2006 Washington State Annual Report to the W-6 Technical Committee

Washington State Representative: Stephen S. Jones

June 6, 2006

In 2006, ninety-two National Plant Germplasm orders were requested by various Washington State agencies, farmers, nurseries, seed companies, hobbyists and state and federal scientists in disciplines such as genetics, horticulture, botany, plant pathology and agronomy. The following is a summary of information regarding the performance of the genetic material Washington State groups have requested from the National Plant Germplasm System (NPGS).

Summary

A letter was sent out on March 10, 2006 to the 92 groups in Washington State that requested germplasm from the NPGS. The request asked for information regarding the performance of the germplasm received, i.e. germination success or percent germinated, grafting success, propagation success, etc. We received 24 (26%) responses to our request.

The majority of the responses were positive stating that those with requests for seed had average or good germination and those with rootstock requests had a 90% or greater success rate. Several groups stated that the material they requested arrived in excellent condition and appreciated the efforts of the NPGS to send them high quality material. There were, however, some specific issues with germination. Please reference the Narrative of Recipient Responses for details regarding germination problems with specific accessions.

The research material generated from the NPGS was used for the following research projects: 24 of the 24 responses gave details on the specific research, they are listed below:

Recipient Narratives/Reports Regarding Observations and Details of Germplasm Use

1. Helen Brocard - Vashon, WA:
Fragaria x ananassa
I received four plant material and only two plants survived. The growth was extremely slow and as the small leaves came up, they were brown on the edges. Dr. Robert Norton found them to be infected with spider mites. Since I did not have spider mite infection with any other plants, I assumed they might have come with the plant material. I dusted them with sulfur and took care of the problem. I am looking forward to having Marshall Strawberries again and hope to eventually grow enough for a taste from the past. Before 1950, Vashon Island was a large producer of Marshalls.

2. Michel Brockington, CSANR – Wenatchee, WA:

Performance of living mulches in a new apple block in Central Washington: Year 1 evaluation.

March 2006

David Granatstein[1], Kent Mullinix[2], Elizabeth Kirby[1], and Michel Brockington[1]

Contact person: David Granatstein, Washington State University, 509-663-8181 x222; granats@wsu.edu

DATE (period which report covers): April – March 2006

KEYWORDS: mulch, living mulch, cover crop, sandwich system, orchard weed control

ABSTRACT: Washington organic orchardists have identified weed control and fertility management as priority research needs. Mechanical weed control has been the standard practice, often with high cost or potential degradation of soil quality. "Living mulch" and "Sandwich systems" in the understory weed strip show promise for improved weed control, soil quality, and fertility, but can compete with new trees and encourage rodent habitat. Screening multiple species of low growing legumes and non-legumes may provide in-row cover options that benefit the system without increased economic damage from meadow voles. Use of the "Sandwich system," which uses tillage on the sides of the tree row keeping the in-row species intact, may disrupt both habitat to minimize risk of herbivory by rodents. The Sandwich system may provide moderate soil quality and fertility improvement, with minimized competition with the trees. Covers seeded in the weed strip in the orchard establishment year established well and provided some early season weed suppression. However, covers and weeds did compete with the new trees for nutrients, and voles were active in some stands where covers were not mowed.

OBJECTIVES:

[1] Center for Sustaining Agriculture and Natural Resources, Washington State University, Wenatchee, WA
[2] Washington State University and Wenatchee Valley College Institute for Rural Innovation and Stewardship

1. Evaluate annual, biennial and perennial ground cover species as 'living' and 'sandwich system' mulches for establishment, vigor, weed suppression, and vole activity.

PROCEDURES:

The screening trial consists of thirty cover crop species planted as either "Living Mulch" (LM) filling the 120cm understory weed strip of one tree row, or as a "Sandwich" system filling 45cm of another tree row with cultivation in outer edges of the weed strip. Experimental design of the 'living' mulch row, planted with cover crops in the entire 5' weed strip, is a Randomized Complete Block with 3 replicates. LM plots are 60cm x 300cm, and sandwich plots are 45cm x 300 cm. Entries included perennial landscape species and various legumes and non-legumes (Table 1). LM perennial entries included native kinnikinnick (*Arctostaphylos uva-ursi*) plugs, and seeded mother-of-thyme (*T. serpyllum),* bentgrass, kura clover, and 3 birdsfoot trefoil (*Lotus corniculatus*) varieties. Seeded annual LM entries included sweet alyssum, Five Spot *(Nemophila maculata),* medics and subclovers. Sandwich entries included transplanted perennial thyme (*T. serpyllum),* sweet woodruff (*G. odoratum),* Corsican mint (*M. requienii), Phlox subulata, Ajuga reptans, Potentilla neumanianna,* and *Veronica repens* and broadcast white clover, black medic, an annual subclover mix and fall-planted chickweed (*Stellaria media*). Seeds were broadcast or hand sown in 4" spaced rows, and rolled; perennial transplants (4" pot size) were planted (30 cm spacing) in the tree row. Sandwich entries were transplanted on 5/6/05 and LM plots were seeded 5/13/05. Year 1 measurements included seedling emergence count, % cover, peak stand biomass, biomass %N and canopy height; also weed biomass, % weed cover, and trunk cross sectional area. Cover flowering dates and seed production were observed. Vole activity was observed and measured in the Sandwich system.

Each row is 330' long, in a newly planted apple block (Pinata^{TM}/M7) being managed for organic certification. Apples were replanted into a former cherry block, which may have resulted in diminished tree growth in year 1 due to replant disease. Plots were mowed for supplemental weed control and to limit competition with the trees. Trees are spaced 5' by 13', and a trenched solid set micro-sprinkler irrigation system with a 12' overlapping circular spray pattern was laid in the tree row prior to planting. Orchard soil is Pogue silty loam. Pelleted chicken manure was broadcast and incorporated in the tree row at a rate of 93 lb N/ac. Because of possible replant disease as well as major competition for nutrients from both living mulches and weeds, trees received supplemental foliar nutrient applications (2.4 #/ac N) and a midseason liquid fertilizer injection of 32 #/ac total N.

PROGRESS TOWARDS OBJECTIVES:

Entries established in 2005 outperformed an earlier screening (Granatstein et al. 2004), probably a result of improved light and irrigation and earlier planting date in the newly planted block. Most seeded cover species established well and provided some early season weed suppression, except thyme and kura clover. By mid-July, weed competition from warm season grasses and lambs quarters competed with cover crops and trees. Stand cover was excellent (50-96%) by 6 weeks post planting (WAP) for most covers (Table 2). Thyme and kura clover exhibited low vigor and were not competitive in the first year; stand covers at 6 WAP were14% and 25%, respectively. Mowing for weed control appeared to encourage thyme. A nurse crop would likely improve weed control in the establishment year. The early establishing annuals, particularly medics, had lower % weed cover. Scimitar and Santiago burr medics, and broadcast black medic and Dutch white clover all had less than 10% weed cover at 6 WAP. Broadcast seed counts were higher than row planted legumes.

Cover and weed biomass samples were collected after at around peak stand. Entries were sampled only once because of limited plot size. They were not analyzed as a group because of the different sampling dates and the increased weed pressure over the season. The medics and alyssum were sampled on 6/29/05. Although there was a large spread of cover (133-264 g/m$^{2)}$ and weed

biomass (45-100 g/m$^{2)}$, the range was not significant at p=0.05 (p=0.30 and p=0.40, respectively, Fig. 1). The highest biomass producer, Scimitar burr medic, had the corresponding lowest average weed biomass. This trend was not found in all cases; Caliph barrel medic produced similar biomass but also had the highest weed biomass (though not significant). This sampling date was early for alyssum which continued to increase biomass after flowering.
Subclovers, white clover and Five spot were sampled mid-July and all seeded perennials were sampled mid August (Figs. 2 and 3). There were significant crop biomass differences but no differences for associated weed biomass on each date.

All medics and subclovers produced viable seed; fall emergence was occurring for all varieties.

Transplanted perennial landscape entries performed variably. Thyme, woodruff and phlox were the most vigorous and well established; mint did not survive and others did not outcompete the weeds. Transplanted thyme had significantly higher cover (93%) and lower weed cover (7%) at 6 WAP than other entries. Weed pressure was severe at this site. Weeds were mowed at cover crop canopy height 4 times in July and August. The kinnikinnick, veronica and cinquefoil which have prostrate growth habit were slower to establish. If they were not out competed in Year 1, they may offer better weed suppression in Year 2. Biomass samples of transplanted covers were not collected during Year 1.

RESULTS AND DISCUSSION

Cover crop and weed competition was detrimental to tree establishment. Monitoring of an adjacent trial showed that trees in plots with cover crops had lower leaf *SPAD* chlorophyll and % trunk growth than cultivated or wood chip mulch plots (Table 5). Early August chlorophyll levels were low for all treatments including plots with no cover crop (tilled, wood chip mulch, and control). Later August *SPAD* chlorophyll levels were typically lower for the cover cropped plots. Average percent TCSA for the tree rows with the Sandwich and LM entries was approximately 30% independent of crop species. This was comparable to tree growth for similar treatments in the adjacent trial where cover crops significantly reduced % TCSA increase in Year 1 compared to cultivated and wood chip plots which had trunk growth increases of 87 and 82%, respectively.

SPECIFIC VARIETIES

Two *Frageria chiloensis* taxon died in year 1. *Fragaria chiloensis* subspecies *pacifica* did well into the second season, yet it did not create a full stand that was competitive against grassy weeds. *Mentha requienii*, two taxon, did not survive. A thyme variety, denoted as Thymus spp., had poor germination, but did have some vigor by the end of the first season. *Ziziphora tenuior* had good germination, flowered and produced a moderately good stand by the end of the first season. *Trifolium ambiguum* germinated and overwintered well. Sporadic seedling establishment was noted in the second season.

The two black medic varieties acquired from the National Plant Germplasm System, *Medicago lupulina* Yugoslavia, and *Medicago lupulina* Afghanistan. Both of these species germinated well, produced a good stand. The Yugoslavia was slightly less vigorous than the stand produced by the Afghanistan. Both germinated the following spring, thought the Yugo had fewer seedlings.

Table 1. Living Mulch screening entries planted in 2005

Common Name	Scientific name	Variety or Location	Life Cycle	System	Planting
Non-Legume Species					
Corsican mint	*Mentha requienii*	Corsican	Perennial	SW	Plugs
Bearberry, Kinnikinnick	*Arctostaphylos uva-ursi*		Perennial	LM	Plugs
Bentgrass	*Agrostis tenuis*	Colonial	Perennial	LM	Broadcast
Bugleweed	*Ajuga reptans*		Perennial	SW	Plugs
Chickweed	*Stellaria media*		Annual	SW	Plugs
Cinquefoil	*Potentilla neumanniana*	Nana	Perennial	SW	Plugs
Five spot	*Nemophila maculata*		Annual	LM	Rows
Moss pink	*Phlox subulata*		Perennial	SW	Plugs
Mother of thyme	*Thymus serpyllum*		Perennial	SW	Plugs
Mother of thyme	*Thymus serpyllum*		Perennial	LM	Rows
Speedwell	*Veronica repens*		Perennial	SW	Plugs
Sweet alyssum	*Lobularia maritima*		Annual	LM	Rows
Sweet woodruff	*Galium odoratum*		Perennial	SW	Plugs
Clovers					
Kura clover	*Trifolium ambiguum*	Prairie	Perennial	LM	Rows
Subclover	*Trifolium subterraneum*	Antas	Annual	LM	Rows
Subclover	*Trifolium subterraneum*	Clare	Annual	LM	Rows
Subclover	*Trifolium subterraneum*	Dalkieth	Annual	LM	Rows
Subclover	*Trifolium subterraneum*	Denmark	Annual	LM	Rows
Subclover	*Trifolium subterraneum*	Mt Barker	Annual	LM	Rows
Subclover	*Trifolium subterraneum*	Nungarin	Annual	LM	Rows
White clover	*Trifolium repens*	Dutch	Annual	SW	Broadcast
Medics					
Barrel medic	*Medicago truncatula*	Caliph	Annual	LM	Rows
Barrel medic	*Medicago truncatula*	Parabinga	Annual	LM	Rows
Burr medic	*Medicago polymorpha*	Santiago	Annual	LM	Rows
Burr medic	*Medicago polymorpha*	Scimitar	Annual	LM	Rows
Black medic	*Medicago lupulina*	VNS, Montana	Biennial	LM	Rows
Black medic	*Medicago lupulina*	Afghanistan	Biennial	LM	Rows
Black medic	*Medicago lupulina*	VNS, Montana	Biennial	SW	Broadcast
Subclover Mix	*Trifolium subterraneum*	Clare, Mt. Barker, Nungarin	Annual	SW	Broadcast
Trefoil					
Birdsfoot trefoil	*Lotus corniculatus*	Canada	Perennial	LM	Rows
Birdsfoot trefoil	*Lotus corniculatus*	Norcen	Perennial	LM	Rows
Birdsfoot trefoil	*Lotus corniculatus*	South America	Perennial	LM	Rows

Table 2. Year 1 ground cover, weed cover and height of spring planted legumes.

Living Mulch	TRT	Cover Rank 1-5* (Day 36)	% Cover (Day 100)	% Weeds (Day 100)	Height (cm)
Grass					

A. tenuis	H	5	88	12	17
Clovers					
T. repens 'Dutch'	O	5	84	17	24.3
T. repens 'NZ'	P	5	84	17	26
T. repens NZ/ *T. fragiferum* Mix	R	4	78	22	25
T. fragiferum 'O'Connor's'	Q	3	55	30	23
T. ambiguum 'Prairie' *PI 427121*	M	2	8	60	
T. ambiguum 'Rhizo' *PI 325489*	L	1	8	52	
Subclovers					
T. subterraneum 'Antas'	S	3	7	55	12.7
T. subterraneum Mix 3 'Howard', 'Mt. Barker' and 'Tallarook'	V	3	32	43	11.7
T. subterraneum Mix 2 'Clare', 'Nungarin'	U	3	27	47	11
Medics					
M. lupulina PI 260980 Afghanistan	W	4	47	42	13.3
M. polymorpha 'Santiago'	BB	4	8**	47	5.3
M. lupulina PI 251150 Yugoslavia	X	3	43	37	11
M. polymorpha 'Serena' *PI 494565*	AA	3	12**	50	7
M polymorpha/scutellata Mix	Z	3	5**	90	
Birdsfoot Trefoil					
L. corniculatus 'Norcen' *PI 592427*	J	4	57	30	14
L. corniculatus 'Kalo' *PI 234670*	I	3	43	32	10

* Relative cover establishment by treatments; 1 = least, 5 = most.

**M. polymorpha stands died back after seeding.

Table 3. Peak stand biomass, Living Mulch Satellite 2005
Sample dates: 6/29/05, 7/11-14/05 and 8/11/05

Sample date 6/29/05	Cover biomass (g/m2)	Weed biomass (g/m2)	Total biomass at peak stand (g/m2
Scimitar	264.3	45.3	309.7
Caliph	256.3	100.7	357.0
Alyssum	236.3	67.3	303.7
Blk med VNS	211.0	64.7	275.7
Santiago	191.7	91.7	283.3
Parabinga	182.3	80.0	262.3
Blk med Afg	133.0	99.3	232.3
p=	0.3	0.4	

Sample date 7/11-14/05	Cover biomass (g/m2)	Weed biomass (g/m2)	Total biomass at peak stand (g/m2
Dutch Wh cl	299.3a	127.0	426.3
Antas	280.7ab	143.0	423.7
Mt Barker	264.7ab	80.0	344.7
Sub Mix	226.0abc	141.3	367.3

Denmark	222.3abc	120.0	342.3
Clare	183.7bcd	151.3	335.0
Dalkieth	156.0cd	153.0	309.0
Nungarin	119.7d	163.7	283.3
Five Spot	104.3d	176.3	280.7
p=	0.006	0.7	

Sample date 8/11/05	Cover biomass (g/m2)	Weed biomass (g/m2)	Total biomass at peak stand (g/m2
BFT Norcen	294.0a	169.7	463.7
BFT SA	222.3a	299.7	522.0
BFT Can	214.7a	252.0	466.7
Praire KC	62.3b	250.3	312.7
Thyme	8.3b	373.7	382.0
p=	0.009	0.419	

Acknowledgements: This study was supported by funding from the Organic Cropping Research grant (USDA-CSREES)**,** Wenatchee Valley College Institute for Rural Innovation and Stewardship **and the Washington Tree Fruit Research Commission.** The authors extend thanks to Amos Kukes, WVC orchard manager, and Kaz Lorentz and Lori Hoagland, Research assistants, for their contributions to this work. Seed and or inoculant were donated by Kamprath Seed Co., Nitragin Co., Big Sky Wholesale Seeds and the USDA, ARS National Plant Germplasm System. Herbicide was donated by G.S.Long Co. and EcoSmart Technologies.

3. Kim Campbell, USDA-ARS – Pullman, WA:
Triticum aestivum* subsp. *Aestivum, Triticum turgidum* subsp. *durum
Everything was fine.

4. Tyler Clark, Ag Alternatives – Sedro-Woolley, WA:
Vigna angularis
I regret to inform you that the grower inadvertently destroyed these plants at harvest time. However, the seed harvested has been subjected to DNA testing by the University of Guelph in Canada.

5. Mark Dawber – Port Angeles, WA:
So far I have had no germination from the seed in question. I could find no specific advice on *G. ovatifolia* in my native plant propagation books. The nearest thing was that *G. shallon* requires no special conditions. I held the seed in the refrigerator until spring, then planted it outdoors in a container of potting soil under natural conditions. So far the container has yielded only a very nice lawn of moss. There is a possibility that I might yet get some germination if the seed requires some freezing stratification. I in the meantime, was able to import some young plants from Frazer's Thimble Farms on the north end of Salt Spring Island, BC. I planted these in a bed.

6. Bill Dean – WA:
The materials I received in 2005 did not provide useful information about adaptability. The seed either decayed without emerging or was eaten by pheasants. There were purple types that looked like the appropriate corn genotypes, but further research is needed and the seed must be treated and perhaps isolated from birds. Thank you for supplying seed for us.

7. Gerald Edwards – Pullman, WA:
In December, 2005, we began to grow seeds of different Cleome species, which we had received from the National Plant Germplasm System, in the School of Biological Sciences WSU greenhouse. Below is our report on how this genetic material performed.

1. *Cleome gynandra*, USDA-PI 490299
Fast and good germination in soil, plants grow very well but all had viruses.
2. *Cleome gynandra*, USDA PI 500649
No germination in soil. In Petri dish with addition of 0.3 mM of gibberellic acid we got 2 seedlings out of 12 seeds. Plants grow well but also have viruses.
3. *C. hirta* (Klotzsch)Oliv. USDA-PI 500664
Seeds of this species have good germination in soil, plants grow very well but all have viruses. Plants of #500664 have pink flowers.
4. *C. hirta* (Klotzsch)Oliv. USDA-PI 500658
5. *C. hirta* (Klotzsch)Oliv. USDA-PI 500662
While germinating in soil, for both of these accessions we got only 1 seedling of each. Plants of both accessions have purple flowers.
6. *C. rubella* Burch. USDA-PI 500684.
After 5 days in soil we got 2 seedlings, they grow very well but have viruses. After 1-1.5 months in the same pot we got several additional seedlings. Plants are very similar to C. hirta #500662 and 500668, also have purple flowers.
7. *C. viscosa* L USDA-PI 279699.
In soil we got 1 seedling after 20 days. Plant is healthy.

a) Samples of all plants were taken for our herbarium for further consultation with the main specialist in systematics of family Capparaceae, Dr. H. Iltis.
b) Samples of all species were taken for analysis of $^{13}C/^{12}C$ for screening for possible C_4 or C_3-C_4 intermediate species.
c) Samples of all species were fixed for study of leaf anatomy.

8. Jack Feil, Feil Orchards – WA:
I used the material for spring grafting 2005. All the grafts are growing well except the Transcendent Crab. The reason for failure is unknown, perhaps incompatibility between scion and stock. I ordered and received, from Geneva Transcendent Crab grafting scions this spring, that should tell me if the problem was with the scion wood from last year.

9. Greg Fredericksen – Outlook, WA:
Malus domestica
All of the *Malus domestica* I received last year took off and grew very well. I had no problems.

10. Alan Hall – WA:
Malus domestica; Malus sieversii; Citroncirus sp.
Everything is still in a nursery. The *Malus domestica* received some damage on about half of the grafts and I'm not sure how there are going to do. It's still early. The *Malus sieversii*, 5 of the grafts did not take. They will be chip budded this fall from new scion from Geneva. The *Citroncirus sp*. I'm not sure what that is. I received 30? seeds from Robert Krueger @ Riverside for rootstock, 28 germinated. In 2-3 yrs I will graft wood from him. They are in pots, half will be put out this year to see if any will winter over.

11. Robert Hearst , Urban Landscapes - Bothell, WA:
Having been free of prostate cancer for 5½ years, thanks in part to black soybeans, I continue my search for a comprehensive set of beans that will grow in the Seattle weather. In addition, I make a Black Soybean dog treat that has been used for over 2½ years by the women at the Gig Harbor Prison their dog training program. The information I gain from new soybeans will be applied to the dog treats. Anyone interested can call me at 425-487-2675. I appreciate the service I receive from the people at the NPGS.

12. Jerry Hilson – Everett, WA:
The scion wood was excellent-well packaged, it grafted well, and successfully took on both rootstock and to other trees.

13. Stephen Jones, WSU Winter Wheat Breeding – Pullman, WA:
Triticum aestivum* subsp. *Aestivum
All material germinated well and is being used toward breeding better wheat varieties for Washington State.

14. Lawrence Krotzer – Port Ludlow, WA:
Malus domestica; Malus hybrid
National germplasm scions (apple); My rootstock was inferior, and as a result my "take" percentage was dismal. (I did no top-working). Thus, I am unable to contribute any information of value. I have better rootstock this year, let's see how it goes.

15. Steve Lyon, WSU Winter Wheat Breeding – Pullman, WA:
Triticum aestivum* subsp. *Aestivum
All material germinated well and is being used toward breeding better wheat varieties for Washington State.

16. Scott McDonald, WSU Plant Pathology – Pullman, WA:
Triticum urartu
The seed stocks of *Tritium urartu* were received in a timely fashion and in good condition. There were a few lines that did not seem to have good germination but we were able to obtain a few plants from each line received.

17. Andy McGuire, CSANR – Ephrata, WA:
Brassica juncea
I received seed for 4 *Brassica juncea* selections last year.
Unfortunately, a wind storm knocked down many of my mustard plots and I was not able to evaluate these selections for biomass, which was my goal. However, germination was good, and growth looked comparable to other entries in this trial. Thank you for this service.

18. Ted Meredith – Edmonds, WA:
Allium sativum
In response to the letter of inquiry, the two samples of *Allium sativum* that I received were in good condition and viable. They performed well, and I will be able to compare phenotypic observations with published AFLP DNA results.

19. Roy Navarre, USDA-ARS – Prosser, WA:
We directly freeze-dried many of the obtained wild-species tubers and are using them for germplasm mining for compounds that might have either nutritional value or be involved in potato disease resistance. Those tubers we planted in the greenhouse, germinated and grew well. Having these wild species tubers sent to us from the National Plant Germplasm Repository was extremely useful to us and saved us a lot of time and headache compared to individually tracking them down, then growing them ourselves.

20. Jason Perrault, Perrault Farms – Pasco, WA:
I received your letter regarding the Echinacea germplasm I received in 2005. I performed a germination trial with the seeds and planted the resulting plants in field plots late in the season. Due to the timing of planting, the plants were not able to flower although I suspect they had sufficient growth to partition resources and survive the winter. I plan on taking more detailed measurements this season particularly with regard to their adaptability to our climate. These were almost all wild seed lots and therefore little is known about them. Unless more information is needed prior, I will provide a full report at the conclusion of the 2006 growing season.

21. Lyndon Porter, USDA-ARS – WA:
The germplasm we received from you performed very well in germination and growth. We planted the seed in greenhouse pots and did not have any problem with over all plant vigor. Thank you very much for providing us with excellent seed. The germplasm was screened for resistance to Fusarium soil pathogens.

22. Bob Solti – WA:
I grafted the apple trees last spring, out of the 60 plants we grafted only three did not take. I have not as yet seen any budding or anything else as of yet of these young trees. But I do not expect to see much from them for another month or so. I grafted them onto M-106 and as of last summer most looked OK. Were some that tend to like our weather a little better then others but over all I had far too good growth. I will let you know more if you like when they start to bud. My hope is that most if not all will come back and have a good year of growth anyway.

23. Russ Staska – Benton City, WA:
Allium sativum* var. *ophioscorodon
Allium sativum* vr. *sativum
In response to your letter on the germplasm I received, At this time all I can respond with is both taxon have germinated 100% and are growing well.

24. Dena Ybarra – WA:
The germplasm we received in August of 2005 was for budding, a form of grafting. The wood was satisfactory. The buds were budded in August and are dormant now. We will be growing the buds into a 5-foot tree for our grower next summer. We harvest the trees in November and deliver to the grower in Spring 2007. If you want more information contact us at 509-787-4411

REFEREED PUBLICATIONS FOR STEPHEN JONES:

2006 Jones, S.S., S.R. Lyon, K.A. Balow, T.D. Murray, X.M. Chen, B.P. Carter, C.R. Morris, K. Garland Campbell, J.W. Burns, W.F. Schillinger, P.E. Reisenauer, B. J. Goates. 2006. Registration of Masami Wheat. Crop Sci. 46: XX-XX *In Press.*

2005 Glenna, Leland, Gollnick, Margaret A., and S.S. Jones. Inhumane Opportunity Structures: Teaching Eugenics at United States Land-Grant Universities, 1911-1972. Social Studies of Science. *(Submitted November 2005)*

2005 Murphy K., D. Lammer, S. Lyon, B. Carter, S.S. Jones. Breeding for organic and low-input farming systems: An evolutionary-participatory breeding method for inbred cereal grains. Renewable Agriculture and Food Systems 20: 45-55.

2005 Li, H.J., M. Arterburn, S.S. Jones and T.D. Murray. Resistance to eyespot of wheat, caused by *Tapesia yallundae*, derived from *Thinopyrum intermedium* homoeologous group 4 chromosome. Theor Appl Genet. 111: 932-940.

2004 Lammer, D., Cai, Xiwen, Arterburn, M., Chatelain, J., Murray, T.D., and Jones, S.S. A single chromosome addition from perennial *Thinopyrum elongatum* confers a polycarpic, perennial habit to annual wheat. Journal of Experimental Botany. Vol. 55, No 403; 1715-1720.

2004 **Li, H.J., M. Arterburn, S.S. Jones and T.D. Murray. A new source of resistance to *Tapesia yallundae* associated with a homoeologous group 4 chromosome in *Thinopyrum ponticum*. Phytopathology. Vol. 94, No. 9; 932-937.**

2004 **Jones, SS. Progress without patents: Agricultural research, no strings attached. Journal of Environmental Law and Litigation. Vol. 19 (2): 463-465.**