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'NuMex Vaquero' Jalapeño

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One of the most popular and recognized chile peppers (*Capsicum annuum* L.) grown and consumed in the United States and the world is the jalapeño pod type, which also represents one of the largest commercial pod types (DeWitt and Bosland, 2009). Jalapeños are grown for both the fresh market and processed into higher-value products. The majority of commercial jalapeños are preserved by canning or pickling, whereas some are dehydrated in either the green or red stage. Most jalapeños for the home garden are used fresh in salsa, sliced into rings for use with nachos, or pickled for later use. Soilborne diseases, like phytophthora blight (*Phytophthora capsici* Leon.), continue to threaten the jalapeño crop in the United States and globally. The use of resistant cultivars is the most desirable, sustainable, and environmentally safe disease control method from both an economic and an environmental perspective. 'NuMex Vaquero' is a phytophthora root rot and foliar blight-resistant, high-yielding, high-quality, open-pollinated jalapeno cultivar that is suitable for fresh market, the processing industry, and the home garden.

Origin

The 'NuMex Vaquero' jalapeño was developed by a pedigree method with several hybridizations and repeated single-plant selections (Fig. 1). The parents of 'NuMex Vaquero' are 'Early Jalapeno', 'TAM Jalapeno', and a Mexican landrace, Criollo de Morelos 334, a phytophthora root rot and foliar blight-resistant accession. This accession is the most stable resistance source known to phytophthora root rot and foliar blight diseases and is used in breeding programs around the world. During each generation of selection for 'NuMex Vaquero', horticultural traits considered to be important to the New Mexico jalapeño industry were accomplished (Bosland and Votava, 1999). Seed from the single plant selection, New Mexico Breeding Line 97C18-1, was increased under insect-proof cages (Bosland, 1993). This increased seed became 'NuMex Vaquero' and was used in subsequent field plot trials and disease screens.

Description

'NuMex Vaquero' incorporates the plant and pod characteristics determined by growers and processors needed for a commercial jalapeño cultivar, including but not limited to a green color without purpling (anthocyanin), slight netting on the skin, a semipointed tip, multiple locules, rounded shoulders, and uniform heat (Fig. 2). The plants were grown in field plots at the Leyendecker Plant Science Research Center, 5 km south of Las Cruces, NM, using standard growing practices commonly found in southern New Mexico (Bosland and Walker, 2005). Fruit quality and yield were based on a randomized complete block design with four replications each containing up to 30 plants. Plants were spaced 25.4 cm apart in a single row on 1-m wide beds. For estimating yield, 5 m in the middle of each plot was harvested. The plots were harvested twice each season.

From each plot, 10 randomly selected fruit were used to calculate averages for fruit quality traits. 'NuMex Vaquero' pods were ≈6.3 cm in length, which was similar to 'Mitla' and 'TAM Jalapeno'. The pod width of 2.3 cm at the stem end was narrower than the other cultivars in the trial (Table 1). The pod color matured from green (Munsell color rating: 7.5GY5/8; Munsell Book of Color, 1980) to red (Munsell color rating: 5R3/8). The fruit wall thickness of 4.7 mm was not significantly different from the other cultivars. At the third node, 'NuMex Vaquero' averaged a height of 15 cm and had a plant canopy 48 cm wide.

An outstanding feature of 'NuMex Vaquero' is its yield, which is greater than other standard open-pollinated jalapeño cultivars grown in southern New Mexico and equal to high-yielding F_1 hybrids like 'Mitla' (Table 1). The yield of ≈24,500 kg·ha^{-1} is excellent for an open-pollinated cultivar. Replicated trials over 3 years confirmed its superior yield and quality to other open-pollinated jalapeño cultivars.

Heat level was determined by a reverse-phase high-performance liquid chromatography system with fluorescence detectors (Collins et al., 1995). The heat level of 'NuMex Vaquero' would be considered "hot" for a jalapeño cultivar at ≈33,417 Scoville Heat Units (SHU) on a dry weight basis. By industry standards, 'Early Jalapeno' at 44,354 SHU is a "hot" cultivar, whereas 'TAM Jalapeno' at 14,920 SHU is a mild cultivar (Villalon, 1983). An organoleptic test of flavor found that 'NuMex Vaquero' has good jalapeño flavor with sweeter tasting walls that the other cultivars in the trial (personal observation).

Another striking feature of 'NuMex Vaquero' is its resistance to phytophthora blight, a disease acerbated by furrow irrigation and heavy rainfall, caused by *Phytophthora capsici* Leon. Host resistance is becoming an integral component in phytophthora blight management for commercial production of peppers, including jalapeños. For example, in North Carolina, Paladin, a bell pepper cultivar, is considered to have "moderate" resistance to phytophthora blight (Louws et al., 2008). The lack of complete or total resistance is because *P. capsici* isolates vary in their virulence profile (Sy et al., 2008). The physiological races of the *P. capsici* isolates used for screening were determined using the New Mexico Recombinant Inbred Lines that have previously differentiated races of *P. capsici* (Sy et al., 2008). In addition, because it is now known that root rot and foliar blight are independent and different diseases, 'NuMex Vaquero' was tested for resistance to both diseases separately (Walker and Bosland, 1999). Disease resistance screening followed the procedure of Bosland and Lindsey (1991) for root rot and Monroy-Barbosa and Bosland (2010) for foliar blight. Each isolate of *P. capsici* was tested on a total of 72 plants with three replications of 26 plants each for root rot. To test for root rot resistance, seedlings were inoculated at the four- to six-true leaf stage. Each plant received a concentration of 10,000 zoospores. Approximately 10 d after inoculation, when the susceptible control ('Camelot') exhibited extreme root rot symptoms, plants were scored for resistance or susceptibility. Plants with no lesions in the root area were considered resistant, whereas plants with symptoms ranging from very small lesions to death were considered susceptible.

For foliar blight resistance, each isolate of *P. capsici* was tested on a total of 24 plants with three replications of eight plants each. To test for foliar blight resistance, seedlings were inoculated at the four- to six-true leaf stage using three mature leaves selected from each plant (Monroy-Barbosa and Bosland, 2010). A 0.5-cm diameter paper disc made from seed germination paper was placed on the surface of each leaf. Using a micropipette, 50 µL of inoculum was placed on each paper disc. The 50 µL held ≈2000 zoospores. The plants were placed into a mist chamber with a minimum relative humidity of 70% and an air temperature of 28 °C. When the susceptible control, 'Camelot', displayed a susceptible phenotype, the plants were scored for resistance or susceptibility.

The test results indicated that 'NuMex Vaquero' possessed resistance to phytophthora root rot races 2 and 3 and phytophthora foliar blight race 2 (Table 2).

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(Criollo de Morelos-334 X 'Early Jalapeno') ⇨ 87C292-1_{F2} X 'TAM Jalapeno' ⇨ 87C630-5 X 'TAM Jalapeno' ⇨ 88C417$_{F2}$ ⇨ 89C76-1_{S3} ⇨ 90C279-$5A_{S4}$ X 90C280-3_{S4} ⇨ 92C524-4_{S1} ⇨ 93C17-4_{S2} ⇨ 93C1401-1_{S3} ⇨ 94C1411-4_{S4} ⇨ 95C1820-1_{S5} ⇨ 96C2208-1_{S6} ⇨ 97C18-1_{S7} ⇨ 98C36_{bulk} ('NuMex Vaquero').

Fig. 1. 'NuMex Vaquero' pedigree.

Fig. 2. Fruits of 'NuMex Vaquero'.

Availability

'NuMex Vaquero' seed is available from the Chile Pepper Institute, New Mexico State University, P.O. Box 30003, MSC 3Q, Las Cruces, NM 88003. The Chile Pepper Institute can be contacted at http://www.chilepepperinstitute.org, hotchile@nmsu.edu, or by phone: (575) 646-3028.

Table 1. Fruit yield, fruit characteristics, and heat level for 'NuMex Vaquero', 'Mitla', 'TAM Jalapeno', and 'Early Jalapeno' compared over 3 years.

		Fruit		
	Yield[z] (kg·ha^{-1})	Length[y] (cm)	Width[y] (cm)	Heat level[x] (SHU)
NuMex Vaquero	24,435 a[w]	6.29 a	2.28 c	33,417 b
Mitla F_1	22,193 a	6.29 a	2.80 a	66,952 a
TAM Jalapeno	10,173 b	6.09 a	2.66 b	14,920 c
Early Jalapeno	9,520 b	5.41 b	2.77 a	44,354 b

[z]Yield is green fruit yield less the weight of diseased or undesirable fruits from two harvests each year.
[y]Fruit length and fruit width was the average 10 fruits/replication.
[x]Scoville Heat Units (SHU), 1 µg·g^{-1} capsaicinoid = 16 SHU per dry weight basis.
[w]Means with different letters are significantly different using Duncan's multiple range test ($P \leq 0.01$).

Table 2. Disease reaction of 'NuMex Vaquero', 'Paladin', 'Camelot', and 'Criollo de Morelos-334' for phytophthora root rot (72 plants) and phytophthora foliar blight (24 plants).

		Root rot[y]		Foliar blight[x]	
	Physiological race[z]	R[w]	S	R	S
NuMex Vaquero	1	0	72	0	24
	2	72	0	24	0
	3	72	0	0	24
Paladin	1	0	72	16	8
	2	72	0	24	0
	3	72	0	24	0
Camelot	1	0	72	0	24
	2	0	72	0	24
	3	0	72	0	24
CM-334	1	72	0	24	0
	2	72	0	24	0
	3	72	0	24	0

[z]Based on New Mexico Recombinant Inbred Lines (Sy et al., 2008).
[y]Root rot screening technique followed Bosland and Lindsey (1991).
[x]Foliar blight screening technique followed the procedure described in Monroy and Bosland (2010).
[w]R = resistant; S = susceptible.

Literature Cited

Bosland, P.W. 1993. An effective plant field-cage to increase the production of genetically pure chile (*Capsicum* spp.) seed. HortScience 28: 1053.

Bosland, P.W. and D.L. Lindsey. 1991. A seedling screen for phytophthora root rot of pepper *Capsicum annuum*. Plant Dis. 75:1048–1050.

Bosland, P.W. and E. Votava. 1999. Peppers: Vegetable and spice capsicums. CAB International, Wallingford, UK.

Bosland, P.W. and S. Walker. 2005. Growing chiles in New Mexico. Cooperative Ext. Guide H-230.

Collins, M.D., L. Mayer-Wasmund, and P.W. Bosland. 1995. Improved method for quantifying capsaicinoids in *Capsicum* using high-performance liquid chromatography. HortScience 30:137–139.

DeWitt, D. and P.W. Bosland. 2009. The complete chile pepper. Timber Press, Portland, OR.

Louws, F.J., G.J. Holmes, and K.L. Ivors. 2008. Pepper—Phytophthora blight. N. Carolina St. Univ, Fact Sheet.

Monroy-Barbosa, A. and P.W. Bosland. 2010. A rapid technique for multiple-race disease screening of phytophthora foliar blight on a single capsicum plant. HortScience 45:1563–1566.

Munsell Book of Color. 1980. Glossy edition. X-Rite Incorporated, Grand Rapids, MI.

Sy, O., R. Steiner, and P.W. Bosland. 2008. Recombinant inbred line differential identifies race-specific resistance to Phytophthora root rot in *Capsicum annuum*. Phytopathology 98: 867–870.

Villalon, B. 1983. TAM mild jalapeno pepper-1 pepper. HortScience 18:492–493.

Walker, S. and P.W. Bosland. 1999. Inheritance of phytophthora root rot and foliar blight resistance in pepper. J. Amer. Soc. Hort. Sci. 124: 14–18.