No. 201000506

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Agriculture and Agri-Food Canada

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

An application requesting a certificate of protection for an alleged distinct variety of sexually reproduced, or tuber propagated plant, the name and description of which are contained in the application and exhibits, a copy of which is hereunto annexed and made a part hereof, and the various requirements of LAW in such cases made and provided have been complied with, and the title thereto is, from the records of the PLANT VARIETY PROTECTION OFFICE, in the applicant(s) indicated in the said copy, and Whereas, upon due examination made, the said applicant(s) is (are) adjudged to be entitled to a certificate of plant variety protection under the LAW.

Now, therefore, this certificate of plant variety protection is to grant unto the said applicant(s) and the successors, heirs or assigns of the said applicant(s) for the term of TWENTY years from the date of this grant, subject to the payment of the required fees and periodic replenishment of viable basic seed of the variety in a public repository as provided by LAW, the right to exclude others from selling the variety, or offering it for sale, or reproducing it, or importing it, or exporting it, or conditioning it for propagation, or stocking it for any of the above purposes, or using it in producing a hybrid or different variety therefrom, to the extent provided by the PLANT VARIETY PROTECTION ACT. IN THE UNITED STATES SEED OF THIS VARIETY (1) SHALL BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED AND (2) SHALL CONFORM TO THE NUMBER OF GENERATIONS SPECIFIED BY THE OWNER OF THE RIGHTS. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

WHEATGRASS, GREEN

'AC Saltlander'

In Testimony Whereof, *I have hereunto set my hand and caused the seal of the* Plant Variety Protection Office *to be affixed at the* ***City of Washington, D.C.*** *this fourteenth day of September, in the year* ***two thousand and twelve.***

Attest:

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Secretary of Agriculture

REPRODUCE LOCALLY. *Include form number and date on all reproductions*

Form Approved - OMB No. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE
(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER
Agriculture and Agri-Food Canada

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME

3. VARIETY NAME
AC Saltlander

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*
6000 C & E Trail
Lacombe, Alberta
T4L 1W1
Canada

5. TELEPHONE *(include area code)*
(403)782-8126

6. FAX *(include area code)*
(403)782-6120

FOR OFFICIAL USE ONLY

PVPO NUMBER
#201000506

FILING DATE
SEPTEMBER 3, 2010

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*
Government

8. IF INCORPORATED, GIVE STATE OF INCORPORATION

9. DATE OF INCORPORATION

10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. *(First person listed will receive all papers)*

Ann de St. Remy
6000 C & E Trail
Lacombe, Alberta
T4L 1W1
Canada

Harold Steppuhn (Technical Contact)
PO Box 1030
Swift Current, Saskatchewan
S9H 3X2
Canada
Phone (306)778-7243

FEES RECEIVED

FILING AND EXAMINATION FEES:
$ 4,382.00
DATE 8/3/10

CERTIFICATION FEE:
$
DATE

11. TELEPHONE (Include area code)
(403)782-8126

12. FAX (Include area code)
(403)782-6120

13. E-MAIL
ann.dest.remy@agr.gc.ca

14. CROP KIND *(Common Name)*
green wheatgrass

16. FAMILY NAME *(Botanical)*
Gramineae

15. GENUS AND SPECIES NAME OF CROP
Elymus hoffmannii

17. IS THE VARIETY A FIRST GENERATION HYBRID?
☐ YES ■ NO

18. DOES THE VARIETY CONTAIN ANY TRANSGENES? (***OPTIONAL***)
☐ YES ■ NO

IF SO, PLEASE GIVE THE ASSIGNED USDA-APHIS REFERENCE NUMBER FOR THE APPROVED PETITION TO DEREGULATE THE GENETICALLY MODIFIED PLANT FOR COMMERCIALIZATION. _____

19. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED
(Follow instructions on reverse)

a. ■ Exhibit A. Origin and Breeding History of the Variety
b. ■ Exhibit B. Statement of Distinctness
c. ■ Exhibit C. Objective Description of Variety
d. ■ Exhibit D. Additional Description of the Variety *(Optional)*
e. ■ Exhibit E. Statement of the Basis of the Owner's Ownership
f. ■ Exhibit F. Declaration Regarding Deposit
g. ■ Voucher Sample *(3,000 viable untreated seeds or, for tuber propagated varieties, verification that tissue culture will be deposited and maintained in an approved public repository)*
h. ■ Filing and Examination Fee ($4,382), made payable to "Treasurer of the United States" *(Mail to the Plant Variety Protection Office)*

20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD ONLY AS A CLASS OF CERTIFIED SEED? *(See Section 83(a) of the Plant Variety Protection Act)*
◉ YES *(If "yes", answer items 21 and 22 below)*
○ NO *(If "no", go to item 23)*
○ UNDECIDED

21. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES?
■ YES ☐ NO
IF YES, WHICH CLASSES? ■ FOUNDATION ■ REGISTERED ■ CERTIFIED

22. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?
■ YES ☐ NO
IF YES, SPECIFY THE NUMBER 1,2,3, etc. FOR EACH CLASS.
☒ FOUNDATION ☒ REGISTERED ☒ CERTIFIED
(If additional explanation is necessary, please use the space indicated on the reverse.)

23. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES?
■ YES ☐ NO CANADA 2007
IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. *(Please use space indicated on reverse.)*

24. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT *(PLANT BREEDER'S RIGHT OR PATENT)*?
☐ YES ■ NO
IF YES, PLEASE GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. *(Please use space indicated on reverse.)*

25. The owners declare that a viable sample of basic seed of the variety has been furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Owner(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF OWNER		SIGNATURE OF OWNER	
NAME *(Please print or type)* Ann de St Remy		NAME *(Please print or type)*	
CAPACITY OR TITLE: Office of Intellectual Property & Commercializatic	DATE: August 18, 2010	CAPACITY OR TITLE	DATE

2010 SEP 3 PM 12:05

#201000506

GENERAL INSTRUCTIONS: To be effectively filed with the Plant Variety Protection Office (PVPO), **ALL** of the following items must be **received** in the PVPO: (1) Completed application form signed by the owner; (2) completed exhibits A, B, C, E, F; (3) for a tuber reproduced variety, verification that a viable *(in the sense that it will reproduce an entire plant)* tissue culture will be deposited and maintained in an approved public repository; and (4) payment by credit card or check drawn on a U.S. bank for $4,382 ($518 filing fee and $3,864 examination fee), payable to "Treasurer of the United States" *(See Section 97.6 of the Regulations and Rules of Practice)*. **NEW:** With the application for a seed reproduced variety **or by direct deposit soon after filing**, the applicant must provide at least 3,000 viable untreated seeds of the variety *per se*, and for a hybrid variety at least 3,000 untreated seeds of each line necessary to **reproduce** the variety. Partial applications will be held in the PVPO for not more than 90 days; then returned to the applicant as un-filed. Mail application and other requirements to Plant Variety Protection Office, AMS, USDA, Room 401, NAL Building, 10301 Baltimore Avenue, Beltsville, MD 20705-2351. Retain one copy for your files. All items on the face of the application are self explanatory unless noted below. Corrections on the application form and exhibits must be initialed and dated. **DO NOT** use masking materials to make corrections. If a certificate is allowed, you will be requested to send a payment by credit card or check payable to "Treasurer of the United States" in the amount of $768 for issuance of the certificate. Certificates will be issued to owner, not licensee or agent.

NOTES: It is the responsibility of the applicant/owner to keep the PVPO informed of any changes of address or change of ownership or assignment or owner's representative during the life of the application/certificate. The fees for filing a change of address; owner's representative; ownership or assignment; or any modification of owner's name is specified in Section 97.175 of the regulations. *(See Section 101 of the Act, and Sections 97.130, 97.131, 97.175(h) of the Regulations and Rules of Practice.)*

Plant Variety Protection Office
Telephone: (301) 504-5518 **FAX:** (301) 504-5291
General E-mail: PVPOmail@usda.gov
Homepage: http://www.ams.usda.gov/science/pvpo/PVPindex.htm

SPECIFIC INSTRUCTIONS:

To avoid conflict with other variety names in use, the applicant must check the appropriate recognized authority and **provide evidence** that the permanent name of the application variety (even if it is a parental, inbred line) has been cleared by the appropriate recognized authority before the Certificate of Protection is issued. For example, for agricultural and vegetable crops, contact: U.S. Department of Agriculture, Agricultural Marketing Service, Livestock and Seed Programs, **Seed Regulatory and Testing Branch**, 801 Summit Crossing Place, Suite C, Gastonia, North Carolina 28054-2193 Telephone: (704) 810-8870. http://www.ams.usda.gov/lsg/seed.htm.

ITEM

19a. Give:
(1) the genealogy, including public and commercial varieties, lines, or clones used, and the breeding method;
(2) the details of subsequent stages of selection and multiplication;
(3) evidence of uniformity and stability; and
(4) the type and frequency of variants during reproduction and multiplication and state how these variants may be identified

19b. Give a summary of the variety's distinctness. Clearly state how this application variety may be distinguished from all other varieties in the same crop. If the new variety is most similar to one variety or a group of related varieties:

(1) identify these varieties and state all differences objectively;
(2) attach replicated statistical data for characters expressed numerically and demonstrate that these are clear differences; and
(3) submit, if helpful, seed and plant specimens or photographs (prints) of seed and plant comparisons which clearly indicate distinctness.

19c. Exhibit C forms are available from the PVPO Office for most crops; specify crop kind. Fill in Exhibit C (Objective Description of Variety) form as completely as possible to describe your variety.

19d. Optional additional characteristics and/or photographs. Describe any additional characteristics that cannot be accurately conveyed in Exhibit C. Use comparative varieties as is necessary to reveal more accurately the characteristics that are difficult to describe, such as plant habit, plant color, disease resistance, *etc.*

19e. Section 52(5) of the Act requires applicants to furnish a statement of the basis of the applicant's ownership. An Exhibit E form is available from the PVPO.

20. If "Yes" is specified *(seed of this variety be sold by variety name only, as a class of certified seed)*, the applicant **MAY NOT** reverse this affirmative decision after the variety has been sold and so labeled, the decision published, or the certificate issued. However, if "No" has been specified, the applicant may change the choice. *(See Regulations and Rules of Practice, Section 97.103).*

23. *See Sections 41, 42, and 43 of the Act and Section 97.5 of the regulations for eligibility requirements.*

24. *See Section 55 of the Act for instructions on claiming the benefit of an earlier filing date.*

22. CONTINUED FROM FRONT *(Please provide a statement as to the limitation and sequence of generations that may be certified.)*

23. CONTINUED FROM FRONT *(Please provide the date of first sale, disposition, transfer, or use for each country and the circumstances, if the variety (including any harvested material) or a hybrid produced from this variety has been sold, disposed of, transferred, or used in the U.S. or other countries.)*

24. CONTINUED FROM FRONT *(Please give the country, date of filing or issuance, and assigned reference number, if the variety or any component of the variety is protected by intellectual property right (Plant Breeder's Right or Patent).)*

AC Saltlander green wheatgrass

Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, Swift Current, Saskatchewan, Canada S9H 3X2 (e-mail: steppuhnh@agr.gc.ca)

Application for Plant Variety Protection Certificate

Item #22

Following an open bidding process in 2005 for the right to grow, increase, clean, prepare, bag, and market AC Saltlander Certified Seed (inspected and approved by the Canadian Food Inspection Agency) from Breeder Seed, a North American proprietary license was granted to MK Miller Seeds Limited of Milk River, Alberta by Agriculture and Agri-Food Canada. MK Miller seeds obtained AC Saltlander Breeder seed (starting in 2005) from the Semiarid Prairie Agricultural Research Centre and seeded the lot into isolated Foundation Seed Blocks. Seed from these Foundation Blocks were planted in individual Certified Seed fields (each under a separate center-pivot and irrigated with Milk River water). Seed from these inspected fields result in the Certified AC Saltlander product which is grown, harvested, cleaned, prepared, and sold in wholesale lots. Thus, each bag of Certified Seed can be traced back to seed from the Canadian federal government Breeder Seed Blocks within two generations: one Foundation and one Certified. All Certified, Foundation, and Breeder Seed Blocks were and are inspected each summer in the field by the Canadian Food Inspection Agency. In addition, seed samples from the breeder's seed blocks are evaluated each year at the Canadian Food Inspection Agency Seed Laboratory in Saskatchewan. And, seed samples from the foundation and certified seed fields are analyzed at government-accredited seed labs.

Item #23

Canada

In the spring of 2007 and under an agreement authorized by the Canadian Office of Intellectual Property and Commercialization, MK Miller Seeds sold a limited quantity of Certified AC Saltlander seed in wholesale to Proven Seed Limited for subsequent retail sale in Canada only. Similar wholesale and retail sales have been made each year since. Besides these sales, Proven Seed (now Viterra) has marketed AC Saltlander separately and recently in a "Salinemaster" blend within Canada. The target sites for AC Saltlander are fields containing slightly, moderately, and just severely (up to 10 dS m^{-1} in electrical conductivity of saturated soil paste extract) saline soils.

United States of America

In 2009, under agreement, MK Miller Seeds sold Certified AC Saltlander seed in wholesale to Producer's Choice Seeds, a subsidiary of Cal/West Seeds Inc., for pre-sale trials, preparation, marketing, packaging, and eventual retail sales in the United States beginning in the fall. This Certified Variety is targeted for hay fields and pastures which receive 13 inches or more of annual precipitation and contain slightly through moderately and into the beginning levels of severely saline soils.

AC Saltlander green wheatgrass

Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, Swift Current, Saskatchewan, Canada S9H 3X2 (e-mail: steppuhnh@agr.gc.ca)

Exhibit A ORIGIN AND BREEDING HISTORY OF AC SALTLANDER

Genealogy

AC Saltlander green wheatgrass possessing a SSSSHH genomic constitution originates from seed collected in 1979 by J.A. Hoffmann and R.J. Metzger (United States Department of Agriculture) from a site about 56 km northwest of Eleskirt, Erzurum Province, Turkey. This original seed was described in the collection notes as belonging to the genus *Agropyron.* Subsequently, D.R. Dewey (U.S. Forage and Range Research Laboratory) included plants from these seeds within a living collection of perennial Triticeae in a nursery near Logan, Utah. From these nursery plants, D.R. Dewey and K.H. Asay selected breeding plants and subjected them to mass selection for the bunch-growth habit. From these selections, 1995 germplasm was made available to the Semiarid Prairie Agricultural Research Centre (SPARC), Agriculture and Agri-Food Canada at Swift Current, Saskatchewan, Canada for salt-tolerance testing, selection, and improvement.

Cultivar Development

A series of four mass-selection breeding cycles were conducted at SPARC in which plants surviving for 45 days while subjected to root-zone hydroponic solutions of 30 dS m^{-1} or more during testing in Canada's Salinity Tolerance testing Laboratory (Steppuhn and Wall, 1999) were retrained and transplanted into isolated, field nurseries at Swift Current. The plants in these nurseries (numbering 400 or more each year) were compared and further selected for winter

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hardiness, vegetative vigor, leafiness, green plant color, freedom from plant pests, seed-set, and plant morphology. Mass-intercrossing among the selected plants resulted in a series of green wheatgrass strains. At the same time, separate plants from each Canadian salinity cycle were cloned into two plants, one of which was transported to the USDA Forage and Range Research Laboratory, Agricultural Research Service, at Logan, Utah. The plants delivered directly to the Utah Laboratory were placed in isolation plots and made available for use in United States breeding programs. Early populations of this hybrid at Logan resulted in a "germplasm release" of *Elymus hoffmannii* K.B. Jensen and K.A. Asay under the experimental name of RS-H (Jensen et al., 2003). The separate Canadian selections continued in development resulting in a strain which was released for commercialization as a Canadian cultivar (AC Saltlander) in 2005 (Steppuhn et al., 2006)

In (1996), Jensen and Asay published the results of their cytological – morphological study of the natural hybrid collected in Turkey in 1979 and from which the RS-H germplasm and subsequently AC Saltlander were developed. Based on chromosome pairing in the RS-H hybrids and paring in *Elymus repens* (L.) Gould [*Agropyron* repens (L.) P. Beauv.; *Elytrigia repens* (L.) Nevski], and the morphological uniqueness of the hybrids apart from *E. repens*, these breeders proposed and successfully demonstrated the existence of *Elymus hoffmannii* as a new species "originating from a primitive hybrid between *E. repens* and the bluebunch wheatgrass (*Pseudoroegneria* ssp.) of Turkey." Plants of this species are cytologically stable, genomically similar to *E. repens*, but morphologically different from *E. repens*.

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The plant description for *Elymus hoffmannii* K.B. Jensen and K.H. Asay, translated from Latin, is based on RS-H plants grown at the Evans Research Farm near Logan, Utah with seed obtained from the F_3 breeding line by Dr. K.H. Asay in 1994: "Perennial forage grass, with a small to moderate amount of rhizome development, culms 54-135 cm tall, herbaceous, internodes glabrous, culm nodes glabrous. Leaves cauline aggregated; second or third uppermost leaf blade flat to involute, 10-40 cm long, 5-13 mm wide, moderate to strongly veined, frequently lax when dried; adaxial surface strigose; abaxial surface glabrous. Ligules 0.6-1.0 mm long, truncate, lacerate. Auricles absent to 1.0 mm long, membranous, rudimentary to smooth hook-like appendages not overlapping. Sheath round, glabrous. Inflorescence a bilateral spike, 10-50 cm long, mostly erect to slightly nodding, green. First rachis internode 4-26 mm long. Third rachis internode 3-19 mm long. Spikelets 10-20 mm long, with five to none florets, sessile, solitary, slightly to moderately imbricate, reduced florets above fertile florets, disarticulation above glumes. Glumes equal 5-11 mm long, 1-2 mm wide, lanceolate to linear lanceolate, three-to five-nerved, nerves glabrous; apex acuminate, awnless or awned to 8 mm long. Lemma 7-12 mm long (excluding any awn), 1-3 mm wide, not enclosing the palea; five-nerved, glabrous; apex acuminate, awnless to awned up to12 mm long; abaxial side glabrous. Palea membranous, oblong, 8-11 mm long, 1-2 mm wide, two-nerved, ciliate on nerves, margins scarious. Three stamens, anthers 4-7 mm long. Chromosome number 2n = 42, x = 7."

The RS-H Hybrid Wheatgrass Germplasm was accepted by the Crop Science Society of America on 31 Oct 2002 following the Utah Agricultural Experiment Station Journal Article No. 7484. Publication of the Registration (No. GP-8, PI 631392) followed and is described in Crop Science 43:1139-1140 (2003). "RS-H has a chromosome number of 2n = 6x = 42 and a genomic

constitution of **StStStStHH** (**SSSSHH**)**.** Genetic interchange likely occurred between the **St** genome of the two parental species."

Variability and Uniformity

Jensen and Asay (1996) recorded a table listing the mean and standard deviation of 22 measured characteristics for RS-H and quackgrass each based on 10 plants per replicate grown in each of four replicate blocks in 1994 within a nursery (Evans Research Farm) located near Logan, Utah; these characteristics were designated as "useful in separating *Elymus hoffmannii* from *Elymus repens*." The means (χ) and standard deviations (sd) from these measured data were used to calculate the coefficients-of-variation (CV=sd/χ) for each of the 22 characteristics and demonstrate comparative uniformity of the variability associated with each characteristic within the two *Elymus* species (Table 1). The CV for 19 of the 22 characteristics within the selected plants each equaled less than 50% for both species. CV-values in the first glume awn length, second glume awn length, and lemma awn length fell between 50% and 66% for the RS-H and between 100% and 133.3% for the quackgrass. This supports the inference that the variation in the morphology of RS-H tends to follow that of quackgrass such that 80% of the morphological characteristics of the two species fall within 16% of each other (Table 1); the exceptions are awn length and rhizome length (described later). The large RS-H variability in awn length was likely inherited from both parents. In conclusion, if the level of variability in quackgrass (*Elymus repens*) plants growing wild in North America shows acceptable uniformity, the RS-H (*Elymus hoffmannii*) germplasm, by showing similar morphological variability as found in the quackgrass parent, also varies uniformly.

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Table 1, Coefficient-of-variation[1] (CV) for selected morphological characteristics among ten RS-H plants and ten quackgrass plants per replicate in four replicate blocks grown in 1994 at the Evans Research Farm, Logan, Utah, as computed with data taken from Jensen and Asay (1996).

Characteristic	Coefficient-of-Variation	
	RS-H	Quackgrass
	(%)	(%)
Plant height	18.3	14.3
Shot blade leaf length	33.5	22.0
Shot blade leaf width	30.7	26.2
Spike length	34.8	22.5
Number of spike nodes	23.4	21.3
First spike internode length	32.2	16.5
Third spike internode length	32.9	16.3
Third spikelet length	14.4	14.8
Third spikelet width	28.3	16.1
First glume length	17.3	13.6
First glume width	35.7	43.8
Number of first glume veins	20.5	17.5
Second glume length	14.5	12.0
Second glume width	38.5	31.2
Number of second glume veins	19.5	16.7
Lemma length	10.6	9.4
Lemma width	21.0	22.2
Palea length	9.5	10.0
First glume awn length	65.4	133.3
Second glume awn length	60.0	100.0
Lemma awn length	51.7	100.0
Rhizome length	30.5	(note[2])
Ratio, spike length / number of rachis nodes	12.0	18.2

[1] Coefficient-of-variation = standard deviation divided by the mean
[2] The standard deviation for this calculation is missing.

AC Saltlander was developed from the 1995 RS-H Utah germplasm obtained from the USDA Forage and Range Research Laboratory, followed by selections for salinity tolerance at Swift Current within four, open-pollinated breeding cycles as described in "**Cultivar Development**." The common name, "green wheatgrass" (GWG), was utilized for the Swift Current-derived populations in order to separate these populations from the Logan RS-H populations. At the end of three of the Swift Current cycles, 18 of the morphological characteristics, shown to be indicative of variability in the 1994 plants at the Evans Research Farm near Logan, Utah, were evaluated for their CV in the 2002 GWG strain at Swift Current, Saskatchewan (Table 2). In

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addition, the awn lengths of the second florets were measured. The CV-values based on 69 or more GWG and 67 or more plot-grown quackgrass plants were randomly sampled from each of five replicate Swift Current Range P field blocks and compared. The quackgrass plants in this isolation nursery were derived from seed collected in a pasture located nine miles south of Swift Current, Saskatchewan. As with the Evans Research Farm data, the CV for all the GWG characteristics measured relatively close to those of the quackgrass, i.e., within ±8% for each pair, except for awn lengths. Awn lengths which showed the greatest variation among all the characteristics in 1994 also tended to show the greatest variability in the 2002 measurements (Please see Table 2 and the section on "**Genetic Stability**").

As reported by Jensen and Asay (1996), awn lengths of *Elymus hoffmannii* plants generally exceed those of *Elymus repens*. Cursory inspections of 150 randomly selected spikes of the third-cycle Saltlander GWG strain and 259 quackgrass spikes grown in 2002 resulted in awn lengths segregated as long (>6 mm), medium (3-6 mm), or short (<3 mm) for samples from five replicated blocks within Range P at Swift Current, Saskatchewan (Table 3). The number of general awn length observations for the third-cycle Saltlander spikes averaged 28.7%, 52.0%, and 19.3% for long, medium, and short categories, respectively. In comparison, the number of quackgrass awn lengths respectively average 0%, 7.3%, and 92.7%. These data reveal occurrence frequencies favoring relatively long and medium awn lengths for the GWG and short awn lengths for the quackgrass. This revelation indicates a relatively high level of variability associated with awn length for *Elymus hoffmannii*, but a variability which appears to consistently remain within the range of the Saltlander cultivar population as well as within that of the quackgrass parent species.

Table 2. The mean (χ), standard deviation (sd), coefficient-of-variation[1] (CV), and number-of-plants (N) measured for selected morphological characteristics among five replicate blocks sampled from the third-cycle strain of green wheatgrass and quackgrass plants grown during 2002 within the Range P isolation site at the Semiarid Prairie Agricultural Research Centre, Swift Current, Saskatchewan.

Characteristic	Green Wheatgrass				Quackgrass			
	χ	sd	CV (%)	N	χ	sd	CV (%)	N
Plant height (cm)	76.41	11.073	14.84	153	71.88	10.396	14.46	256
Shot blade leaf length (cm)	9.67	3.044	31.47	105	8.96	2.034	24.81	209
Spike length (cm)	10.38	2.687	25.89	157	9.67	2.679	27.70	258
Number of spike nodes	14.91	3.291	22.07	156	16.07	3.658	22.76	258
First spike internode length (mm)	8.92	3.398	38.11	155	7.80	2.951	37.84	258
Third spike internode length (mm)	5.78	2.342	40.53	155	4.70	1.814	38.56	258
Third spikelet length (mm)	8.73	1.922	22.02	92	10.32	1.811	17.56	258
Third spikelet width (mm)	3.34	0.509	15.23	69	3.58	0.352	9.85	67
First glume length (mm)	7.88	1.362	17.29	69	9.26	1.005	10.85	67
First glume width (mm)	1.08	0.162	14.99	69	1.33	0.246	18.52	67
Second glume length (mm)	8.42	1.351	16.05	69	9.83	1.025	10.43	67
Second glume width (mm)	1.08	0.151	13.96	69	1.38	0.249	18.03	67
Lemma 1 length (mm)	10.52	0.761	7.23	69	9.74	0.765	7.85	67
Lemma 1 width (mm)	1.24	0.174	14.00	69	1.30	0.203	15.53	67
Lemma 2 length (mm)	9.92	0.849	8.55	69	9.22	0.868	9.42	67
Lemma 2 width (mm)	1.19	0.207	17.33	69	1.16	0.187	16.04	67
Palea 1 length (mm)	8.91	0.580	6.51	69	8.35	0.588	7.04	67
Palea 2 length (mm)	8.63	0.653	7.57	69	8.13	0.628	7.73	67
First glume awn length (mm)	1.95	0.967	49.61	69	1.09	0.519	47.72	67
Second glume awn length (mm)	2.16	1.139	52.62	69	1.13	0.539	47.57	67
Lemma 1 awn length (mm)	5.90	1.620	34.03	69	0.87	0.600	69.01	67
Lemma 2 awn length (mm)	6.60	2.036	39.10	69	0.99	0.666	67.45	67

[1] Coefficient-of-variation = standard deviation divided by the mean

Table 3. Observed number of general overall awn lengths from inspections of 150 spikes of the 3rd-cycle Saltlander strain of green wheatgrass and 259 quackgrass spikes classified as long (>6 mm), medium (3-6 mm), or short (<3 mm) by replicate block (five blocks) in Range P, Swift Current, Saskatchewan, in 2002.

Replicate Block	General awn lengths of spikes					
	Green Wheatgrass			Quackgrass		
	Long	Medium	Short	Long	Medium	Short
1	4	10	2	0	4	77
2	7	10	4	0	1	33
3	0	12	13	0	7	62
4	26	33	3	0	7	68
5	6	13	7			
Total	43	78	29	0	19	240
% of total	28.7	52.0	19.3	0	7.3	92.7

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Rhizome Length

In a favorable site for growth at Swift Current, the vegetative spread of the third-cycle Saltlander GWG strain and quackgrass (using wild seed obtained nine miles south of Swift Current) was compared in 2002 after plant establishment in 2000 and two subsequent growing seasons. The vegetative spread of the quackgrass occurred at about twice the rate as that of the green wheatgrass whether the crop was cut for hay (two cuts per year) or clipped periodically to simulate grazing (Table 4). These data show that the vegetative aggressiveness of green wheatgrass grown on negligibly saline soil ranks well below that of quackgrass.

Table 4. Mean spread of the third-cycle Saltlander green wheatgrass strain and quackgrass, averaged from five replicates measured after plant establishment and two growing seasons at 40 points per plot, Range P at Swift Current, Saskatchewan.

	Average maximum plant width (cm)	
	Treatment	
Crop	Hay[1]	Simulated pasture[2]
Green wheatgrass	84	88
Quackgrass	173	172

[1] Two harvest cuts per year
[2] Hand-clipped when plant heights exceeded 18 cm

Genetic Stability

Jensen and Asay (1996) described RS-H *Elymus hoffmannii* as stable with "aneuploids of 2n = 41 and 43" as having been "infrequently observed." Comparisons between Saltlander green

wheatgrass and quackgrass reveal their progeny-parent relationship and support this conclusion (Tables 2-4). Not only are the values of the morphological characteristics for the two species fairly close (except for lemma awn length and rhizome (vegetative) spread), but seed of the two are difficult to distinguish apart. Consequently, seed of *E. hoffmannii* must be marketed only as a class of "certified seed" to substantiate its separate identity from quackgrass. At present, only MK Miller Seeds Limited of Milk River, Alberta is licensed to grow and market certified seed of AC Saltlander.

Eight years and at least three selection cycles for salinity tolerance separated the RS-H and 3rd-cycle Saltlander populations. A comparison of 19 morphological characteristics between the 1994 RS-H and the 2002 Saltlander GWG populations shows the mean values for the RS-H equaling or exceeding the GWG values in all comparable 19 traits (Table 5). Besides the differing locations, soils, climates, and environments during the growth of these two populations, the GWG plants were selected from the RS-H plants to produce greater shoot biomass production while subjected to saline root-zones. Selecting for salinity tolerance in plants often reduces the stature of the resulting progeny. Salt tolerance mechanisms typically utilize photosynthetic energy at the expense of plant growth.

Table 5. Mean and (standard deviation) of selected morphological characteristics for 40 RS-H plants (*Elymus hoffmannii*) grown in the Evans Nursery in 1994 and 69 or more green wheatgrass (GWG) plants (*E. hoffmannii*) grown in Range P during 2002.

Characteristic	RS-H	GWG
Plant height (cm)	99.1 (18.1)	76.4 (11.1)
Shot blade leaf length (cm)	17.0 (5.7)	9.7 (3.0)
Shot blade leaf width (cm)	7.5 (2.3)	not meas.[1]
Spike length (cm)	18.7 (6.5)	10.4 (2.7)
Number of spike nodes	23.9 (5.6)	14.9 (3.3)
First spike internode length (mm)	12.1 (3.9)	8.9 (3.4)
Third spike internode length (mm)	8.2 (2.7)	5.8 (2.3)
Third spikelet length (mm)	15.3 (2.2)	8.7 (1.9)
Third spikelet width (mm)	5.3 (1.5)	3.3 (0.51)
First glume length (mm)	8.1 (1.4)	7.9 (1.36)
First glume width (mm)	1.4 (0.5)	1.1 (0.16)
Number of first glume veins	3.9 (0.8)	not meas.
Second glume length (mm)	8.3 (1.2)	8.4 (1.35)
Second glume width (mm)	1.3 (0.5)	1.4 (0.25)
Number of second glume veins	4.1 (0.8)	not meas.
Lemma 1 length (mm)	10.4 (1.1)	10.6 (0.76)
Lemma 1 width (mm)	1.9 (0.4)	1.2 (0.17)
Lemma 2 length (mm)	not meas.	9.2 (0.85)
Lemma 2 width (mm)	not meas.	1.2 (0.21)
Palea 1 length (mm)	9.5 (0.9)	8.9 (0.58)
Palea 2 length (mm)	not meas.	8.6 (0.65)
First glume awn length (mm)	2.6 (1.7)	1.9 (0.97)
Second glume awn length (mm)	3.0 (1.8)	2.2 (1.14)
Lemma 1 awn length (mm)	6.0 (3.1)	5.9 (1.62)
Lemma 2 awn length (mm)	not meas.	6.6 (2.04)
Rhizome length (cm)	46.6 (14.2)	(Table 4)[2]
Ratio, spike length (cm) / number of rachis nodes	0.78	0.70

[1] not meas. = not measured
[2] Please see Table 4.

Increased lemma awn length and reduced rhizome growth in *Elymus hoffmannii* compared to *E. repens* constitute differences which seemed to have persisted as the selection cycling for desirable agronomic and morphologic characteristics and for salinity tolerance in the hybrid ensued. According to the Jensen and Asay (1996) data, the mean awn lengths for RS-H equaled 2.6, 3.0, and 6.0 mm for the 1st, 2nd glumes, and the lemma, while the companion quackgrass awn lengths averaged 0.3, 0.5, and 0.5 mm, respectively. Based on a common awn

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representation per spikelet, the respective overall average awn lengths for the 1994 RS-H and quackgrass equaled 4.40 and 0.45 mm, respectively. Eight years later, the general 2002 awn lengths of the spikes in the GWG plants and companion quackgrass plants averaged 4.15 and 0.92 mm, respectively. The variation in awn length in the 2002 third-cycle Saltlander GWG spikes occurred with an estimated frequency of 4% showing no awns, 15.3% displaying "short" awns, and 80.7% featuring "medium" or "long" awns compared to 96.4% short or no awns for the local quackgrass (Table 3). This infers little change in representative awn lengths between species pairs over the eight-year period assuming stability in the widespread, wild North American quackgrass.

Another way of measuring genetic stability depends upon the associated variability of morphological characteristics between the plants representing RS-H or GWG and those of the quackgrass grown in the respective nurseries of these two *Elymus hoffmannii* populations. The 22 characteristics forming Tables 1 and 2 provide an opportunity to correlate respective CVs between respective quackgrass plants and RS-H or Saltlander germplasm in separate sets. This was done by fitting each set of CV-values for their morphological characteristics (less lemma awn lengths) for each of the combinations (RS-H with its quackgrass (Table 1) and GWG with its quackgrass (Table 2)) in linear regressions using SAS (2009) software. Respective printouts (Printout RSH and Printout GWG) resulted in: RSquare values of 0.765 and 0.941; and, orthogonal correlation coefficients of 0.874 and 0.970. With such strong correlations of variability over eight years and at least three selection cycles between parent and progeny, the evidence points to a pedigree-stable AC Saltlander GWG cultivar equal to that of the stable, wild quackgrass population.

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AC Saltlander green wheatgrass was observed over three salinity-tolerance selection cycles, four generations of reproduction, and two breeder seed block renewals in Canada; the variety appears to be stable and uniform within the normal range of a forage crop population developed by mass-selection.

Plants of the variety 'AC Saltlander' have been reproduced and, with spot checks, judged stable for the past five breeder seed and two seed increases (foundation and certified) generations. Excluding plant height, variety 'AC Saltlander' is uniform for all traits as described in Exhibit C (Objective Description of Variety) except lemma awn length. AC Saltlander shows no variants other than what would normally be expected due to environment and a forage crop population developed by mass-selection.

AC Saltlander has been observed for seven generations of development and increase and is stable and uniform. Variants outside the intra-population range appear in AC Saltlander within a frequency of about 1 in 200. These variants have lengthened or shortened lemma awns but are identical to the variety in all other characteristics as described in Exhibit C. These variants are likely the result of spontaneous mutation due to aneuploidy. This type of mutation occurs in most, if not all, wheatgrasses and is a characteristic of the genus. These variants are commercially acceptable and predictable.

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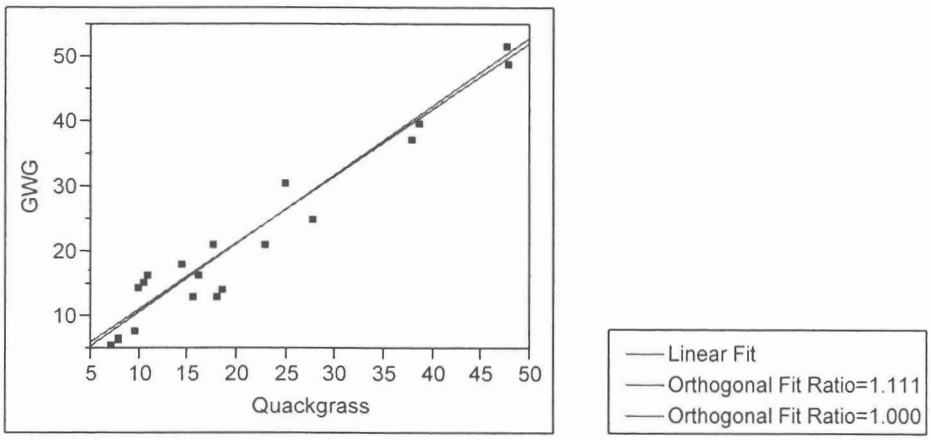
Printout GWG. Relating the coefficients-of-variations determined from 20 morphological characteristics of the 2002 3rd-cycle green wheatgrass (GWG) in the Range P Nursery and its (quackgrass) excluding the lemma awn length.

Bivariate Fit of GWG By Quackgrass



Linear Fit

GWG = 1.0229847 + 1.0224006*Quackgrass

Summary of Fit

RSquare	0.940699
RSquare Adj	0.937405
Root Mean Square Error	3.42843
Mean of Response	21.996
Observations (or Sum Wgts)	20

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	3356.2536	3356.25	285.5381
Error	18	211.5744	11.75	Prob > F
C. Total	19	3567.8281		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	1.0229847	1.458833	0.70	0.4921
Quackgrass	1.0224006	0.060505	16.90	<.0001*

Orthogonal Regression

Variable	Mean	Std Dev	Variance Ratio	Correlation
Quackgrass	20.5135	12.99958	1.111198	0.9699
GWG	21.996	13.7033		

Intercept	Slope	LowerCL	UpperCL	Alpha
0.372029	1.054134	0.930291	1.194463	0.05000

Orthogonal Regression

Variable	Mean	Std Dev	Variance Ratio	Correlation
Quackgrass	20.5135	12.99958	1	0.9699
GWG	21.996	13.7033		

Intercept	Slope	LowerCL	UpperCL	Alpha
0.336652	1.055858	0.932209	1.196925	0.05000

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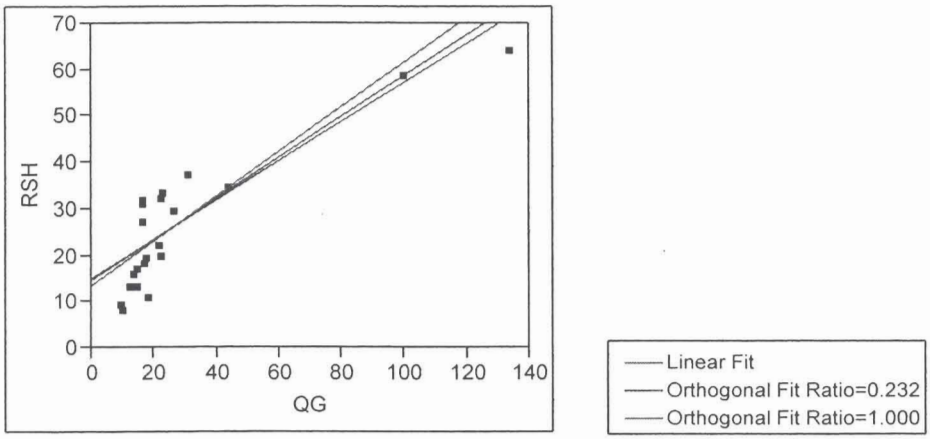
Printout RSH. Relating the coefficients-of-variations determined from 21 morphological characteristics of the 1994 (RS-H) in the Evans Nursery and its quackgrass (QG) with lemma awn length excluded.

Bivariate Fit of RSH By QG



Linear Fit

RSH = 15.3009 + 0.4209418*QG

Summary of Fit

RSquare	0.764767
RSquare Adj	0.752386
Root Mean Square Error	7.366087
Mean of Response	27.28571
Observations (or Sum Wgts)	21

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	3351.6402	3351.64	61.7709
Error	19	1030.9256	54.26	Prob > F
C. Total	20	4382.5657		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	15.3009	2.215643	6.91	<.0001*
QG	0.4209418	0.053559	7.86	<.0001*

Orthogonal Regression

Variable	Mean	Std Dev	Variance Ratio	Correlation
QG	28.47143	30.75329	0.231694	0.8745
RSH	27.28571	14.80298		

Intercept	Slope	LowerCL	UpperCL	Alpha
13.5811	0.481346	0.366391	0.632368	0.05000

Orthogonal Regression

Variable	Mean	Std Dev	Variance Ratio	Correlation
QG	28.47143	30.75329	1	0.8745
RSH	27.28571	14.80298		

Intercept	Slope	LowerCL	UpperCL	Alpha
14.72348	0.441223	0.327545	0.565321	0.05000

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AC Saltlander green wheatgrass

Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, Swift Current, Saskatchewan, Canada S9H 3X2 (e-mail: steppuhnh@agr.gc.ca)

Exhibit B STATEMENT OF DISTINCTIVENESS

A cytology-morphology study conducted by Jensen and Asay (1996) showed that RS-H and, by pedigree, AC Saltlander green wheatgrass plants exhibit attributes of a stable, natural hybrid that logically resulted from a cross between a member of the Eurasian bluebunch wheatgrass complex [*Pseudoroegneria strigosa* (SS) or *P. geniculata* (SSSS) or *P. stipifolia* (SSSS)] and quackgrass [*Elymus repens* (SSSSHH)]. Based on the genealogy, cultivar development, variability, uniformity, and genetic stability described in Exhibit A, AC Saltlander (derived from the RS-H hybrid wheatgrass germplasm) constitutes a "newly identified crop" (Jensen et al., 2003).

Prior to obtaining the RS-H germplasm from the seed originally collected in Turkey, grass breeders at the U.S.D.A. Forage and Range Research Laboratory in Logan, Utah had synthetically bred a fertile hybrid by artificially crossing the naturalized North American quackgrass [*Elymus repens* (L.) Gould, previously classed as *Elytrigia repens* (L.) Nevski = *Agropyron repens* (L.) P. Beauv.] and the North American bluebunch wheatgrass (*Pseudoroegneria spicata* (Pursh.) A. Löve). Artificial crossings of the two species (*repens and spicata*, "RS") began during the 1960s or perhaps earlier (Dewey, 1967; 1976; 1984). In (1981), Asay and Dewey registered two germplasms, RS-1 and RS-2, from these crosses. In (1991), Asay et al. registered the 'NewHy' RS Hybrid wheatgrass (Reg. no CV-18, PI 538763) from a 1989 release in cooperation with the Utah Agricultural Experiment Station and the USDA-SCS.

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NewHy and its precursors were always classed as 'hybrids' of *Elymus* (alias *Elytrigia*, alias *Agropyron*) *repens* x *Pseudoroegneria spicata* (alias *Agropyron spicatum*).

The new species *Elymus hoffmannii* was added in 1996 in order to properly classify the natural RS-H hybrid (found in Turkey) within the plant kingdom. At the same time, 'NewHy' was placed within this species partly because of convenience but mostly because its plants feature the prominent chromosome number of 2n = 6x = 42 and possess a similar genomic constitution of SSSSHH (Jensen and Asay, 1996). Although the RS-H hybrid plants resemble NewHy plants in many characteristics, the two populations consist of separate germplasms, trace different parentages, and originated on different continents.

Given that quackgrass (*Elymus repens* (L.) Beauv.) is considered a weed in many parts of the world and that its seed and those of AC Saltlander cannot be distinguished apart by physical appearance, the distinctiveness between the two should be addressed. Quackgrass is native to Eurasia, but occurs widely throughout North America. It spreads vegetatively and is known for its aggressive rhizomes. It is usually grouped as a weed, but it offers nourishing fodder and service in soil stabilization (Wyse et al., 2003). Despite similar appearance of their seed, green wheatgrass AC Saltlander differs morphologically from quackgrass [*Elymus repens*, previously classed as *Elytrigia repens* (L.) Nevski or *Agropyron repens* (L.) Beauv.]. Quackgrass plants tend to be shorter than those of AC Saltlander. In 2002, mid-season height measurements averaged 764 mm for the wheatgrass and 719 mm for quackgrass grown in a comparative test near Swift Current, Saskatchewan. Not uncommonly, however, the shorter-stature of the wild quackgrass also reflects growth in poorer sites. Although the flag leaves of the green wheatgrass

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in the test tended to extend to longer lengths than those of the quackgrass, the most definitive morphological difference between the two grasses occurred in the length of the lemma awns in the bottom floret (the first developed) of each spikelet. Although the awns of the glumes of the 2002 green wheatgrass (2 mm in length) averaged only one millimeter longer than those of the quackgrass glumes (1 mm), the awns of the lemmas of the mature green wheatgrass florets extended from 5 to 7 mm in mean length, while those of quackgrass averaged only 1 mm. Paleae of the bottom florets of both species were awnless. On average, the number of florets per spikelet counted three for AC Saltlander and five for the quackgrass. Also, spikelets of the wheatgrass were generally more open than those of the quackgrass (Figure 1).

Plants representative of the RS-H 1995 population of *Elymus hoffmannii* were used at Swift Current to primarily select for salinity tolerance. The plant population, for which Plant-Variety-Protection is sought, resulted from three successive selection cycles (plus four intervening seed production cycles selecting for winter hardiness and desirable plant physical characteristics) and formed a stable cultivar, AC Saltlander. Evaluations of crop-product yield for salinity tolerance are routinely conducted in Canada's Salinity Tolerance Testing Laboratory (SaltLab) and are field-verified at Swift Current (Steppuhn and Wall, 1999).

Tall wheatgrass [*Thinopyrom ponticum* (Podp.) Liu & Wang] ranks as the most salinity tolerant wheatgrass in North America, but lacks livestock palatability, especially if it is harvested late in its annual growth period (Tremblay, 2003). Two salinity tolerance tests were conducted in the SaltLab comparing two strains of Saltlander green wheatgrass with 'Orbit' tall wheatgrass (Steppuhn and Asay, 2005). The first, based on chloride salinity, included NewHy; the second

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featured sulfate salinity. Saltlander plants differ from those of NewHy genetically and in salinity tolerance as reflected in their relative shoot biomass production. The above-ground biomass produced across eight increasing levels of root-zone salinity relative to production from plants growing in negligible salinity for 'NewHy,' 'Orbit' tall, and Saltlander Strain A6 wheatgrasses resulted in salinity-tolerance-indices[1] of 5.7, 11.2, and 12.9, respectively (Figure 2). In the second test, the salinity-tolerance-indices for the tall and green (Strains A6 and S2) wheatgrasses equaled 11.7, 12.8, and 12.5, respectively (Figure 3). The S2 strain was pre-registered in Canada as AC Saltlander. The covariance yield analyses based on paired t-tests in both salinity tests led to the statistical inference that the salinity tolerance of AC Saltlander equaled that of Orbit tall wheatgrass and exceeded that of the NewHy.

[1] The salinity-tolerance-index [$STI = C_{50} + (sC_{50})$] derives from two parameters, C_{50} and s, determined from the modified discount equation (Steppuhn, van Genuchten, & Grieve, 2005),

$$Y_r = Y/Y_m = 1/[1 + (C/C_{50})^{\exp(sC_{50})}],$$

where Y = the shoot biomass (forage yield) of plants grown in media measuring C in salinity,
Y_m = Y from plants grown in root zones with negligible salinity,
$Y_r = Y/Y_m$ = (relative yield),
C = root-zone salinity usually measured in electrical conductivity resulting in Y yield,
C_{50} = C at $0.5Y_r$, and
s = the mean change in relative yield (Y_r) per unit decrease in C where $0.3 \geq Y_r \geq 0.7$.

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Figure 1. Representative AC Saltlander green wheatgrass and quackgrass seedheads.

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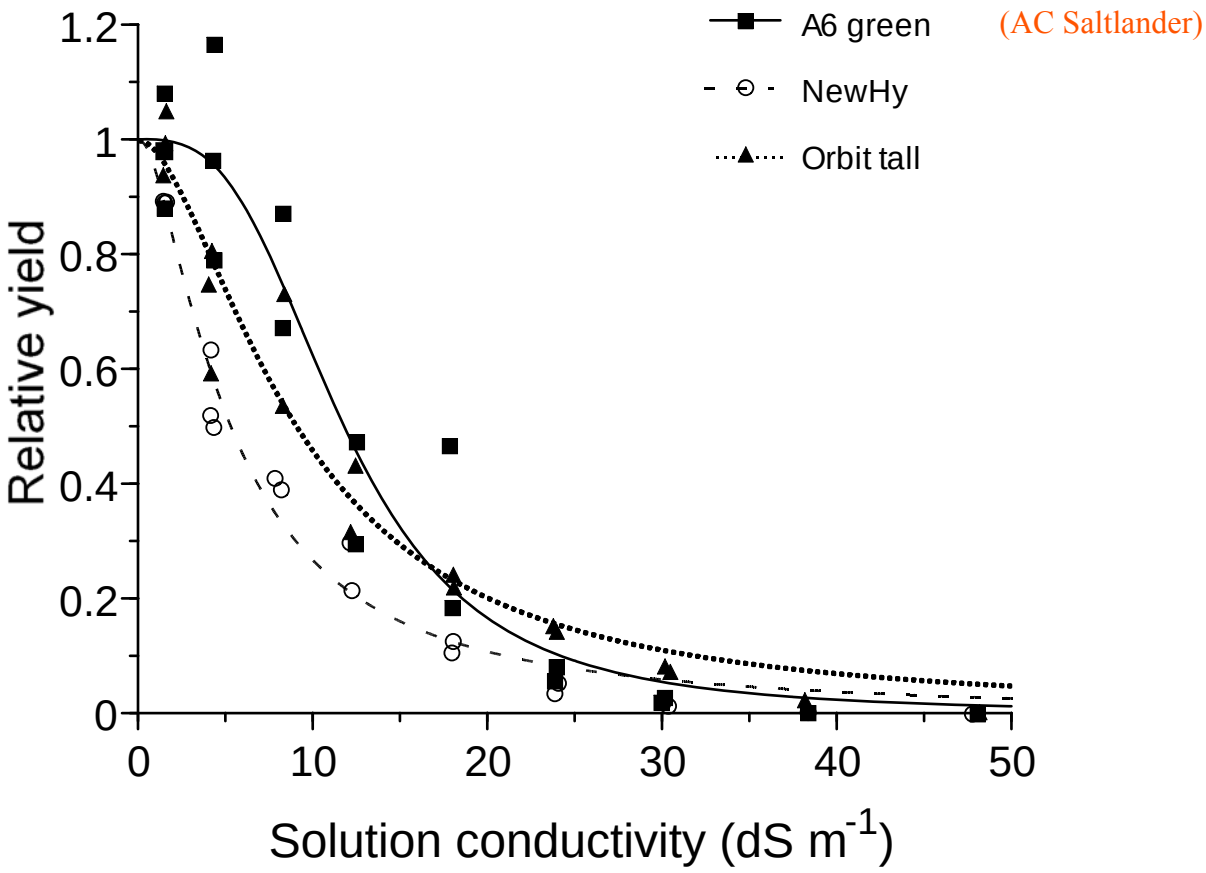

Figure 2. Relative above-ground biomass yield with increasing chloride salinity (solution electrical conductivity) for Orbit tall, NewHy, and Strain A6 green wheatgrasses. (Taken from Steppuhn and Asay, 2005)

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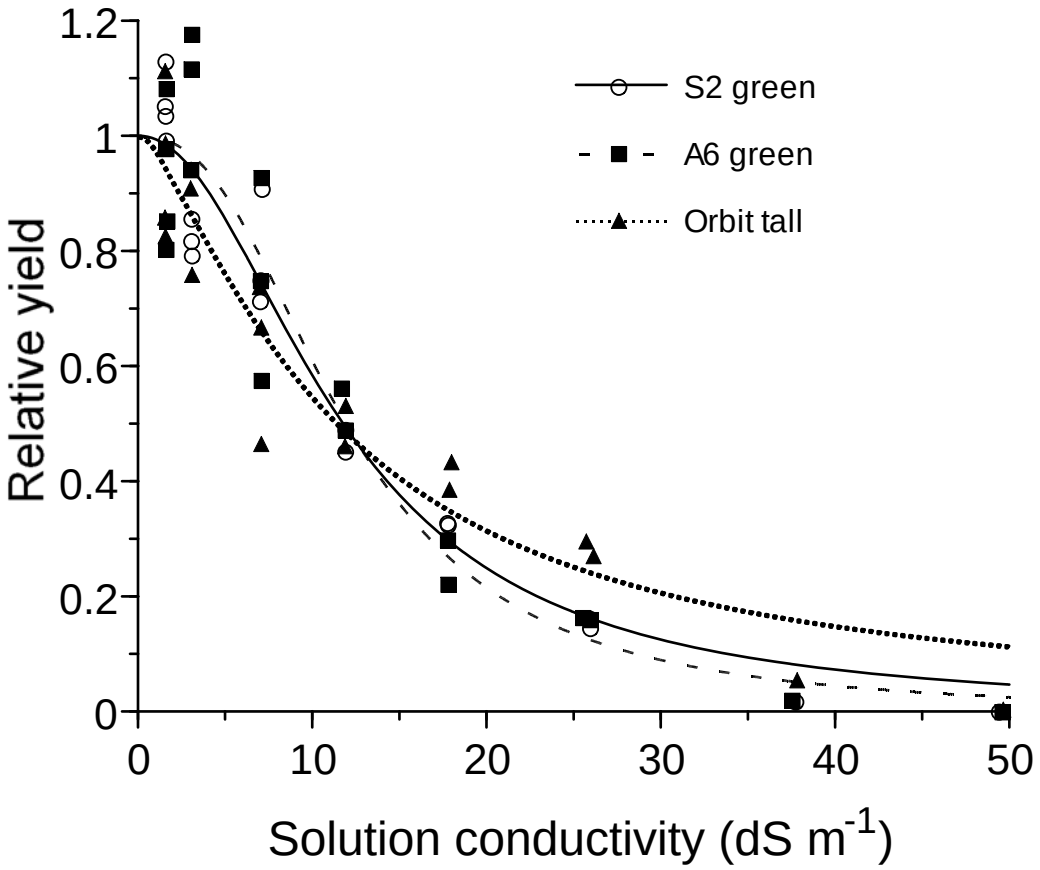

Figure 3. Relative above-ground biomass yield with increasing sulfate salinity (solution electrical conductivity) for Orbit tall, Strain A6, and Strain S2 green wheatgrasses. (Taken from Steppuhn and Asay, 2005)

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U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MD 20705

EXHIBIT C

OBJECTIVE DESCRIPTION OF VARIETY
WHEATGRASS

NAME OF APPLICANT (S)	TEMPORARY OR EXPERIMENTAL DESIGNATION	VARIETY NAME
Agriculture & Agri-Food Canada		AC Saltlander

ADDRESS *(Street and No. or RD No., City, State, Zip Code, and Country)*	FOR OFFICIAL USE ONLY
6000 C & E Trail Lacombe, Alberta T4L 1W1 CANADA	PVPO NUMBER #201000506

PLEASE READ ALL INSTRUCTIONS CAREFULLY: Place the appropriate number that describes the varietal character of this variety in the spaces below. Place a zero in the first space (e.g. 0 9 or 0 9 9) when number is either 99 or less or 9 or less respectively. Data for quantitative plant characters should be based on a minimum of 25 plants. Comparative data should be determined from varieties entered in the same trial. Royal Horticultural Society or an recognized color standard may be used to determine plant colors; designate system used:

_____

Please answer all questions for your variety; lack of response may delay progress of your application.

1. SPECIES

13 Common and Scientific Name:
green wheatgrass or RS-H natural hybrid wheatgrass
Elymus hoffmannii K.B. Jensen and K.A. Asay
(Reg. no. GP-8, PI 631392)
Germplasm release

1 = Fairway Crested Wheatgrass (*Agropyron cristatum*)
2 = Standard Crested Wheatgrass (*Agropyron desertorum*)
3 = Siberian Wheatgrass (*Agropyron fragile* ssp. *sibiricum*)
4 = Streambank Wheatgrass (*Elymus lanceolatus* ssp. *lanceolatus*)
5 = Slender Wheatgrass (*Elymus trachycaulus*)
6 = Tall Wheatgrass (*Elytrigia elongata*)
7 = Intermediate Pubescent Wheatgrass (*Elytrigia intermedia* ssp. *intermedia*)
8 =
9 = Thickspike Wheatgrass
10 = Western Wheatgrass (*pascopyrum smithii*)
11 = Beardless Wheatgrass(*Pseudoroegneria spicata* ssp. *inermis*)
12 = Bluebunch Wheatgrass (*Pseudoroegneria spicata* ssp. *spicata*)
13 = Other:
(Specify) Green wheatgrass

04 Interspecific Hybrid:
Elytrigia repens X Pseudoroegneria ssp. of Turkey

1 = *Agropyron cristatum* x *desertorum* = Crested Wheatgrass
2 = *Elytrigia repens* ssp. *repens* x *Pseudoroegneria spicata* = RS Wheatgrass
3 = *Pseudoroegneria spicata* x *Elymus lanceolatus*

03 Ploidy Level:

1 = 2n=2x 2 = 2n=4x 3 = 2n=6x 4 = 2n=8x

2. ADAPTATION

Geographical Region: Erzurum Province, Turkey; Western North America

Land Resource Areas: saline soils within an ECe range of 1 through 10 dS/m

03-05 USDA Plant Hardiness Zones: 3A through 5B

1 = 1 4 = 4 7 = 7 10 = 10
2 = 2 5 = 5 8 = 8 11 = 11
3 = 3 6 = 6 9 = 9

3. MATURITY

04 Relative Maturity:

1 = Very Early 2 = Early 3 = Medium Early 4 = Medium 5 = Medium Late 6 = Late 7 = Very Late

075 Days to Anthesis: 25 days before swathing at Latitude 49 degrees N

___ Number of Days Earlier. Name of Check Variety:_____

Same Number of Days. Name of Check Variety: 'Chief' intermediate wheatgrass

07 Number of Days Later. Name of Check Variety: standard crested wheatgrass

4. PLANT

076 Plant Height in centimeters (cm) "Newly identified crop"

___ Number of cm Shorter. Name of Check Variety:_____

Same Height. Name of Check Variety:_____

04 Number of cm Taller. Name of Check Variety: wild quackgrass

01 Growth Habit: 1 = Erect 2 = Semi-Erect 3 = Prostrate

01 Rhizomes: 1 = Present 2 = Absent

01 Culm Pubscence: 1 = Blabrous 2 = Pubescent 3 = Partial 4 = Variable

02 Culm Claucosity: 1 = Glaucous 2 = Non-Glaucous 3 = Variable

5. LEAF

04 Leaf Color:

1 = Blue-Green 2 = Grey-Green 3 = Dark Green 4 = Green 5 = Light Green 6 = Yellow-Green 7 = Slate-Green 8 = Other: _____

Leaf Color Reference Number: 85-255-128 HSL ~~Hue-Sat-Lum~~ #255 green from Microsoft Power Point Color Chart

01 Leaf Pubsecence: 1 = Glabrous 2 = Pubescent 3 = Partial 4 = Variable

02 Leaf Glaucosity: 1 = Glaucous 2 = Non-Glaucous 3 = Variable

01 Leaf Margin: 1 = Smooth 2 = Toothed

017 Leaf Length in centimeters. (Flag leaf) "Newly identified crop"

___ Number of cm Shorter. Name of Check Variety:_____

Same Length. Name of Check Variety:_____

___ Number of cm Longer. Name of Check Variety:_____

075 Leaf Width in millimeters (mm). "Newly identified crop"

___ Number of mm Narrower. Name of Check Variety:_____

Same Width. Name of Check Variety:_____

___ Number of mm Wider. Name of Check Variety:_____

01 Sheath Auricles: 1 = Present 2 = Absent

01 Sheath Margins: 1 = Smooth 2 = Toothed

01 Sheath Ligule: 1 = Present 2 = Absent

6. SPIKE (Please note the decimal point)

01 Spike Shape: 1 = Oblong 2 = Tapering 3 = Clavate 4 = Elliptical

01 Spike Orientation: 1 = Erect 2 = Semierect 3 = Drooping

01 Anther Color: 1 = Yellow 2 = Red 3 = White 4 = Green 5 = Purple 6 = Other (Specify) _____

6. SPIKE (Continued)

03 Glume Color: 1 = Green 2 = Grey-Green 3 = Yellow 4 = Tan 5 = Tawny 6 = Buff 7 = Other (Specify) _____

10.4 Spike Length in Centimeters.

02 Spike Density: 1 = Lax 2 = Laxidense 3 = Dense

01 Glume Shape: 1 = Lanceolate 2 = Obovate 3 = Ovate

7. SEED (Please note the decimal point)

08 Glume Length in Millimeters.

Glume Color: yellow

10.6 Lemma Length in Millimeters.

Glume Awn (Descriptors): 2mm

01.2 Lemma Width in Millimeters.

1 mm longer than quackgrass

03 Lemma Pubescence: 1 = Pubescent 2 = Partial 3 = Glabrous

05 Lema Awn Size: 1 = Very Short 2 = Short 3 = Medium Short 4 = Medium 5 = Medium Long 6 = Long 7 = Very Long

3650 Seed Weight in Milligrams per 1000 Seeds.

8. DISEASE AND PEST RESISTANCE: 1 = Suseptible 2 = Resistant 3 = Tolerant 4 = Avoidance 0 = Not Tested

02 Leaf Rust (*Uromyces dactylidis*)

02 Stripe Rust (*Puccinia striiformis*)

00 Black Grass Bug

00 Pacific Grass Bug

04 Stem Rust (*Puccinia graminis* ssp. *graminicola*)

___ Other Disease(s) _____

00 Grass Billbug

00 Nematode(s) (please specify species) _____

9. INTENDED USE: (Please indicate all that apply)

X Hay and Pasture

___ Range Reseeding

X Conservation Cover

X Erosion Control

___ Silage/Green Manure

X Wildlife Habitat Plantings

X Saline/Alkaline Soil Stabilization

___ Other (Specify) _____

10. COMMENTS:

A "newly identified crop" very similar to quackgrass and NewHy, from Registered RS-H Hybrid Wheatgrass Germplasm described in Crop Science, Vol. 43, pages 1139-1140 (2003).

Exhibit C DESCRIPTION OF AC SALTLANDER

'AC Saltlander' is the first cultivar of green wheatgrass (*Elymus hoffmannii* Jensen & Asay) specifically selected in Canada to tolerate root-zone salinity. Following collaboration with the United States Agricultural Research Service, researchers at the Semiarid Prairie Agricultural Research Centre (SPARC) further developed this palatable, perennial, hybrid forage grass by incorporating exceptional salinity tolerance.

'AC Saltlander' originated from seed collected in Turkey by United States Department of Agricultural (USDA) scientists. Plants from these seeds were grown in a nursery near Logan, Utah, where researchers at the USDA Forage and Range Research Laboratory selected desirable parents to obtain caespitose growth. In a collaborative project, selected germplasm of this natural hybrid was made available to the Semiarid Prairie Agricultural Research Centre (SPARC), Agriculture and Agri-Food Canada (AAFC) for salt-tolerance testing and improvement. A series of mass selection breeding cycles was conducted at Swift Current, where the resulting plants were evaluated for resistance to root-zone salinity, winter hardiness, and desirable plant morphology, including uniform plant color, vegetative vigor, leafiness, seed-set, and freedom from plant pests. The progenies from each cycle were cloned into duplicate plants, one of which was transported to the Agricultural Research Service Laboratory in Utah, and the second intercrossed to develop AC Saltlander, a palatable forage with salinity tolerance equal to that of tall wheatgrass [*Thinopyrum ponticum* (Podp.) Lui & Wang].

In (1996), Jensen and Asay determined that natural hybrids between Eurasian bluebunch wheatgrasses [*Pseudoroegneria strigosa* (M. Bieb.) A. Löve, *P. geniculata* (Trin.) A. Löve, *P. stipifolia* (Czern. Ex Nevski) A. Löve] and quackgrass [*Elymus repens* (L.) Gould] belong to a new species. Green wheatgrass AC Saltlander descended from seed collected in Turkey as one such fertile, natural Eurasian hybrid. Green wheatgrass differs morphologically and expresses a separate genetic pedigree from quackgrass, although seed from the two are similar in appearance.

Exhibit D ADDITIONAL DESCRIPTION OF AC SALTLANDER

Performance

Precursor strains of RS-H and Saltlander green wheatgrass were grown in a co-operative dryland forage trial at Swift Current from 1996 to 2000. The Swift Current trial included 20 other cultivars of crested wheatgrass [*Agropyron cristatum* (L.) Gaertner], Altai wild ryegrass [*Leymus angustus* (Trin.) Pilger], tall fescue (*Schedonorus arundinacea* Dumort. syn. *Festuca arundinacea* Schreber), and other species. Of these, only 'Kirk' crested wheatgrasses produced more forage than the RS-H plants (Table 6). The 5-year dry-forage yield of RS-H tended to average 10% greater than that of 'Swift' Russian wild ryegrass [*Psathyrostachys juncea* (Fisch.) Nevski]. In a more recent Swift Current trial, the yield of the 3rd–cycle strain of Saltlander forage hay and simulated pasture (clipped whenever the crop height reached approximately 18 cm) produced in 2001 showed no statistical differences from that of 'Carlton' smooth bromegrass [*Bromus inermis* (L.) Leyss.] (Table 7). Once established, AC Saltlander plants showed good recovery following the simulated, repeated, moderate grazing.

Forage Quality

The forage quality of AC Saltlander grown in negligibly to slightly saline soil during 2001 and 2002 at Swift Current was evaluated in feed laboratory analyses and averaged. In measures of organic matter, organic matter digestibility, crude protein, potassium, total phosphorus, calcium, magnesium, and sulfur concentrations, the green wheatgrass forage tended to show slightly lower or equal values than those for Carlton smooth bromegrass (Table 8). For iron, neutral and acid detergent fiber, the green wheatgrass tended to register slightly higher values. These trends

existed whether the forage was cut for hay (two cuts per year at the heading stage) or clipped (3 to 4 cuts per year) to simulate a pasture. Although green wheatgrass begins growth early in the spring, it remains more succulent and palatable for livestock for longer periods in the growing season than most other wheatgrasses, giving rise to its common name.

Table 6. Dry-matter forage yield and standard error (se) from three grasses[1] grown in a dryland field trial during 1996-2000 at Swift Current, Saskatchewan, Canada.

	Dry matter forage yields ±se		
Year	Kirk (g/m^2)	Swift (g/m^2)	RS-H (g/m^2)
1996	406	191	392 ±72
1997	590	433	450 ±83
1998	254	256	150 ±42
1999	408	309	334 ±72
2000	150	114	109 ±39
Mean	361	260	287 ±46
% of Swift	139	100	110

[1] Grasses: 'Kirk' crested wheatgrass
'Swift' Russian wild ryegrass
RS-H hybrid wheatgrass, early strain

Table 7. Mean dry-forage yield and ±standard error for 'Carlton' smooth bromegrass and 'AC Saltlander' green wheatgrass harvested as hay (when heading) and as simulated pasture[1] in negligibly to slightly saline soil (ten replicates) at Swift Current, Saskatchewan, Canada during 2001.

Harvest	Cultivar		Difference[2]
	Carlton smooth bromegrass	AC Saltlander green wheatgrass	
	---------- g m^{-2} ----------		
Hay	480 ±23.1	442 ±22.3	ns
Simulated Pasture	321 ±16.8	315 ±16.4	ns

[1] Clipped when vegetative height exceeded 18 cm.
[2] ns = yields are not significantly different between cultivars at $p_{\alpha} < 0.05$.

Table 8. Mean forage quality and ±standard error from analyses of shoot biomass obtained for 'Carlton' smooth bromegrass and 'AC Saltlander' green wheatgrass grown as forage hay (cut at heading stage) and simulated pasture (vegetative stage) in negligibly to slightly saline soils during 2001 and 2002 at Swift Current, Saskatchewan; shown as averages for the two years.

Analysis	Cultivar			
	Carlton smooth bromegrass		AC Saltlander green wheatgrass	
	Hay	Pasture	Hay	Pasture
	---------- (%) ----------			
Organic matter	88.5 ±0.64	85.8 ±0.78	88.0 ±0.66	85.7 ±0.41
Organic matter digestibility	62.0 ±1.43	69.3 ±0.93	61.8 ±1.04	67.2 ±0.57
Crude protein	16.5 ±0.61	19.5 ±0.58	15.1 ±0.73	18.8 ±0.37
Potassium	2.80 ±0.14	3.80 ±0.11	2.70 ±0.12	3.00 ±0.06
Total phosphorus	0.24 ±0.01	0.27 ±0.10	0.20 ±0.01	0.25 ±0.01
Calcium	0.34 ±0.02	0.43 ±0.02	0.40 ±0.02	0.41 ±0.01
Magnesium	0.25 ±0.02	0.27 ±0.02	0.22 ±0.01	0.24 ±0.01
Sulfur	0.27 ±0.01	0.28 ±0.01	0.22 ±0.01	0.24 ±0.01
Iron	0.05 ±0.01	0.08 ±0.01	0.06 ±0.01	0.09 ±0.01
Neutral detergent fiber	51.5 ±1.34	46.2 ±1.22	52.6 ±1.22	47.2 ±0.72
Acid detergent fiber	28.7 ±0.88	24.9 ±0.67	29.4 ±0.84	25.2 ±0.41

Weed Suppression

The ability of AC Saltlander green wheatgrass plants to tolerate saline soils suggests growing these forage perennials to suppress invasive weeds such as foxtail barley (*Hordeum jubatum* L.) and downy brome (*Bromus tectorum* L.), growing in saline sites. Two such Canadian sites were seeded in 2006 in a trial of ten suppressor-crop treatments:

* Saltmaster seed blend, Proven Seed
* AC Rocket smooth bromegrass (SBG)
* Spredor 4 alfalfa
* AC Saltlander green wheatgrass, 12-inch row spacing (GWG-30)
* AC Saltlander green wheatgrass, 6-inch row spacing (GWG-15)
* Nuttall's salt-meadow grass
* Polar northern wheatgrass (NWG)
* Slender and green wheatgrass (SWG & GWG in alternating rows, 6-inch spacing)
* Poole western wheatgrass (WWG)
* Orbit tall wheatgrass

All treatments were replicated in six random plots per treatment and compared to 12 randomized un-seeded control plots at each of two sites: (1) near Warner, Alberta, Canada and (2) near Oyen, Alberta, Canada.

Six subplots per plot (36 per treatment with 72 control subplots) at each site were hand-harvested at the time of optimum forage production in 2008 (following three growing seasons). Above-ground (shoot) biomass averaged by treatment at Warner indicated success with the AC Saltlander GWG and tall wheatgrass treatments, followed by the smooth bromegrass and the Saltmaster blend; the northern and western wheatgrass treatments seemed slower in weed suppression; the Nuttall's salt-meadow grass failed to emerge; and the alfalfa treatment encountered difficulty in controlling thistle weeds (Figure 4). At Oyen, the July 2008 above-ground (shoot) biomass averaged the most for the AC Saltlander treatments followed by the Saltmaster blend, the smooth bromegrass, the tall wheatgrass, and the alfalfa treatments (Figure 5). The foxtail barley shoot biomass exceeded those from the suppressor forages in the

remaining treatments. In conclusion, based on these results, AC Saltlander possesses the ability to suppress foxtail barley growing in slightly through moderately saline soils.

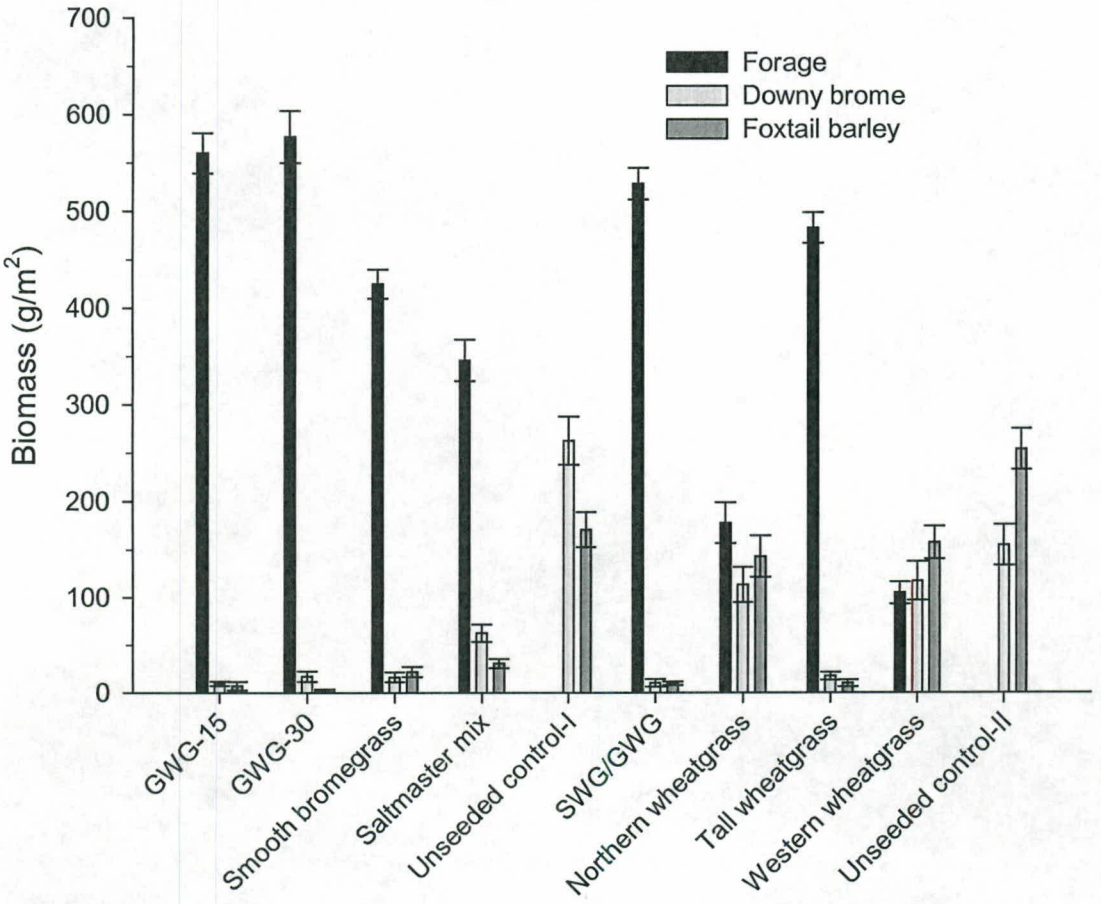

Figure 4. Mean above-ground biomass for suppressor forages and weeds by treatments at the Warner Site, June 24-26, 2008; soil salinity ranged from negligibly to initially severe. GWG = green wheatgrass, 15 & 30 cm row spacings; SWG = slender wheatgrass

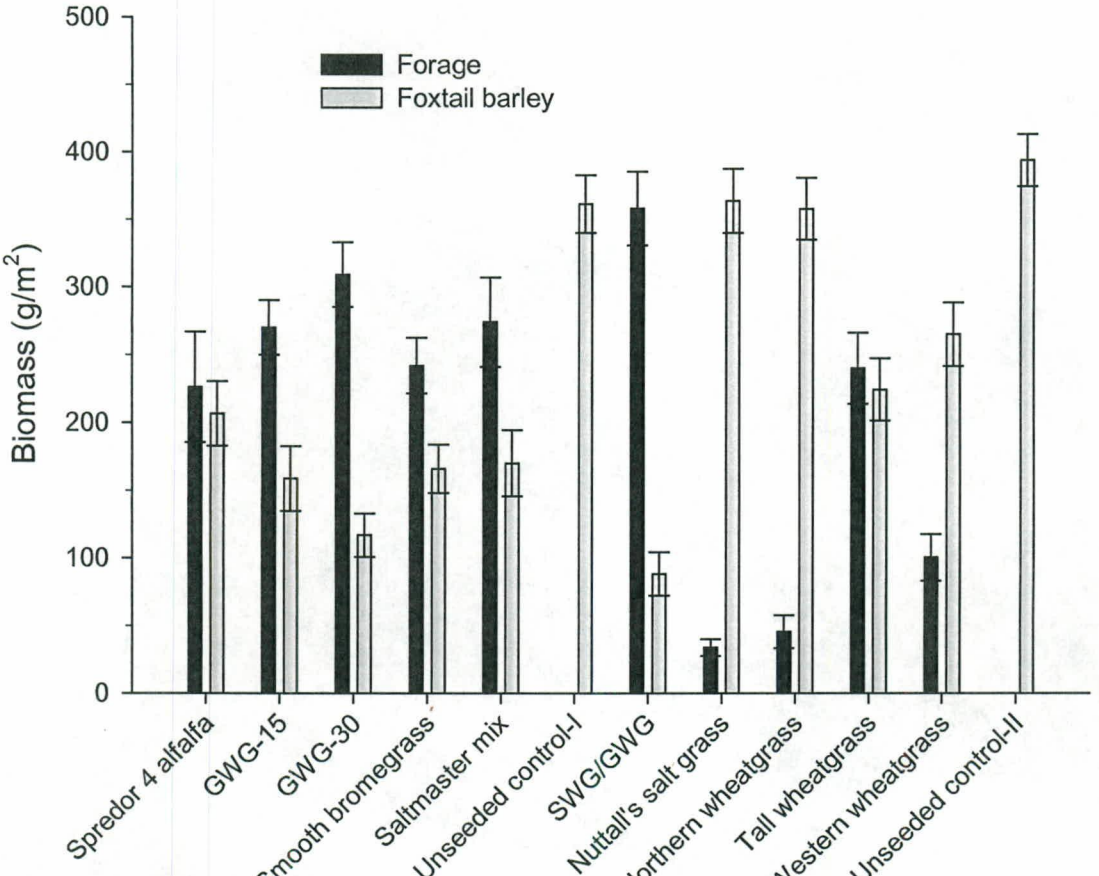

Figure 5. Mean above-ground biomass for suppressor forages and weeds by treatments at the Oyen Site, July 7-9, 2008; soil salinity ranged from negligibly to initially severe. GWG = green wheatgrass, 15 & 30 cm row spacings; SWG = slender wheatgrass

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U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

Application is required in order to determine if a plant variety protection certificate is to be issued *(7 U.S.C. 2421)*. The information is held confidential until the certificate is issued *(7 U.S.C. 2426)*.

1. NAME OF APPLICANT(S)

Agriculture and Agri-Food Canada

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER

3. VARIETY NAME

AC Saltlander

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP, and Country)*

6000 C & E Trail
Lacombe, Alberta
T4L 1W1
Canada

5. TELEPHONE *(Include area code)*

(403)782-8126

6. FAX *(Include area code)*

(403)782-6120

7. PVPO NUMBER

#201000506

8. Does the applicant own all rights to the variety? Mark an "X" in the appropriate block. **If no, please explain.** ☒ **YES** ☐ **NO**

9. Is the applicant a U.S. national or a U.S. based entity? **If no, give name of country.** ☐ **YES** ☒ **NO**

Canada

10. Is the applicant the original owner? ☒ **YES** ☐ **NO** **If no, please answer one of the following:**

a. If the original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. National(s)?
☐ **YES** ☐ **NO** **If no, give name of country**

b. If the original rights to variety were owned by a company(ies), is (are) the original owner(s) a U.S. based company?
☐ **YES** ☐ **NO** **If no, give name of country**

11. Additional explanation on ownership *(Trace ownership from original breeder to current owner. Use the reverse for extra space if needed)*:

Dr. J. Grant McLeod, the breeder of record, and Dr. Harold Steppuhn, who developed AC Saltlander green wheatgrass, were in the employ of Agriculture and Agri-Food Canada when the mass-selections were made and have been continuously so employed since then. As Crown employees, as per Section 3 of the Public Servants Inventions Act P-32 of Canada all inventions made by public servants acting within the scope of their duties belong to Her Majesty the Queen in Right of Canada. Management of inventions owned by the Crown is delegated to government departments and to individuals who have been authorized to sign on behalf of the Crown.

PLEASE NOTE:

Plant variety protection can only be afforded to the owners (not licensees) who meet the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.
2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.
3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed the final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definitions.

Exhibit E BASIS OF OWNERSHIP

As a hybrid crop-type, green wheatgrass is not subject to variety registration in Canada. However, AC Saltlander was granted a "Certificate for Eligibility of Certification" (Number: 617-2003) by the Canadian Seed Growers' Association, April 19th, 2004).

Breeder seed of AC Saltlander is maintained by the Semiarid Prairie Agricultural Research Centre, Agriculture and Agri-Food Canada, Swift Current, Saskatchewan, Canada S9H 3X2. Multiplication and distribution of pedigreed seed is being carried out by MK Miller Seeds Limited, P.O. Box 87, Milk River, Alberta, Canada T0K 1M0. A license agreement exists between the Government of Canada and MK Miller Seeds Limited which requires that all seed of AC Saltlander be sold only as "Certified Seed."

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MD 20705

EXHIBIT F
DECLARATION REGARDING DEPOSIT

NAME OF OWNER (S)	ADDRESS *(Street and No. or RD No., City, State, and Zip Code and Country)*	TEMPORARY OR EXPERIMENTAL DESIGNATION
Agriculture and Agri-Food Canada	6000 C & E Trail Lacombe, Alberta T4L 1W1 Canada	**VARIETY NAME** AC Saltlander
NAME OF OWNER REPRESENTATIVE (S)	**ADDRESS** *(Street and No. or RD No., City, State, and Zip Code and Country)*	**FOR OFFICIAL USE ONLY**
Ann de St. Remy	6000 C & E Trail Lacombe, Alberta T4L 1W1 Canada	**PVPO NUMBER** #201000506

I do hereby declare that during the life of the certificate a viable sample of propagating material of the subject variety will be deposited, and replenished as needed periodically, in a public repository in the United States in accordance with the regulations established by the Plant Variety Protection Office.

Breeder: Dr. Grant J. McLeod
Contact Info: PO Box 1030
Swift Current, SK.
S9H 3X2
Canada
Phone (306) 778-7240
Fax (306) 778-3188

Signature

August 18, 2010
Date