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Registration of 'NU-ARS AC2' Crested Wheatgrass

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Cowpea aphid-borne mosaic virus (CABMV), and bacterial blight [caused by *Xanthomonas campestris* pv. *vignicola* (Burkholder) Dye], and has early maturity. Yacine is adapted for dry grain production under rainfed conditions in the Sahelian Zone of northern Senegal where the annual monomodal rainfall provides 200–400 mm per growing season. Yacine is not recommended for zones where flower thrips (*Megalurothrips sjostedti* Trybom) are prevalent, such as those zones with higher rainfall, since it is more susceptible to flower thrips than 'Melakh'.

Yacine was derived from the cross 86-5-2/Melakh which was made in 1989. The line 86-5-2 is a selection from the landrace 'Mame Penda' (Sène, 1966; Cissé and Hall, 2003) which is widely grown in northern Senegal. Farm families prefer Mame Penda for its desirable grain qualities (color, taste, and size), and it has resistance to bacterial blight. Mame Penda is, however, susceptible to cowpea aphids and CABMV. Melakh (Cissé et al., 1997) is also grown in northern Senegal and flowers and matures earlier than Mame Penda. Melakh has resistance to cowpea aphid, CABMV, and bacterial blight. Single plant selections for resistance to mosaic virus and bacterial blight were made in 1990–1991 at the F_2, F_3, and F_4 under artificial inoculation. The F_5 was included in a preliminary yield trial under the designation ISRA-819 during the 1991 growing season and was bulk harvested. A single F_6 plant that had no infestation of cowpea aphid and no symptoms of mosaic virus or bacterial blight under field conditions was selected based on various seed qualities and earliness from an observational nursery in 1998. Reselection for resistance to cowpea aphid was made under artificial infestation at F_7. F_8 seeds of resistant plants were bulked and introduced in yield trials in Senegal from 1999 through 2003. Tests were conducted at two sites (Bambey and Thilmakha) per year and at 50 on-farm sites from 2001 to 2003. Selection for uniform seed color was made at F_{10}. The resulting lines were bulked as Breeder seed of Yacine.

Yacine is erect and belongs to the same maturity group as Melakh, whereas Mame Penda has an indeterminate growth habit and a greater biomass production. Under well-watered conditions Yacine reaches physiological maturity 62 d after sowing, whereas Mame Penda reaches maturity at 75 d. Yacine produced 40% more grain (1434 kg ha^{-1}) than Mame Penda (1020 kg ha^{-1}) and had similar grain yield as Melakh. Yacine produced less hay (dry shoot biomass minus pods) than either Mame Penda or Melakh. Seeds of Yacine are brown with a small, white eye and are larger (23 g 100 seed^{-1}) than those of Mame Penda (18 g 100 seed^{-1}) and Melakh (19 g 100 seed^{-1}). On-farm yields of Yacine in pure culture were similar to those of Melakh (750 kg ha^{-1}) and 30% greater than those of Mame Penda (580 kg ha^{-1}). Grain taste of Yacine has been rated superior to that of Melakh and Mame Penda by farm families.

Breeder seed will be maintained by ISRA at the Center National de Recherches Agronomiques, BP53 Bambey, Senegal.

N. Cissé,* M. Ndiaye, and A. Sène

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Registration of 'Beefmaker' Intermediate Wheatgrass

'Beefmaker' intermediate wheatgrass [*Elytrigia intermedia* (Host) Nevski subsp. *intermedia* = *Thinopyrum intermedium* subsp. *intermedium* (Host) Barkw. & D.R. Dewey] (Reg. no. CV-26, PI 634505) is a broadly adapted cultivar that produces forage with high in vitro dry matter digestibility (IVDMD) and high protein concentration in the tall, mid-grass, and short-grass ecoregions of the central Great Plains, USA. It was released in January 2003 by the USDA, Agricultural Research Service and the Agricultural Research Division, Institute of Agricultural and Natural Resources, University of Nebraska. Beefmaker was tested as NE TI1 C1.

Beefmaker intermediate wheatgrass was developed from six plant introductions (PI 345586, PI 273733, PI 273732, PI 315353, PI 315067, and PI 3155355) that were identified as having superior agronomic performance in the central Great Plains in a germplasm evaluation (Vogel, 1980). Approximately 40 plants from each PI strain were subdivided into ramets and were transplanted into separate, isolated polycross nurseries in 1978 at the University of Nebraska's Agricultural Research and Development Center near Ithaca, NE, where all subsequent selection and polycross research was conducted. Seed was harvested in bulk in 1979 from each of the polycross nurseries. This seed was used to establish space-transplanted selection nurseries in 1980 for each strain using greenhouse grown seedlings. Each selection nursery contained approximately 1000 plants. In 1981, approximately 100 plants were visually selected in each nursery for forage yield, leafiness, erectness, and absence of diseases by using a modified form of restricted recurrent phenotypic selection (RRPS) (Burton, 1974). The visually selected plants were harvested for forage yield and sampled for IVDMD analysis. A selection index that equally weighted forage yield and IVDMD was used to select 20 plants from each population (total of 120 plants). Two ramets of each of the 120 plants were transplanted into an isolated polycross nursery in 1983. Seed was harvested from individual plants in 1984 and equally bulked to form experimental strain NE TI1. This Syn 1 seed was used to establish a seeded nursery in 1985 for the production of Syn 2 seed which was used to initiate the first cycle of selection for the synthesized population.

A space-transplanted selection nursery containing 1100 plants was established in 1987 using greenhouse grown seedlings started with Syn 2 seed. A modified form of RRPS was used on this selection nursery. Three hundred plants were visually selected for harvest in 1988. These plants were harvested on an individual plant basis after spike emergence and were analyzed for IVDMD. A selection index was again used to identify plants with both superior yield and IVDMD. Sixty-five plants were selected for polycrossing and were subdivided into two ramets each and transplanted into an isolated polycross nursery in 1991. Seed harvested from this nursery was designated NE TI1 C1 Syn 1, and it was used to establish regional tests and a 400 m^2 increase nursery in 1999 which produced 18.6 kg of Breeder seed in 2000.

Beefmaker was tested across several ecoregions (Bailey, 1995) in the central Great Plains, specifically at the following

sites: Prairie (Ithaca, NE), Steppe (Hays, KS), and Dry Steppe (Sidney, NE, and Cheyenne, WY) during the period 1993–1995. Beefmaker had the highest IVDMD and protein concentration averaged over ecoregions. Beefmaker forage averaged 7–20 g kg^{-1} greater IVDMD than forage of other released cultivars of intermediate wheatgrass in these trials. Beefmaker forage yields were lower than the yields of 'Haymaker' but were similar to yields of other released cultivars of intermediate wheatgrass. The improved forage quality of Beefmaker was stable across a wide array of ecoregions. In a previous grazing trial with intermediate wheatgrass at Ithaca in which Beefmaker's parent strain, NE TI1, was included, a one percentile or 10 g kg^{-1} increase in IVDMD resulted in a 25 kg ha^{-1} improvement in total gains of beef yearling stockers (Moore et al., 1995; Casler and Vogel, 1999). Beefmaker will be recommended for use in pastures in the central Great Plains for growing beef cattle.

Beefmaker has an erect growth habit and has rhizomes typical of intermediate wheatgrass. Its culms and leaves are glabrous and non-glacuous and leaf margins are smooth. Leaves are green-yellow or Munsell 5GY 5/4 (Munsell Color, 1977). Sheaths have ligules, very small auricles, and smooth sheath margins. Spikes are oblong, erect, and have green, lanceolate glumes. Spike density is lax. Anthers are yellow. At 41° N lat. in the central Great Plains, Beefmaker is at anthesis during the last week of June. In swards at Ithaca, its spike and flag leaf height are about 5 and 3 cm, respectively, shorter in height than the intermediate wheatgrass cultivars Luna, Manska, Reliant, and Oahe. Beefmaker is adapted to USDA Plant Hardiness Zones 3, 4, and 5.

Breeder seed will be jointly maintained and produced as needed by USDA-ARS and the University of Nebraska-Lincoln with random-mated isolations based on the Syn 2 Breeder seed produced in 2000. Foundation seed production of Beefmaker will be managed by the Nebraska Foundation Seed Division, University of Nebraska–Lincoln, Lincoln, NE 68583. Foundation seed will be made available for Certified seed production on a non-exclusive basis to seed producers who contractually agree to produce and market the seed only as Certified seed using the cultivar name Beefmaker. A technology development and transfer fee will be assessed by the University of Nebraska. Seed of this release will be deposited in the National Plant Germplasm System (USDA-ARS, 2004) where it will be available for research purposes. Limited amounts of seed for research purposes will be provided on written request to the corresponding author. Recipients are asked to recognize the source if it contributes to the development of a cultivar or germplasm or is used for other research purposes. Application for U.S. Plant Variety Protection is pending.

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Registration of 'Haymaker' Intermediate Wheatgrass

'Haymaker' intermediate wheatgrass [*Elytrigia intermedia* (Host) Nevski subsp. *intermedia* = *Thinopyrum intermedium* subsp. *intermedium* (Host) Barkw. & D.R. Dewey] (Reg. no. CV-27, PI 634506) is a broadly adapted cultivar that produces high, stable forage yields when used for cool-season grass hay production or for pastures in the tall, mid-grass, and short-grass ecoregions of the central and northern Great Plains. It was released in April 2003 by USDA-ARS; Agricultural Research Division, Institute of Agricultural and Natural Resources, University of Nebraska-Lincoln; and USDA-NRCS. Haymaker was tested under the experimental designation NE TI3.

Haymaker is a synthetic cultivar or population produced by intermating selected plants from intermediate wheatgrass germplasm accessions and an adapted cultivar, Slate (Newell, 1974). The accessions originated from collections made by Douglas Dewey, USDA-ARS Plant Geneticist, in the former USSR in 1977. Three accessions with high forage yields, in vitro dry matter digestibility (IVDMD), and overall forage evaluation scores were identified. Superior plants in these accessions and from 'Slate' were identified prior to flowering in 1985 in an evaluation nursery at Mead, NE. All other plants were mowed and seed was harvested from the selected plants. The evaluation nursery had 20 plants of each accession. The accessions and the number of plants (in parentheses) selected from each accession were as follows: PI 440015 (15), PI 440008 (10), PI 440011 (17), and Slate (12). The harvested seed was used to establish an increase nursery of the strain designated NE TI3 in the fall of 1985. The increase nursery contained 1100 spaced plants which produced the Syn 2 seed of NE TI3 used to establish evaluation trials in the Great Plains.

Haymaker was tested across several ecoregions (Bailey, 1995) of the central and northern Great Plains at the following sites: Prairie (Mead, NE), Steppe (Hays, KS; Ft. Pierre, SD), Dry Steppe (Sidney, NE; Cheyenne, WY; Hettinger, ND) during the period 1990–1997. Haymaker had the greatest average forage yields at both the central and northern Great Plains sites when compared with released cultivars and other experimental strains of intermediate wheatgrass. The forage quality of Haymaker as measured by IVDMD and protein concentration is less than that of 'Beefmaker' (Vogel et al., 2005), but

is similar to that of other released cultivars of intermediate wheatgrass. Haymaker is recommended for dryland hay production in the central and northern Great Plains, USA in USDA Plant Hardiness Zones 3, 4, and 5 (Cathey, 1990).

Haymaker has an erect growth habit and has rhizomes typical of intermediate wheatgrass. Its culms and leaves are glabrous and non-glacuous, and leaf margins are smooth. Leaves are green-yellow or Munsell 5GY 5/4 (Munsell Color, 1977). Sheaths have ligules, auricles are usually absent, and sheath margins are smooth. Spikes are oblong, erect, and have green, lanceolate glumes. Spike density is lax. Anthers are yellow. At 41° N lat. in the central Great Plains, Haymaker has anthesis the last week of June. The spike height of Haymaker varies with environment but is typically taller than other intermediate wheatgrasses and has a wider flag leaf.

Breeder seed will be jointly maintained and produced as needed by USDA-ARS and the University of Nebraska-Lincoln with random-mated isolations based on the Syn 2 seed used in evaluation trials. Foundation seed production of Haymaker will be managed by the Nebraska Foundation Seed Division, University of Nebraska-Lincoln, Lincoln, NE 68583. Foundation seed will be made available for Certified seed production on a non-exclusive basis to seed producers who contractually agree to produce and market the seed only as Certified seed using the cultivar name Haymaker. A technology development and transfer fee will be assessed by the University of Nebraska.

Limited amounts of seed for research purposes will be provided upon written request to the corresponding author. Recipients are asked to recognize the source if it contributes to the development of a cultivar or germplasm or is used for other research purposes. U.S. Plant Variety Protection will be sought for Haymaker.

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Registration of 'NU-ARS AC2' Crested Wheatgrass

'NU-ARS AC2' crested wheatgrass [*Agropyron cristatum* (L.) Gaertn.–*A. cristatum* var. *pectinatum* (M. Bieb.) Tzvelev] (Reg. no. CV-28, PI 634507) is a broadly adapted, complex composite population produced by allowing selected plants from fairway-type germplasm accessions to randomly intermate. It originates from collections made by Douglas Dewey, USDA-ARS Plant Geneticist, in the former USSR in 1977. It was released in September 2002 by USDA-ARS; Agricultural Research Division, Institute of Agricultural and Natural Resources, University of Nebraska-Lincoln; and the USDA-NRCS. NU-ARS AC2 was tested under the experimental designation NE AC2.

Seed of fairway-type crested wheatgrass accessions obtained from Dewey's collections were used to establish evaluation trials at Mead and Alliance, NE. Accessions were evaluated during the period 1979–1983 in space-transplanted evaluation trials. Four accessions with high forage yields, high in vitro dry matter digestibility (IVDMD), and overall superior forage evaluation ratings were identified. Superior plants of these accessions were visually selected in the evaluation nursery at Mead, NE, in 1985 prior to anthesis. All non-selected plants in the evaluation nursery were mowed prior to anthesis and seed was harvested and bulked from the selected plants. The Dewey accessions and the numbers of plants selected from each accession to form NU-ARS AC-2 were as follows: D-1458 (18), D-1462 (6), D-1610 (13), and D-1654 (9). The Dewey accessions have been entered into the USDA Plant Germplasm System. D-1458 was a single plant collection (D.R. Dewey, personal communication, 1980) which was combined with D-1457 to form PI 440062. D-1462 was a bulk collection and assigned PI 439922. Both PI 440062 and PI 439922 are fairway-like in appearance and were collected from a site 52 km southeast of Stavropol, Russia. PI 440062 has subsequently been classified as *A. cristatum* var. *pectinatum* and is a tetraploid. D-1610 was assigned PI 439926 and D-1654 was assigned PI 439929. PI 439926 and PI 439929 were classified as *A. cristatum*. PI 439926 was collected on a seeded site near Stavropol, Russia and believed to be the cultivar Krasnokovskii 305 (D.R. Dewey, personal communication, 1980). PI 439929, a diploid, was collected about 50 km southeast of Svetlograd, Russia. Bulked seed from selected plants was used to establish an increase nursery in the fall of 1985 at Mead, NE. Seed harvested from the increase nursery (Syn 2 generation) produced the synthesized population, NE AC2, which was used to plant evaluation trials.

NU-ARS AC2 was tested across several eco-regions (Bailey, 1995) in the Central and Northern Great Plains at the following sites; Prairie (Mead, NE), Steppe (Hays, KS; Ft. Pierre, SD), Dry Steppe (Sidney, NE; Cheyenne, WY; Hettinger, ND) during the period 1990–1997. In both the Central and Northern Plains locations, NU-ARS AC2 had greater average forage yields than the other fairway-type crested wheatgrass entries and was equivalent to the best standard crested wheatgrass cultivars. The in vitro dry matter digestibility (IVDMD) and protein content of NU-ARS AC2 was similar to that of the other strains and cultivars evaluated. Seed yields were 200 and 260 kg ha^{-1} in 2000 and 2001, respectively, under rainfed conditions at Mead, NE.

NU-ARS AC2 has an erect, caespitose growth habit typical of crested wheatgrasses. Its culms and leaves are glabrous and non-glacuous, and leaf margins are smooth. Leaves are green-

yellow or Munsell 5GY 4/4 (Munsell Color, 1977). Sheaths have ligules, sheath margins are smooth, and auricles are absent. Spikes are dense, tapering, erect, and have green, lanceolate, awned glumes. At 41° N lat. in the central Great Plains, NU-ARS AC2 heads the last 10 d of May. Approximately 95% of the plants in a population of NU-ARS AC2 are diploids, the remainder are tetraploids. No triploids were identified in almost 100 seedlings produced from Breeder seed. Although NU-ARS AC2 is genetically heterogeneous, it is similar in phenotypic uniformity to other fairway-type crested wheatgrasses. It is typically about 3–5 cm taller in height than *A. cristatum* cultivars such as Fairway or Parkway and 10 to 12 cm in height shorter than *A. desertorum* or standard crested wheatgrass cultivars such as HyCrest and Nordan. Spike length is shorter and spike width is greater than standard crested wheatgrass cultivars. NU-ARS AC-2 is adapted to USDA Plant Hardiness Zones 3, 4, and 5 (Cathey, 1990).

Breeder seed will be jointly maintained and produced as needed by USDA-ARS and the University of Nebraska-Lincoln with random mated isolations based on the Syn 2 Breeder seed. Foundation seed production of NU-ARS AC2 will be managed by the Nebraska Foundation Seed Division, University of Nebraska-Lincoln, Lincoln, NE 68583. Foundation seed will be made available for Certified seed production on a nonexclusive basis to seed producers who contractually agree to produce and market the seed only as Certified seed using cultivar name NU-ARS AC2. A fee for technology development and transfer will be assessed by the University of Nebraska. Limited amounts of seed for research purposes will be provided upon written request to the corresponding author. Recipients are asked to recognize the source if it contributes to the development of a cultivar or germplasm or is used for other research purposes. U.S. Plant Variety Protection will be sought for NU-ARS AC2.

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Registration of 'McCormick' Wheat

'McCormick' (Reg. no. CV-959, PI 632691) is a soft red winter wheat (*Triticum aestivum* L.) developed and released May 2002 by the Virginia Agricultural Experiment Station. McCormick wheat was named in tribute of Robert Hall of Walnut Grove in Rockbridge County, VA, and his sons, including Cyrus Hall McCormick, William Sanderson McCormick, and Leander James McCormick. Their inventing, perfecting, manufacturing, and marketing of the mechanical grain reaper ushered in the era of modern agriculture and wrought one of the greatest advancements in agricultural history. McCormick wheat is broadly adapted and has performed well over most of the soft red winter wheat production region. In addition to high grain yield and volume weight, McCormick provides the wheat industry with a good pastry-quality cultivar that has resistance to most disease and insect pests prevalent in the region.

McCormick was derived from the cross VA92-51-39/AL870365. The parentage of VA92-51-39 is IN71761A4-31-5-48//VA71-54-147 (CItr 17449)/'McNair 1813' (CItr 15289). Wheat line IN71761A4-31-5-48 was developed by Purdue University and has the pedigree 'Benhur' (CItr 14054)/3/'Arthur' (CItr 14425)/'Knox' (CItr12798) type line/4/'Beau' (CItr17420)*2/3/Arthur*2//'Riley' (CItr 13702)/'Bulgaria 88' (PI 94407). The Knox type line has gene *H5* for Hessian fly [*Mayetiola destructor* (Say)] resistance. The parental line AL870365 was derived from the cross 'Coker 747' (CItr 17923)*2/'Amigo' (PI 578213) by the Coker Breeding Program now a part of Syngenta and was selected as a parent from the 1990–1991 USDA-ARS Uniform Eastern Soft Red Winter Wheat Nursery. McCormick possesses the 1AL.1RS translocation derived from AL870365, which inherited it from Amigo (Sebesta et al., 1995). The cross from which McCormick originated was made in spring 1992, and the F_1 generation was grown in the field at Warsaw, VA, as a single 1.2-m headrow in 1993 to produce F_2 seed. The population was advanced from the F_2 to F_4 generation using a modified bulk breeding method. Wheat spikes were selected from the population in each segregating generation (F_2–F_3) on the basis of disease resistance, early maturity, short straw, and desirable head shape and size. Selected spikes were threshed in bulk, and the seed was planted in a 20.8-m^2 block in the fall of each year. Spikes selected from the F_4 bulk were threshed individually and planted in separate 1.2-m headrows at Warsaw, VA. McCormick was derived as a bulk of one of these $F_{5:6}$ headrows selected in 1997 on the basis of earliness of head emergence, short plant height, and resistance to powdery mildew [caused by *Erisyphe graminis* DC. f. sp. *tritici* Ém. Marchal; syn. *Blumeria graminis* (DC) E.O. Speer] and leaf rust (caused by *Puccinia triticina* Eriks.). Before its release, McCormick was evaluated as VA98W-591 in Virginia's official variety trials and throughout the soft red winter wheat region in the USDA-ARS Uniform Southern and Uniform Eastern Soft Red Winter Wheat Nurseries in 2001 and 2002.

Coleoptiles of McCormick are red. Juvenile plants exhibit a prostrate growth habit. Plant color at boot stage is green and a waxy bloom is present on the stem and flag leaf sheath. Plants grown in greenhouse have yellow anther color, while those grown under field conditions often have reddish-purple anther color. Straw color is reddish purple at physiological maturity. Spikes are tapering, middense, and awnleted. Glumes are short and midwide, and have rounded shoulders with acute beaks. Kernels are red, soft, and ovate with a narrow and shallow crease, rounded cheeks, and a short non-collared brush. The phenol reaction is brown.

Head emergence of McCormick is 1 to 3 d later than 'AGS 2000' and 1 to 2 d earlier than 'Roane'. Average plant height of McCormick (79 cm) is similar to that of 'Coker 9835' and