

Dr. Kim Hummer
National Clonal Germplasm Repository
33447 Peoria Road
Corvallis, Oregon 97330

Rec. 11/3/99

Dear Kim,

Glad I could let you know by phone that the enclosed seed shipment was on its way. Let's discuss the ideas and details of these seeds, as pertains to the general policy of "germplasm release". After we've talked it through, it should be clear that the split shipment that I mentioned would have no bearing on general agreements of using and dispensing germplasm.

Temporarily, at least I believe the seeds should be stored at app. 4 C. On a longer-term basis, we should perhaps seek the advice of John Henning and/or Al Haunold. In any case, I believe we should attempt as long-term storage as feasible.

The accompanying table outlines information on exact (i.e., GPS) locations of the population of plants from which seeds were taken. Please let me know if you need additional information for your records.

You will notice that some Humulus genotypes yielded several hundreds of seed, whereas some "barely eked out" 3 or 4 seeds. Those with few seeds, however, contribute meaningfully to the genotype representation of this significant relative of European hops, Humulus lupulus var. lupuloides. We may need to think together about specific ways of handling/utilizing those genotypes represented by small numbers of seeds.

Please feel free to call me at home (208-642-1393), for discussions on any of these details. I should be recovered from the collection trip by 8 November.

With best wishes,

Sincerely,



Richard Hampton
2170 Bonnie Drive
Payette, Idaho 83661

infosheet #38
Rec. 11/3/99

Sites from which Humulus seeds were collected, 23 - 29 Oct 1999
(Sites in North Dakota, Saskatchewan, and Manitoba indicated under name of site)

<u>Location Name</u>	<u># of bags (cones)</u>	<u>GPS Specification</u>	<u>Notations</u>
Souris-E-2 Manitoba	6 <u>CHUM</u> 1000	N 49 37' W 100 14	Seeds of six genotypes sampled Farthest downstream Souris R. site
Logan-NE N. Dakota	7 1001	N 48 10 W 101 10	Seeds of seven genotypes sampled Substantial genetic diversity at site
Burlington-NE N. Dakota	5 1002	N 48 17 W 101 26	Seeds of five genotypes sampled One of three premier collection sites
Burlington-NE#2	6 1003	(same)	Seeds of six genotypes sampled Extensive genetic diversity
Minot-E N. Dakota	1 1004	N 48 17 W 101 14	Only a single genotype with cones Extensive 1999 herbicide injury beside R.R. tracks, at this site
White Earth-S N. Dakota	3 1005	N 48 20 W 102 46	Seeds of three genotypes sampled Separate (Missouri R.) watershed
White Earth-S#2 N. Dakota	3 1006	N 48 19 W 102 46	Seeds of three genotypes sampled
Little Knife-E N. Dakota	2 1007	N 48 09 W 102 27	Seeds of two genotypes sampled Separate (Missouri R.) watershed
Oxbow-S Saskatchewan	8 1008	N 49 13 W 102 11	Seeds of eight genotypes sampled One of three premier collection sites
Indian Head-E Sask.	2 1009	N 50 39 W 103 35	Seeds of two genotypes sampled Severe habitat damage at this site
Bridge 2-S Sask.	6 1010	Not recorded	Seeds of six genotypes sampled Site closest to Indian Head-E E N
2 Qu'Appelle Sask.	5 1011	N 50 34 W 103 15	Ten genotypes sampled, but some were inseparable; composited, as Indicated on labels. One of three premier sites for diversity

Site Locations, cont.

<u>Location Name</u>		<u>GPS Specification</u>	<u>Notations</u>
3 Qu'Appelle ⁴ Sask.	<u>CHUM</u> 1012	N 50 32 W 103 14	Seeds from six genotypes; three not separable
Grenfell-N ³ Sask.	1013	N 50 38 W 102 53	Seeds from four genotypes; two not separable
Melville-SE ^S ² Sask.	1014	N 50 39 W 102 49	Seeds from two genotypes Several lost from collection, by wind shatter
4 Qu'Appelle ³ Sask.	1015	N 50 32 W 102 29	Seeds from three genotypes Poor pollination and seed set; valued as genotypes representative of region

rec'd 2000 JA 13

38

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5 January 2000

Dr. Kim Hummer, USDA ARS
National Clonal Germplasm Repository
33447 Peoria Road
Corvallis, Oregon 97330

Dear Kim,

The enclosed six pages of information provide final documentation of our 1999 study sites and seed collections of Humulus lupulus var. lupuloides (N. Dakota, Saskatchewan, Manitoba), H. japonicus (Indian Cave State Park, Nebraska and Craig-SW, Missouri), and possibly H.¹ lupulus var. pubescens, from the Rulo-E site, Missouri. Identities of H. japonicus and H. l. var. pubescens are based on Dr. Ernie Small's publications and concepts, but he hasn't seen the plants presumed to best fit these two species.

You would have received the November seed shipments from Fargo, ND, with the best documentation we could provide at the time, from the field. The enclosed information should be regarded as an upgrade of that prior information.

Seeds obtained from Sheyenne River and Missouri River habitats are ready to be shipped to your facilities. You should receive them sometime next week. The enclosed information is inclusive of those seedlots. Hopefully, you would have been in touch with Mel Anderson, regarding his plans/wishes for their long-term storage.

Please feel free to call me, or use the above E-mail address, if you need further information.

Sincerely,

¹ Note Humulus lupulus var. pubescens; NOT Humulus pubescens.

Richard O. Hampton

Humulus Seed Collections, N. Dakota, Saskatchewan, Manitoba, 22 Oct - 2 Nov 1999

<u>Location Name & Cone Sample #'s</u>	<u>Study Site Coordinates</u>	<u>Comments Regarding Location and Samples</u>
Souris-E2 Man. 1 2 3 4 5 6	N 049° 35.67' ¹ W 100° 14.40' <i>CHUM 1006</i>	Valuable replacement of near-by extinct popul'n; farthest downstream site on the Souris River, in these 1989-1999 studies. Samples taken from west to east, along escarpment ~ 70 m N. of river bank. These plants typically yielded small quantities of seed, e.g., Sample #6 yielded only 22 seeds.
Logan-N ND 1 2 3 4 5 6 7	N 048° 09.57' W 101° 09.67' <i>CHUM 1004</i>	Plants and/or cones of several marked plants had been removed (?users of wild hops?); cone Sample #1 was taken from <u>H.</u> plant climbing ash tree; hidden from "gatherers" by tree foliage; clearly visible after frost-induced defoliation. Samples 2 - 7 taken from profusion of <u>H.</u> plants in old brush pile ~ 100 m N. of sample #1. Cones taken from plant no's 2 yielded fewest seeds.
Minot-E ND 1	N 048° 13.44' W 100° 15.80' <i>CHUM 1004</i>	Most plants at this site killed by July herbicide spray; site definitely worthy of future collections.
Burlington-N ND 1 2 3 4 5	N 048° 16.91' W 101° 26.00' <i>CHUM 1002</i>	This population is "holding its own" very well, and contains both genetic diversity and plant/cone characteristics of economic value. This is considered one of three most important <u>Humulus</u> populations in the Northern Grasslands (with Oxbow-S and 2Qu'Appelle). Good seed yields.
Burlington-N#2 ND 1 2 3 4 5 6	N 048° 17.75' W 101° 27.45' <i>CHUM 1003</i>	This population, discovered in August 1999, may actually exceed the value of its near-neighbor, "Burlington-N"; contains plants of exceptional typiness and cone-yielding ability. Some of the largest seed yields of this collection trip came from plants at these two locations.

Location Name & Cone Sample #'s	Study Site Coordinates	Comments Regarding Location and Samples
White Earth-S ND 1 2 3	CHUM 1005 N 048° 19.77' W 102° 45.62'	At these three locations, in the watersheds of the White Earth and Little Knife Rivers, <u>Humulus</u> plants appear to exhibit less genetic diversity than those at other sites. However, their potential value lies in their geographic distinctiveness; thus, in the potentially distinct genetic derivations. These two rivers drain southward into the Missouri River and thence to the Gulf of Mexico. All other locations are associated with northward drainage systems that terminate in the Hudson Bay. We hope to pursue such potential genetic distinctions of <u>Humulus</u> populations according to major watershed differences.
White Earth-S2 ND 1 2 3	N 048° 18.75' W 102° 45.91'	
Little Knife-E ND 1 2	CHUM 1007 N 048° 8.99' W 102° 27.39'	
Oxbow-S Sask 1 2 3 4 5 6 7 8	CHUM 1008 N 049° 13.16' W 102° 10.95'	Although valuable genotypes have been lost from this population since 1989-90, it remains unique and significant. Seed Samples 1 and 2, heteroecious and monoecious, respectively, are morphotypes of those considered most interesting in 1989 (may contain both insect-repellant and anti-microbial agents). The other seed samples were collected from plants representative of types at this location. Some seed yields were surprisingly low.
Indian Head-N Sask 1 2	CHUM 1009 N 050° 38.05' W 103° 33.70'	This had been the population of "most elegant plant types" of any North American location observed in 1989. Most plants here were destroyed by cattle. Thankfully, seed yields were excellent.
Bridge 2-S Sask 1 2 3 4 5 6	CHUM 1010 N 050° 36.62' W 103° 33.58'	This is the population of closest proximity to Indian Head-E (~ 4 mi SE). It contains plants of unique value and diversity, and is appreciated as a genetic resource that is supplemental to Indian Head-E. Seed yields were uniquely variable, suggesting either inherently distinct yielding capacities or individual/genetic pollination requirements.

coordinates for Upland Ravine site above and a mile away from Little Knife-E should be: N 48° 08.09' W 102° 26.39'

Location Name & Cone Sample #'s	Study Site Coordinates
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Comments Regarding Location and Samples

2Qu'Appelle Sask 1+2+3 4+5+6 7+8 9 10	CHUM 1011 N 050° 33.67' ² W 103° 19.77'
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Although this population is dissimilar to that of 1989 Indian Head-E, it could prove equally valuable as a genetic resource. The range of cone-type variability is exceptional for a single site. Seed yields were good to excellent.

3Qu'Appelle Sask 1 2 3 4+5+6	CHUM 1012 N 050° 31.83' ² W 103° 15.43'
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Located across the Qu'Appelle River from the above population, these plants exhibit their own morphotype parameters. Seed yields were good to excellent.

Grenfell-N Sask 1 2+3 4	CHUM 1013 N 050° 38.14' ⁴ W 102° 52.76'
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This is a small, isolated population ~20 miles downstream (Qu'Appelle River) from that of 3Qu'Appelle.

Melville-SE Sask 1 2	CHUM 1014 N 050° 38.65' ⁴ W 102° 49.36'
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A significant population, deserving of further study and collection. Many cone-bearing plants, of August 1999, had no cones in late October. Seed Sample #1 contained mostly "unfilled" seeds.

4Qu'Appelle Sask 1 2 3	CHUM 1015 N 050° 32.32 W 102° 28.67
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In August 1999, this was considered a population of "oddities" (drastic cone-type variants), with the "promise" of genetic diversity. Cones produced the poorest seed yields encountered in 1999.

• Enderlin-NE ND 1	CHUM 1016 N 046° 37.30' W 097° 35.65'
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Only an estimated 1% of the plants observed along the Sheyenne River produced cones (most plants were small and spindly). The seven samples from three locations comprised an average of 30 cones, yielding fewer than 1 seed per cone. No seeds were produced by "Fort Ransom #5" cones, from a very large, old plant producing hundreds of cones. In retrospect, the many hundreds of plants observed along the Sheyenne River watershed do not seem strategic for Humulus germplasm conservation. Of interest is the mechanism for population survival, with little ostensible sexual reproduction.

Seed counts
6

• Lisbon-NW ND 1	CHUM 1017 N 046° 27.68' W 097° 43.37'
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14

• Fort Ransom ND 1 2 3 4 5 (no seed)	CHUM 1018 N 046° 32.73' W 097° 55.79'
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108

Humulus Seed Collections, N. Dakota, Saskatchewan, Manitoba, 22 Oct - 2 Nov 1999, cont.

Footnotes:

- ¹ Collection site added since 22 Sept - 4 Oct 1999 trip report.
- ² GPS latitude and longitude coordinates for these sites were compared with those derived from Saskatchewan Maps "Indian Head No. 62L/12" and "Indian Head No. 62L/11", Canada Dept of Energy, Mines and Resources. Little difference occurred at two sites; however, map coordinates for the "Indian Head N" study site were N 50° 38.05' and W 103° 33.70'. Please note that these coordinates have replaced data in an earlier report, generated by a 'Garmin III+' GPS instrument.
- ³ These coordinates were derived entirely from the official Canada maps cited in Footnote # 2.
- ⁴ These coordinates were obtained during Oct-Nov 1999 collection trip, and had not been available for the summer report on these locations.

New study sites established during 1999 include: Souris-E-2, Burlington-N-2, White Earth-S-2, Little Knife-E, Bridge-2-S (Qu'Appelle Valley), 2Qu'Appelle, 3Qu'Appelle, Grenfell-N, Melville-SE, 4Qu'Appelle, Newton-NW (Assiniboine R., near Oakville Manitoba), Enderin-NE (Sheyenne River, SE N. Dakota), Lisbon-NW (ibid), and Fort Ransom (ibid). For future study or seed collections, latitude-longitude coordinates were established for each site.

For a variety of reasons, no seeds were collected from the following established study sites: Souris-E (orig.), Mohall-W, Northgate-E, Midale-SW, Glen Ewen-S, and Newton-NW (see following summary).

Humulus Seed Collections, SE Nebraska & NW Missouri, 15 - 19 November 1999

<u>Location Name</u>	<u>GPS Locations</u>	<u>Comments, Location and Samples Taken</u>
Brownville-S 1 NB 2	N 040° 22.98' W 095° 39.31'	Only two of hundreds of plants bore cones; cones from those two plants produced no seeds. Ø
Rulo-E 1 MO 2 3 4 5+6 ² 7 8 9	N 040° 03.65' ¹ W 095° 23.55'	Certainly the premier population of this lower Missouri River region; includes plants that arguably produce the highest ratio of cones per unit-plant-mass in North America, with some of the most favorable cone/plant-type attributes. All cone samples yielded seeds; the fewest (18) produced by plant #8 and the most by plants #1 (~1,000) and #9 (~2,000). ~2000
Rulo-E2 1 MO 2	N 040° 04.13' W 095° 21.92'	This site supports a substantial <u>Humulus</u> population and should be included in future collections. ~100
Craig-SW 1+2+3 MO 1	N 040° 10.20' W 095° 27.43'	The Craig-SW and Indian Cave sites contain populations that appear to be 100% <u>H. japonicus</u> , i.e., NOT a sub-species of <u>H. lupulus</u> , as the binomial indicates. Compatibility of this species with conventional breeding-program objectives is problematic. Collection purpose: to test progenies for possible resistance to <u>Sphaerotheca humuli</u> DC. (Burr.); reconsideration of its value as a genetic resource, pending the outcome of resistance screen. ~85
Indian Cave 1 NB 2+3 4+5+6 7 8 9	N 040° 14.79' W 95° 31.03'	Compatibility of this species with conventional breeding-program objectives is problematic. Collection purpose: to test progenies for possible resistance to <u>Sphaerotheca humuli</u> DC. (Burr.); reconsideration of its value as a genetic resource, pending the outcome of resistance screen. ~85 ~190

Footnotes:

¹ Location coordinates presented, may differ slightly from those reported earlier. At the Rulo-E site, coordinates specify the location of plant/cone Sample #1; subsequent cone samples (i.e., 2 - 9) were taken at points progressively westward from that position..

² The sample designation, "5+6", indicates that two proximal plants with similar morphology may have been intertwined, with cones being harvested from both plants. Otherwise, cone samples can be assumed to have single-plant sources.

Summary of study sites and ecosystem developments between 1989 and 1999

Complete populations of Humulus were lost between 1989 and 1999, at the following sites: Souris-E, Man. (no discernible cause); Mohall-W, N. Dak. (new power line crossing; little observable habitat disturbance); Midale-SW, Sask. (destroyed by Souris River impoundment). Indian Head-E, Sask. sustained 95% loss of a preeminent North American Humulus population by mismanagement of a large cattle herd, 1995-99. Minot-E sustained 98% loss due to herbicide applications by nearby railroad maintenance crews. The Humulus population at Glen Ewen-S produced no seed in 1999 due to nearby road construction; heavy dust is presumed to have coated stigma surfaces in developing cones and thereby to have precluded pollination. The population at White Earth-S, N. Dak., had diminished substantially, ostensibly from natural causes (perhaps reduction in uphill supply of subterranean water); a very similar cause of Humulus population decline is presumed to have occurred at Northgate-E, N. Dak.

Humulus populations discovered in Aug. 1999 that partially compensated for those losses were: Souris-E#2; Burlington-N2, N. Dak.; White Earth-S#2, N. Dak.; Little Knife-E, N. Dak.; Bridge 2-S, Sask.; 2 Qu'Appelle, 3 Qu'Appelle, and 4 Qu'Appelle, Sask.; Grenfell-N, Sask.; Melville-SE, Sask.; Portage-E, Man. (Assiniboine River); Enderin-E, N. Dak. (Maple River); and Lisbon-NW and Fort Ransom, N. Dak. (Sheyenne River). Particularly those populations in the upper Qu'Appelle Valley (e.g., 3Qu'Appelle and westward) are among the richest Humulus genetic resources in North America.

There were apparently expanding Humulus populations at Burlington-N, N. Dak., Oxbow-S, Sask., and Rulo-E, Missouri, three sites that contribute significantly to the diversity and quality attributes for Humulus lupulus var. lupuloides germplasm.