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'NuMex Nematador', Southern Root-knot Nematode-resistant Cayenne Pepper

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The New Mexico State Univ. Agricultural Experiment Station announces the release of a new, open-pollinated, nematode-resistant cayenne-type pepper (*Capsicum annuum* L.) that is designated 'NuMex Nematador'. This name is a contraction of "nematode" and "matador"; thus, it is the "nematode killer." Cayennes are becoming increasingly important to New Mexico's pepper production. In 1997, cayennes grown in New Mexico were valued in excess of $4.7 million at farm-gate (New Mexico Agricultural Statistics, 1998). Most of New Mexico's cayenne crop is processed, adding further to its value. During the past decade, processing companies have expanded their production facilities to meet the increased demand for cayenne mash, which is a key ingredient in the hot sauce industry (Bosland, 1992). The southern root-knot nematode [*Meloidogyne incognita* (Kofoid & White) Chitwood race 3] is a major pest of cayenne in New Mexico (Thomas, 1994). Continuing reductions in the number of nematicides registered for use on peppers, including the impending ban of methyl bromide, make the development of nematode-resistant cayennes more urgent. 'NuMex Nematador' is adapted to the southern New Mexico and similar ecological regions, where it can be expected to produce good yields. The high level of root-knot nematode resistance could save cayenne producers $250 per hectare in commercial production costs (Thomas, 1994) and reduce environmental risks by reducing the need for annual preplant fumigation.

Origin

'NuMex Nematador' is a nematode-resistant cayenne. It was developed from the southern root-knot nematode-susceptible cayenne cultivar Large Red Thick by a pedigree breeding method. The major attribute of the new cultivar is its high level of resistance to southern root-knot nematode and higher pungency level than 'Large Red Thick'. Fortunately, 'Large Red Thick' is heterogenous (southern root-knot nematode egg count from zero to 372,852 eggs per gram dry root) for resistant/susceptible individuals. Fifteen single plants were selected from the original population (124 plants) based on low nematode reproduction as measured by egg count (Hussey and Barker, 1973). Each selected plant was self-pollinated to form the next population for selection. For three generations, an average of 10% of the plants were selected based on low root-knot nematode egg production, then self-pollinated, screened, and the cycle repeated. 'NuMex Nematador' originated from a single plant, New Mexico Breeding Line 97C1721-1. All succeeding generations of increased seed were bulked from plants grown under an insect-proof cage (Bosland, 1993). This seed became 'NuMex Nematador' and was used for replicated field plot and greenhouse nematode screening trials.

All root-knot nematode screening was done in a greenhouse using 12-celled bedding plant containers (Hummert International, Earth City, Mo.), where each cell had a total volume of 32 cm^3, and contained pasteurized washed silica sand. The bedding plant containers were placed in planting trays (Hummert International). A single plant was raised in each cell. The temperature of the growing medium was kept at 30 ± 2 °C throughout the screening by placing the planting trays on a propagation pad. Seedlings were watered twice a day to maintain optimum growth. A water-soluble fertilizer (Miracle-Gro® 15N–12.9P–12.4K; Scott's-Sierra Horticultural Products, Marysville, Ohio) was mixed at the rate of 4 $g \cdot L^{-1}$ of water and applied to the seedlings twice a week to maintain vigorous plant growth. A randomized complete-block design with six replications was used. Each treatment had 12 plants in each replication. The roots of each plant were inoculated with 1000 southern root-knot nematode eggs (Hussey and Barker, 1973) when the seedlings were 5 to 6 weeks of age. 'NuMex Joe E. Parker' was selected as a susceptible control because of its uniform susceptibility to southern root-knot nematode race 3. The roots of the plants were harvested 45 d after inoculation and the root-knot nematode eggs were extracted and counted. The data were $\log_{10}(x+1)$ transformed before statistical analysis. Because there was a significant cultivar × year interaction for egg counts, data of each year are presented (Table 1).

'NuMex Nematador' was evaluated for yield and other horticultural characteristics along with 'Large Red Thick' cayenne for 2 years on nematode-free plots at the Leyendecker Plant Science Research Center (12.5 km south of Las Cruces) and at the Fabian Garcia Science Center, Las Cruces, N.M. At each location, the field plot was replicated four times and a randomized complete-block design was used. There were 30 to 36 plants in each plot. Homogeneity of error variance test (Gomez and Gomez, 1983) was performed on plant and fruit characteristics across years and locations, and none of the error mean squares were significant for any of the traits. Therefore, combined analyses of variance for the cultivars across two years and two locations were performed to determine cultivar × location, cultivar × year, and cultivar × location × year interactions for each trait using the GLM procedure of SAS (SAS Institute, 1999). Significance levels were determined as suggested by McIntosh (1983). Because there were no significant differences in cultivar × location, cultivar × year, and cultivar × location × year interactions, the combined data of the two locations and two years are presented in Table 2.

Description

'NuMex Nematador' is a southern root-knot nematode race 3 resistant cayenne that is adapted to the southern New Mexico and similar ecological regions. It is a selection from 'Large Red Thick' cayenne, which is highly adapted to the southern New Mexico production area. 'NuMex Nematador' is as resistant as the highly resistant cultivar Carolina Cayenne (Zamora et al., 1994) to *Meloidogyne incognita* (Kofoid & White) Chitwood race 3 (Table 1). This level of resistance was measured under

Table 1. Numbers of *Meloidogyne incognita* (Kofoid & White) Chitwood race 3 eggs[z] per gram dry root weight for 'NuMex Joe E. Parker,' 'Carolina Cayenne', and 'NuMex Nematador' pepper cultivars.

Cultivar	1999	2000	2001	2002	4–year mean
NuMex Joe E. Parker (S)[y]	109,123 a[x]	33,801 a	264,517 a	54,302 a	115,436
Carolina Cayenne (R)[w]	6 b	0 b	366 b	41 b	103
NuMex Nematador	53 b	135 b	156 b	161 b	126

[z]Values are least square means from pepper seedlings harvested 45 d after inoculation.
[y]Susceptible to *Meloidogyne incognita* (Kofoid & White) Chitwood race 3.
[x]Mean separation in columns by least significant difference (LSD) test at $P \leq 0.01$.
[w]Resistant to *Meloidogyne incognita* (Kofoid & White) Chitwood race 3.

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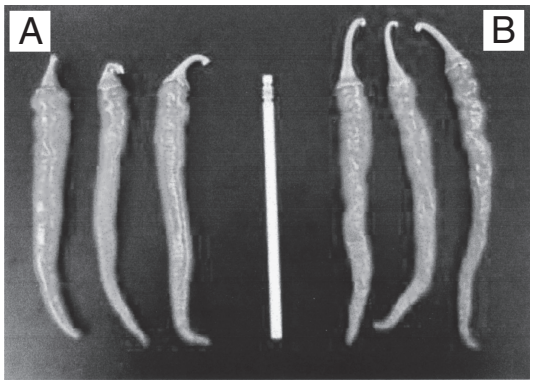

Fig. 1. Fruits of (**A**) 'Large Red Thick' and (**B**) 'NuMex Nematador' pepper cultivars.

temperature screening conditions of 30 ± 2 °C at which some pepper cultivars homozygous for the *N* gene, which infers resistance for southern root-knot nematode, have exhibited a partial loss of resistance (Theis and Fery, 1998).

The marketable yield for 'NuMex Nematador' was 9.10 t·ha^{-1} and did not differ from 'Large Red Thick' (Table 2). In addition, 'NuMex Nematador' did not differ from 'Large Red Thick' in fruit length, wall thickness, or plant width (Fig. 1). Pungency level and plant height of 'NuMex Nematador' were significantly higher than 'Large Red Thick'. 'NuMex Nematador' took an average of 99 d from transplanting until the first harvest, which was the same as for 'Large Red Thick' (data not presented).

Availability

Seed increases will be on a four-generation basis (breeder, foundation, registered, and certified) with seed production following the guidelines of the New Mexico Crop Improvement Association (NMCIA). Breeder's seed will be maintained for 5 years after the release date by the New Mexico Chile Pepper Breeding Program. Commercial distribution of 'NuMex Nematador' will be through the NMCIA, New Mexico State University, Box 3CI, Las Cruces, NM 88003. Foundation seed is available through the NMCIA.

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Table 2. Two years' combined fruit yield, fruit characteristics, and plant characteristics from the Leyendecker Plant Science Research Center and the Fabian Garcia Science Center, Las Cruces, N.M., for 'NuMex Nematador' and 'Large Red Thick' cayenne pepper cultivars.

			Fruit characteristics				Plant characteristics	
	Fruit yield (t·ha^{-1})		Length	Width	Wall thickness	Pungency	Ht	Width
Cultivar	Field[z]	Market[y]	(cm)	(cm)	(mm)	(SHU[x])	(cm)	(cm)
NuMex Nematador	9.61	9.10	14.71	1.60	3.11	15,989	55.47	48.47
Large Red Thick	10.88	10.05	13.53	1.94	3.21	9,683	50.82	47.45
Significance	NS	NS	NS	**	NS	**	**	NS
CV (%)	18.62	19.85	8.17	5.68	9.63	42.84	7.50	7.92

[z]Field fruit yield is the weight of the total fresh fruits.
[y]Market fruit yield is the field fresh fruit yield less the weight of diseased, immature, or undesirable fruits.
[x]Scoville Heat Units (SHU), 1 mg·kg^{-1} capsaicinoid = 15 SHU per dry weight basis.
NS, **Nonsignificant or significant at $P < 0.01$ according to Least Significant Difference (LSD) test.