ca or (250) 391-2600, ext. 4328#.



Ecosystem Services of Farm Trees

The Farm Woodland Forum will hold its annual meeting on the theme "Ecosystem services of farm trees" from 29 June to 1 July, 2005 at the University of Wales Conference Centre at Gregynog, Powys, Wales, UK. The organizers invite presentations on how trees can contribute to key ecosystem service functions, such as flood risk management, provision of clean water and the maintenance of biodiversity, at a range of scales from the field to the river catchment. For guidelines on submissions, please contact [Fergus Sinclair](#).

National Food Business Incubator Meeting

The new *National Food Business Incubator Network* (Food BIN) invites you to join them to explore innovative practices in food sector entrepreneurship on May 13, 14 and 15, 2005. If you are currently operating a kitchen incubator, partnering with a kitchen incubator or considering starting one, this is an event that you should not miss. To register for the Food BIN meeting or to make any inquiries, contact [Carol Coren](#) at 503-872-6657. This gathering immediately succeeds the Association for Enterprise Opportunity's (AEO) [Fifteenth Annual Conference and Membership Meeting](#) in Portland, Oregon.

Women Involved In Agriculture ... Making A Difference Conference

Sponsored by Washington State University Extension, this conference will give women the tools and information they need to help their family farm operations and agribusinesses thrive. The conference will be held Saturday, April 23, 2005 at Eastmont Junior High in East Wenatchee, WA. Women, who are members of farm family operations and enterprises in North Central Washington and throughout the state, are encouraged to attend. This conference acknowledges the different roles and variety of farm, family and personal decisions that women make, from active involvement in day-to-day operations, to women as land owners/operators and those who make decisions and play supporting roles. The program

will provide skills and confidence to become better managers and decision makers. Jolene Brown, a nationally known speaker from Iowa, will give two presentations, "The Top Ten Things Families Do To Break Up Their Farming Operations" and "Normal Doesn't Live Here Anymore." For more information and a copy of the registration brochure, call WSU Extension in Wenatchee at (509) 667-6540 or Waterville at (509) 745-8531.

Practicum in Organic Agriculture

Washington State University will offer a 6 credit summer 2005 class, [Practicum in Organic Agriculture](#). The hands-on course will utilize the certified organic teaching farm on campus.



4th National Small Farms Conference

The 4th National Small Farm Conference will be held October 16-19, 2005 in Greensboro, North Carolina. Submissions for topic presentations, speakers, poster presentations, exhibit displays, and success stories must be made by May 13, 2005. Conference tracks include: Alternative Enterprises; Risk Management; Professional/Program Development; Marketing, Risk Management, and Bridging Gaps in Programs and Services. For submission guideline or conference information, see the [conference website](#) or contact [Patricia McAleer](#) at 202-720-2635.

Updates

Tillamook Creamery Bans rBGH

Recently the board of Tillamook Creamery, a dairy cooperative famous for quality cheese, voted to ban the use of rBGH—a genetically engineered growth hormone manufactured by Monsanto. See the [Portland Business Journal article](#).

Neem Patent Revoked

([IFOAM Press Release](#) - Munich, May 10, 2000) The European Patent Office

(EPO) revoked the patent of multinational corporation W.R. Grace for a fungicide derived from seeds of the Neem tree. Following extensive testimony, the four-person panel judged that the "invention" lacked an "inventive step," a prerequisite to obtain patent protection. The panel ruled earlier that the USA/Grace neem fungicide product was lacking in "novelty," another patent criterion, and established that its properties and use were "prior art" years before the "proprietors" applied for a patent. The panel did not find that the patent constituted a violation of "public order and morality" or that it constituted a de facto monopoly on a single plant variety, both of which are prohibited by the European Patent Convention.

Linda Bullard stated that the decision "...in Munich will provide a strong impetus to the effort to introduce protection mechanisms within the framework of the Biological Diversity Convention and eventually the Trade Related Intellectual Property Rights agreement. Revocation of the neem patent shows that it is possible."

Resources Agriculture

Low Impact Development Manual

Recently published by the Puget Sound Action Team in Washington State, [Low Impact Development: Technical Guidance Manual for Puget Sound](#) provides stormwater managers and site designers with a common understanding of LID goals, objectives, specifications for individual practices, and flow reduction credits applicable to the Puget Sound region.

Sustainable Agriculture Resources and Programs for K-12 Youth

This [16-page guide](#) to sustainable agriculture/food oriented educational opportunities features more than 50 programs and curricula nationwide and includes direct links, program contact information and ideas for integrating lessons into school programs.

Continued on next page

Making Farms the Engine of Economic Growth ... and Community Connection

On the shores of Lake Champlain, the [Intervale Foundation](#) has established one of the nation's most successful farm incubator programs, giving would-be farmers access to land, equipment and training, while the city's residents get access to great food, responsible recycling, and a wealth of other benefits.

Purdue Offers Entrepreneurs Web-based Business Planning Tool

Purdue's Agricultural Innovation and Commercialization Center is making a new [online business planning tool](#) for entrepreneurs. The business planner helps entrepreneurs define their businesses step by step, so that they can develop a business plan to take to potential partners or financial backers. The tool also guides a periodic assessment of business progress. See the [New Farm article](#).

Farmer's Guide to GMOs

Published by Farmers' Legal Action Group, Inc. and Rural Advancement Foundation International.

Farmers' Guide to GMOs



New Organic Farming Compliance Handbook Available Online

As the number of organic farmers and ranchers continues to increase and acreage in certified organic production expands in the SARE Western Region, more Extension professionals and federal agency field personnel handle questions related to certified organic production practices, particularly with regard to allowable materials, and certification rules and procedures. A new manual, the [Organic Farming Compliance Handbook](#), offers materials

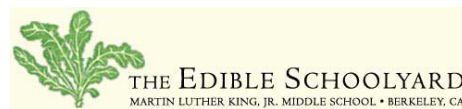
for use by agricultural professionals interested in what methods, materials, and practices are compatible and consistent with organic standards. Materials were assembled from the most current national, regional, and local sources. The resource guide was developed as part of an educational project funded by the [Western Region USDA SARE](#) program.

Building Better Rural Places

Searching for federal funding or agricultural expertise? You'll find many answers in *Building Better Rural Places*, a newly revised 160-page guide to 82 federal programs offering assistance in agriculture, forestry, conservation, and rural community development. Download the entire publication or view ordering information at <http://www.sare.org/publications/ruralplaces.htm>.

'Edible Schoolyard' Efforts Profiled

California restaurateur Alice Waters, through her organization [Edible Schoolyard](#), recently persuaded the Berkeley Unified School District to adopt food and agriculture issues as part of its curriculum for students from kindergarten through 12th



grade. "We want to teach students about the consequences of the decisions they make about food, their relation to the land; we want to instill basic values. What we are doing is creating a new way of thinking about food. Making food an academic subject will give it legitimacy." See the full Mother Earth News profile <http://www.motherearthnews.com/article/2150/>

Report Finds Financing Barrier to Growth of Sustainable Farms

The report, [Funding the New Harvest](#), from the nonprofit Center for Community Self-Help, says that financing remains a major barrier to the growth of the sustainable farm movement. Based on a survey of 400 organic farmers in North Carolina examining credit needs and barriers for small and sustainable farms, the sur-

vey found that while lender bias was rare, obtaining funding was still formed a barrier to sustainable farm growth.

Sustainable Agriculture Online

The Fall 2004 issue of the University of California Sustainable Agriculture Research and Education Program's

(SAREP) newsletter "Sustainable Agriculture" can be viewed at the [SAREP web site](#).

New Manual on Direct Marketing and Farm Viability

The Center for Agroecology and Sustainable Food System recently published a manual titled [Teaching Direct Marketing and Small Farm Viability: Resources for Instructors](#), organized into six units, three focusing on marketing and three covering other topics related to making a small farm economically viable. Included are lessons and resources for running a CSA project, selling at farmers' markets, forming collaborative marketing groups and grower cooperatives, and selling to restaurants. Also covered are strategies to improve small farm planning, including enterprise visioning and market assessment; creating a business plan, including marketing and crop



plans; and managing cash flow. Land tenure options such as cash-rent leases from non-profits, shared ownership models, conservation easements, and community land trusts are reviewed as additional mechanisms for addressing the complex issue of the economic viability of small-scale agriculture.

Washington State Small Farm and Direct Marketing Program Report

The 2003-2004 Annual Report for the Washington State Department of Agriculture Small Farm and Direct Marketing Program can be viewed at the [WSDA web site](#) and outlines the work done to enhance local food systems and provide direct marketing opportunities for Washington farmers.

Continued on next page

You Say Tomato, I Say Hidden Costs of Transport: Locally grown food greener than organic

(BBC World News, March 2, 2005) A recent [Food Policy report](#) finds that buying locally grown food, even those grown using pesticides, is easier on the environment than organic foods. Based on the hidden costs of farming and food transport, researchers concluded that the UK would save \$4 billion a year in environmental and traffic costs if only locally grown food was consumed (an additional \$2.1 billion a year would be saved if all food were grown organically). The study suggested supermarkets label items with the number of “food miles” they travel to get to the store. “The most political act we do on a daily basis is to eat, as our actions affect farms, landscapes, and food businesses,” said study co-author Jules Pretty of the University of Essex.

Multifunctional Agriculture

(AFTA) A paired-watershed study in Minnesota published in the journal *Bioscience* showed that net farm income and environmental benefits (e.g. water quality, erosion control, wildlife) increased under land use scenarios with greater crop diversity and more perennial vegetation compared to conventional corn and soybean agriculture. These scenarios included wide riparian buffers, wetland restoration, perennial crops and managed intensive rotational grazing. Lower commodity payments would be partially offset by enrollment of buffers into CRP. The authors suggest that rather than support commodity production, US farm policy should support agricultural diversification which can create more environmental benefits at lower public cost. See the full article on the [Land Stewardship Project](#).

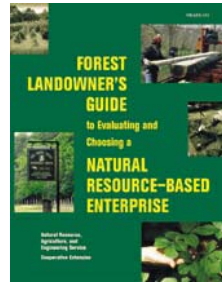
Forestry

“As a Matter of Fact, Money Does Grow on Trees”

From Outside Online magazine, an interesting article that looks at a different tack for valuing natural resources.

Business Opportunities for Forest Landowners

A new book, *Forest Landowner's Guide to Evaluating and Choosing a Natural Resource-Based Enterprise* helps forest landowners identify and evaluate potential forest-based enterprises beyond wood products. The book begins with a discussion of forest resource stewardship, and then guides readers through a step-by-step process of evaluating potential new business ideas. The second half of the book includes detailed budgets for eleven different enterprises, including shiitake mushrooms, ginseng, Christmas trees, custom sawmilling, vacation cabins, fee fishing, hunting leases, and horse boarding. Ordering information on the [Natural Resource, Agriculture, and Engineering Service \(NRAES\) website](#).



January issue of The Temperate Agroforester

The January, 2005 issue of The Temperate Agroforester, AFTA's quarterly newsletter, is now available on the AFTA website. The contents include a report of a low-interest loan fund to support short-rotation tree planting on farms in Minnesota; highlights of recent agroforestry research and public projects in Ontario, Canada; news of two landowner field days on silvopasture management opportunities in Mississippi; and a review of a new book on methods to analyze the economics of agroforestry systems.

Oregon Forest Industry Directory

The [Oregon Forest Industry Directory \(OFID\)](#) for Washington and Oregon was developed last year via an OFRI-funded project with OSU Forestry Extension, OSWA, and the Northwest Wood Products Association. OFID hopes to foster market connections, such as helping:

landowners find log and non-timber forest products buyers;

mill operators find sources of logs and buyers for their lumber; and

value-added' mills find sources of raw material, e.g., kiln-dried Oregon hardwood lumber

Visitors can do detailed searches, login (once an account is established) to update their entry, fill-in a form to add themselves to the list, and post to a buyers/ sellers directory (like want-ads).

A Fortune in the Forest

Production and marketing of nontimber forest products on private forests and woodlands in Wisconsin will be the focus of a conference on April 9, 2005 in Rhinelander, WI. The conference will provide participants with information on many ways to utilize forest resources for the production of a variety of different products, such as floral greenery, boughs, cones, bark and mushrooms. Additionally, participants will have an opportunity to learn how they can market their products and make their business a success. For more information about this conference, contact [Bill Klase](#) (715 365-2658) or visit their [web site](#).

Forest Health Issues for Washington State

The [2004 status reports](#) about many major forest health issues is now online and includes such issues as exotic pest introductions, bark beetle and defoliating insect activity trends, loops of activity over the last several years pheromone trapping results for gypsy moth, and Western spruce budworm infestations.



Submitting articles: Submit articles electronically to [Doug Stienbarger](#) in MS Word or RTF formats. Photos and graphics are encouraged.

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