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‘NuMex Silhouette’ Onion

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The New Mexico State University (NMSU) Agricultural Experiment Station announces the release of ‘NuMex Silhouette’ onion (*Allium cepa* L.). ‘NuMex Silhouette’ is an open-pollinated, late-maturing, short-day, onion cultivar with red-colored dry outer scales for autumn sowing in southern New Mexico and similar environments. ‘NuMex Silhouette’ matures in early to mid-June when autumn-sown in Las Cruces, NM.

Origin

‘NuMex Silhouette’ originates from similar germplasm that was used in the development of ‘NuMex Crimson’ before 1989 (Cramer and Corgan, 2003) (Fig. 1). ‘NuMex Crimson’ is a short-day, overwintered cultivar with red-colored dry outer scales that originated from intercrosses among short-day cultivars (Kurenai, Red Grano, and Rojo) with red-colored dry outer scales, short-day cultivars (Henry’s Special and Texas Grano 502 PRR) with yellow-colored dry outer scales, and an intermediate-day cultivar (Peckham Yellow Sweet Spanish) with yellow-colored dry outer scales (Cramer and Corgan, 2003). The plants of ‘Texas Grano 502 PRR’ had been selected for bolting resistance, labeled as NMSU 89-78-2, and used in the development of ‘NuMex Silhouette’.

In Aug. 1989, seeds of NMSU 89-78-2 were sown and in January, plants that exhibited red outer scale layers (The Royal Horticultural Society Color Chart 71A) were selected and placed in a crossing cage, 90-52. In May 1990, plants in the cage flowered, pollinators were placed in the cage, and once mature, seeds were harvested from all plants in the cage. In Sept. 1990, seeds of 90-52 were sown and bulbs that possessed red-colored dry outer scales, greater bulb height and size, and fewer symptoms of pink root [causal organism, *Phoma terrestris* (Hansen)] were selected in May 1991. Bulbs were separated, based on their maturity, mid-May or late May. After selected bulbs broke dormancy in Oct. 1991, they were placed into separate crossing cages numbered 92-10 and 92-12, based on their relative bulb maturity (Fig. 1). In May 1992, plants in both cages flowered and seeds were harvested. In Sept. 1992, seeds of both breeding lines were sown, and bulbs that possessed red-colored dry outer scales, fewer pink root symptoms, and early (92-10) or later (92-12) maturity were selected in May 1993. After selected bulbs from each line broke dormancy in Oct. 1993, they were placed into separate crossing cages numbered 94-4 and 94-6 and in May 1994, plants in both cages flowered and seeds were harvested. In August of 1994, seeds of both breeding lines were sown, and bulbs that possessed red-colored dry outer scales, greater bulb firmness when hand squeezed, fewer pink root symptoms, and less taper toward the bottom of the bulb were selected from both lines in May (94-4) or June (94-6) 1995. In addition, bulbs with the absence of multiple meristem centers visible in the expanded leaves were selected from both breeding lines. After the selected bulbs broke dormancy in Oct. 1995, bulbs from 94-4 and 94-6 that were selected for a reduced number of visible meristems were placed as the first entry (-1) in the crossing cage, 96-6-1 and 96-9-1, respectively (Fig. 1). Those bulbs selected from 94-4 and 94-6 that displayed multiple meristem centers were placed as the second entry (-2) in the same respective crossing cage. In May 1996, bulbs of each entry in each cage flowered, pollinators were introduced, and once mature, seeds were harvested and kept separate from plants of each entry of each cage. In Sept. 1996, seeds of 96-6-1 and 96-9-1 were sown and bulbs that possessed darker red (The Royal Horticultural Society Color Chart 71A) dry outer scale layers, less pink root, and the absence of multiple meristems visible in the expanded leaves were selected in May (96-6-1) or June (96-9-1) 1997. Once the bulbs broke dormancy in Oct. 1997, the bulbs selected from 96-6-1 were placed in a crossing cage numbered 98-16, whereas bulbs selected from 96-9-1 were placed in a crossing cage numbered 98-17-1. In May 1998, bulbs in each cage flowered, pollinators were introduced, and once mature, seeds were harvested from plants in each cage.

In Sept. 1998, seeds of 98-16 and 98-17-1 were sown and bulbs that possessed darker red dry outer and internal fleshy scale layers, less pink root symptoms, more rounded bulb shape and less taper at the bottom of the bulb, and greater bulb firmness when hand squeezed were selected from both breeding lines in June 1999. Once bulbs broke dormancy in Oct. 1999, two cycles of S1 progeny selection was initiated in which selected bulbs were placed individually in separate isolation cages to allow for self-pollination to occur the following year. Individual bulbs were selected that possessed darker red dry outer scale layers and more rounded bulb shape. In May 2000, bulbs from 33 separate cages flowered, pollinators were introduced, and seeds were harvested separately from each cage. In May or June 2001 bulbs were selected from five different breeding lines and were placed into 10 separate cages in Oct. 2001 (Fig. 1). Seeds from these cages were sown Sept. 2002 and in June 2003 bulbs were selected from nine different breeding lines (Fig. 1). In Oct. 2003, 135 selected bulbs were placed together in a single crossing cage numbered 04-10. In addition, three bulbs selected from 02-157-1 were placed in a crossing cage numbered 04-215-1. In May 2004, bulbs in both cages flowered, pollinators were introduced, and seed was harvested. In Sept. 2004, seeds of both lines were sown and in June 2005, 18 bulbs total from both lines that possessed darker red dry outer and internal fleshy scale layers, greater bulb firmness when hand squeezed, and a rounder bulb shape were selected (Fig. 1). In Oct. 2005, the selected bulbs from both lines were placed together in a single crossing cage numbered 06-10.

Three additional cycles of phenotypic recurrent selection were conducted in 2006, 2008, and 2010. Bulbs were selected for a more rounded and uniform shape, increased bulb firmness when hand squeezed, fewer pink root symptoms, and darker red-colored dry outer scales. In June 2011, bulbs were selected from 10-19 for the same characteristics; and successively, in Oct. 2011, single bulbs were placed into 23 separate, small isolation cages for self-pollination, with 12-109 being one of those cages. In May 2012, bulbs in all cages flowered, pollinators were introduced, and seed was harvested. In Sept. 2012, seeds of 23 lines were sown and in June 2013, bulbs of each line were evaluated for the same characteristics and all bulbs of 12-109 were selected without making an individual bulb selection. In Oct. 2013, these bulbs were placed in a crossing cage numbered 14-09. In May 2014, bulbs flowered, pollinators were introduced, and seed was harvested and labeled as ‘NuMex Silhouette’.

Evaluation Procedures

‘NuMex Silhouette’ was compared with ‘Mata Hari’ (BASF, Parma, ID), a commercial short-day, hybrid red onion cultivar, in replicated trials grown in four fields in the Mesilla Valley of New Mexico (Table 1). The field soil texture at the NMSU Fabian Garcia Science Center (trial 3) in Las Cruces, NM, was a Glendale loam, whereas the field soil texture at the NMSU Leyendecker Plant Science Research Center (trial 1), 14.5 km south of Las Cruces, NM, was an Armijo loam. Two trials were conducted in a

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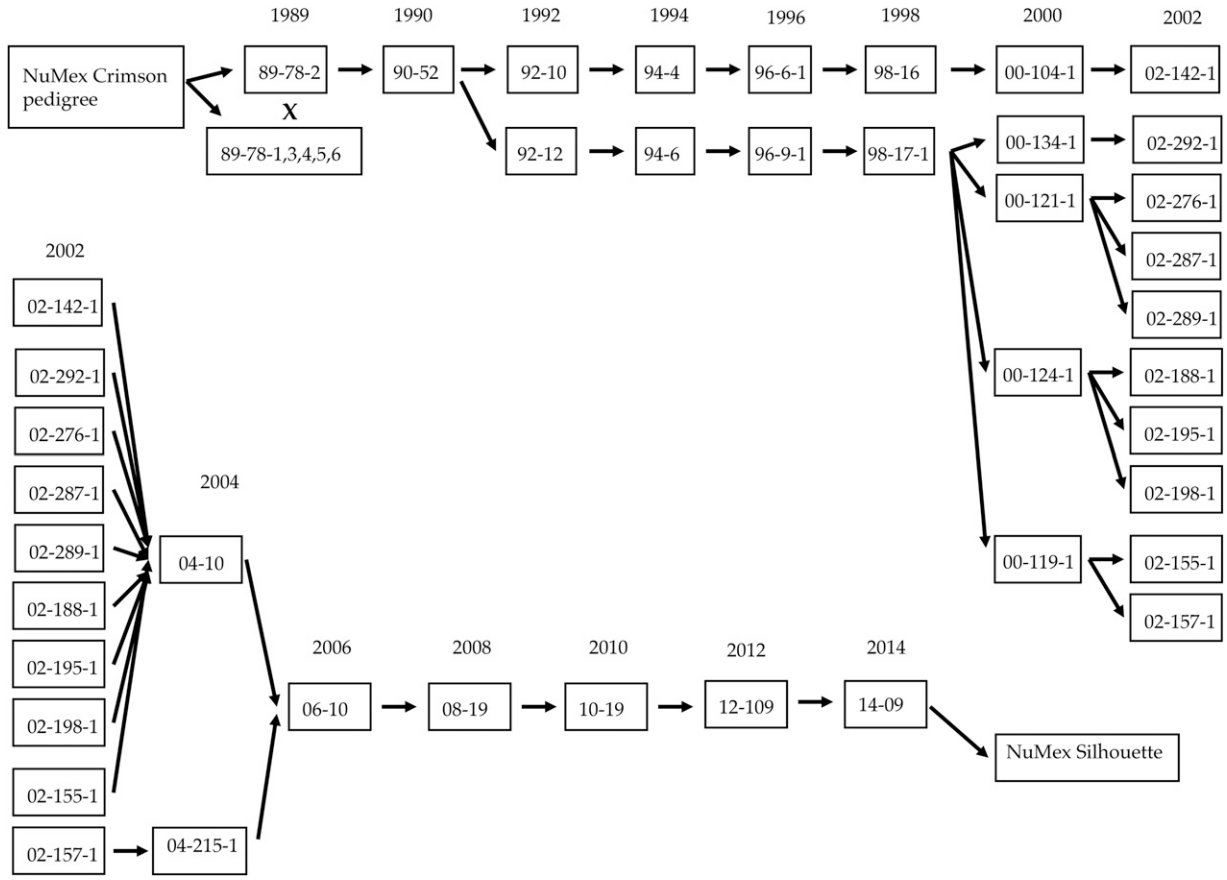

Fig. 1. Pedigree of 'NuMex Silhouette'.

Table 1. Bulb maturity, scape production, pink root severity rating, marketable yield, average bulb weight, and percentage of single centers of 'NuMex Silhouette' as compared with 'Mata Hari' when grown in Las Cruces, NM, from 2015 to 2016 and 2016 to 2017.

Entry	Maturity date (DAS)[z]	Scapes (%)[y]	Pink root severity rating[x]	Marketable yield (t·ha^{-1})[w]	Avg bulb wt (g)[v]	Single centers (%)[u]
			Trial 1 (19 Oct. 2015 sowing date)			
NuMex Silhouette	23 June (246)	0.0	2.8	44.1	172	61.0
Mata Hari	8 June (233)	0.0	2.4	45.5	184	27.0
	**	NS	NS	NS	NS	+
			Trial 2 (29 Sept. 2015 sowing date)			
NuMex Silhouette	1 June (246)	0.0	1.0	90.3	366	72.0
Mata Hari	21 May (235)	2.1	1.0	100.8	205	46.0
	*	+	NS	NS	NS	*
			Trial 3 (29 Sept. 2016 sowing date)[t]			
NuMex Silhouette	13 June (258)	0.0	1.8	23.2	153	98.0
Mata Hari	16 May (230)	22.4	4.5	19.5	128	95.0
	***	+	**	NS	NS	NS
			Trial 4 (7 Oct. 2016 sowing date)			
NuMex Silhouette	5 June (250)	0.2	1.0	116.8	342	82.0
Mata Hari	30 May (244)	2.6	1.0	142.3	305	24.0
	***	NS	NS	**	NS	***

[z]A plot was considered mature when 80% of the tops were down and was harvested at that time.
[y]The percentage of premature flower scapes was determined at harvest and calculated by dividing the number of plants with scapes by the total number of plants per plot and multiply by 100.
[x]Root systems of 20 bulbs per plot were rated based on a scale of 1 (no infected roots) to 9 (completely infected roots).
[w]Marketable bulb yield (t·ha^{-1}) was calculated by weighing the marketable bulbs per plot and adjusting the plot size to 1 ha.
[v]Average bulb weight was calculated by dividing the marketable bulb weight by the number of marketable bulbs.
[u]The percentage of bulbs with single centers (single growing points) was determined by cutting each bulb transversely at the vertical center and measuring the number of growing points that extended 1.3 cm beyond the bulb's center.
[t]Drip irrigation was used for trial 3 whereas furrow flood irrigation was used for trials 1, 2, and 4.
NS, +, *, **, *** Not significant at $P = 0.10$; significant at $P = 0.10$, $P = 0.05$, $P = 0.01$, and $P = 0.001$, respectively. Test was conducted at $\alpha = 0.05$.
DAS = days after sowing.

grower's field. The soil texture of the grower's field used in 2015 to 2016 (trial 2, located 7.2 km southwest of Las Cruces) was a Glendale loam while the soil texture of the grower's field used in 2016 to 2017 (trial 4, located 4 km southwest of Las Cruces) was an Anthony–Vinton clay loam. Seeds were sown ≈1.5 cm deep in two rows 6 cm apart from late September to mid-October, depending on field location and year. For each two-row plot, 1.0 g of seed was sown and plants were thinned to 10 cm between plants within