‘Truhart-NR’, A Root-knot Nematode-resistant, Pimento-type Pepper

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‘Truhart-NR’ is a new pimento-type pepper (*Capsicum annuum* L.) released 20 Oct. 2009 by the Agricultural Research Service of the U.S. Department of Agriculture. ‘Truhart-NR’ is a pimento-type cultivar that is homozygous for a dominant gene conditioning a high level of resistance to the southern root-knot nematode [*Meloidogyne incognita* (Chitwood) Kofoid and White], the peanut root-knot nematode [*M. arenaria* (Neal) Chitwood], and the tropical root-knot nematode [*M. javanica* (Treub) Chitwood]. ‘Truhart-NR’ is being released as a replacement for ‘Truhart Perfection’, a widely adapted and long popular pimento-type cultivar that is highly susceptible to root-knot nematodes.

Origin

In 2000, a recurrent backcross breeding procedure was initiated to incorporate the dominant root-knot nematode resistance gene (*N*) into the classical pimento-type “Perfection” genetic background (Fig. 1) (Fery and Dukes, 1996; Hare, 1957). The donor parent of the *N* resistance gene was ‘Mississippi Nemaheart’ and the recurrent parent was ‘Truhart Perfection’. ‘Mississippi Nemaheart’ was released by Mississippi State University in 1966 (Hare, 1966). Although ‘Mississippi Nemaheart’ itself is the product of a recurrent backcross breeding procedure (10 backcrosses) that used ‘Truhart Perfection’ as the recurrent parent, it was never used widely by industry because it was considered by many to produce a weak plant. ‘Truhart Perfection’ was released by the Georgia Experiment Station in 1943 (Cochran, 1943); it is susceptible to root-knot nematodes. ‘Truhart Perfection’ is an inbred selection from the original Perfection cultivar that was released by S.D. Riegel and Sons of Experiment, GA, in 1912 (Cochran, 1943). Both ‘Perfection’ and ‘Truhart Perfection’ were predominant cultivars for Georgia’s large pimento pepper industry

for a number of decades after their release; ‘Truhart Perfection’ is still recommended for use by specialty crop growers in several southern states. The ‘Truhart Perfection’ accession that was used as the recurrent parental line for the current release was derived from a sample of foundation seed increased at the Georgia Experiment Station in 1988. ‘Truhart-NR’ was derived from a single BC2F3 plant grown in 2006.

Fig. 1. Pedigree of the root-knot nematode-resistant, pimento-type pepper cultivar Truhart-NR.

Table 1. Average plant height, plant width, days from transplant to harvest, and marketable fruit yield for the root-knot nematode-resistant cultivar Truhart-NR and the root-knot nematode-susceptible cultivar Truhart Perfection grown in two separate field trials at Charleston, SC, 2007–2008.^z

Trial/pepper cultivar	Plant ht (cm)	Plant width (cm)	Days to harvest (no.)	Marketable fruit yield (kg·ha ⁻¹)
Trial I				
Truhart-NR	76.8 a ^y	72.3 a	76.2 a	12,304 a
Truhart Perfection	72.0 a	70.8 a	76.2 a	9,742 a
Trial II				
Truhart-NR	48.2 a	57.8 a	70.0 ^x	16,802 a
Truhart Perfection	48.0 a	53.1 a	70.0	14,887 a
Combined analysis of both trials				
Truhart-NR	59.0 a NS	63.3 a NS	72.3 a NS	15,116 a NS
Truhart Perfection	56.4 a	59.8 a	72.3 a	12,957 b

^aThe experimental design of each trial was a randomized complete block with six (Trial I) or 10 replications (Trial II). Single-row plots were used for both trials (10 plants/plot, 30 cm between plants, and 102 cm between rows). Both trials were established using transplants; Trial I was planted on 2 May 2007 and Trial II was planted on 6 May 2008. Fully mature fruits were harvested from 16 July 2007 to 14 Aug. 2007 (Trial I) and 15 July 2008 to 19 Aug. 2008 (Trial II).

^yMean separation within columns and trials by Student-Newman-Keuls multiple range test ($P \leq 0.05$).

^xNo variation observed for either cultivar treatment in this analysis.

NS = Non-significant interaction between cultivar and trial at $P \leq 0.05$.

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Description

‘Truhart-NR’ is quite similar in appearance and maturity to ‘Truhart Perfection’. ‘Truhart-NR’ has an erect plant habit (height = 59 cm; width = 63 cm) and produces heart-shaped, dark red fruit (Table 1; Fig. 2). The foliage is dense and the fruits are well protected from sun scald. The period from transplanting to first harvest of mature fruit is ≈ 72 d at Charleston, SC. There is usually one pedicel per axil and the pedicel position at anthesis is pendant. Corolla color is white with yellow throat markings, corolla spots are absent, and the stamens have white filaments and purple anthers. At full anthesis, the length of the style is usually slightly longer than the stamen. The lanceolate-shaped leaves are medium-sized and have a medium green color. The stems and leaves are glabrous. The stems and nodes are green. There is an occasional presence of very slight anthocyanin pigmentation on the stems, slight to moderate pigmentation at the base of branches, very slight pigmentation on the petioles, and moderate pigmentation at the base of the pedicels. The seedling hypocotyl exhibits a moderate amount of pigmentation. The fruits are attached to the pedicel in a pendant manner (typically one fruit per cluster); the calyx margin shape is smooth for ripe fruit (midway between smooth and dentate for green fruit); the annular constriction at the junction of the calyx and pedicel is absent; and the pedicels are short to intermediate in length, curved, and thick. The fruits are persistent, i.e., the pedicel and calyx usually remain with the fruit at harvest.

The results of two replicated field studies conducted in 2007 and 2008 at Charleston, SC, indicate that the fruit and yield characteristics of ‘Truhart-NR’ are superior to those of ‘Truhart Perfection’. Over the 2-year period, ‘Truhart-NR’ yielded an average of 16.7% more marketable fruit than did ‘Truhart Perfection’ (15,116 kg·ha⁻¹ versus 12,957 kg·ha⁻¹, respectively). ‘Truhart-NR’ fruit were also

Fig. 2. Freshly harvested fruit of the root-knot nematode-resistant, pimento-type pepper cultivar Truhart-NR (left) and the root-knot nematode susceptible, pimento-type pepper cultivar Truhart Perfection (right).

Table 2. Comparison of fruit characteristics of the southern root-knot nematode-resistant cultivar Truhart-NR and the root-knot nematode-susceptible cultivar Truhart Perfection.^z

Trial/pepper cultivar	Fruit characteristic				
	Width (cm)	Length (cm)	Wall thickness (mm)	Locules (no.)	Fruit size (g/fruit)
Trial I					
Truhart-NR	5.67 a ^y	7.53 a	4.42 a	3.0 ^x	69.5 a
Truhart Perfection	5.50 a	6.92 a	4.17 a	3.0	61.2 b
Trial II					
Truhart-NR	5.63 a	7.25 a	4.41 a	3.0 ^x	66.7 a
Truhart Perfection	5.54 a	6.93 b	4.27 a	3.0	64.4 a
Combined analysis of both trials					
Truhart-NR	5.64 a NS	7.36 a NS	4.41 a NS	3.0 ^x	67.8 a NS
Truhart Perfection	5.52 a	6.93 b	4.23 b	3.0	63.4 b

^zFruit samples harvested from replicated field trials conducted at Charleston, SC, 2007 (Trial I) and 2008 (Trial II).

^yMean separation within columns and trials by Student-Newman-Keuls multiple range test ($P \leq 0.05$).

^xNo variation observed for either cultivar treatment in this analysis.

NS = Non-significant interaction between cultivar and trial at $P \leq 0.05$.

Table 3. Average root-gall index and average egg mass index for 'Truhart-NR', 'Truhart Perfection' (susceptible recurrent parent), 'Charleston Belle' (resistant control), and 'Keystone Resistant Giant' (susceptible control) plants grown in soil infested with the southern root-knot nematode, *Meloidogyne incognita* race 3 (Greenhouse Experiment, 2008).^z

Cultivar	Gall index ^y	Egg mass index ^x
Truhart-NR	1.05 b ^w	1.05 b
Truhart Perfection	4.90 a	4.85 a
Charleston Belle	1.35 b	1.37 b
Keystone Resistant Giant	4.73 a	4.63 a

^zRandomized complete-block experiment with six replications (five plants per plot; seeds planted on 22 Feb. 2008; seedlings transplanted into a steam-pasteurized mixture of soil, sand, and peat on 6 Mar. 2008; soil surrounding roots of each seedling was infested with 3000 *M. incognita* race 3 eggs on 18 Mar. 2008; and roots of all plants removed from the growth media on 17 June 2008 for evaluation for galling and egg masses).

^yRated on a scale of 1 to 5: 1 = no galls; 2 = light galling, 1% to 25% of root system galled; 3 = moderate galling, 26% to 50% of root system galled; 4 = heavy galling, 51% to 80% of root system galled; and 5 = severe galling, 81% to 100% of root system galled.

^xRated on a scale of 1 to 5: 1 = no egg masses evident, 2 = scattered egg masses covering 1% to 25% of root system, 3 = moderate number of egg masses covering 26% to 50% of root system, 4 = numerous egg masses covering 51% to 80% of root system, and 5 = extremely large number of egg masses covering 81% to 100% of root system.

^wMean separation within columns by Student-Newman-Keuls multiple range test ($P \leq 0.05$).

6.9% heavier, 6.2% longer, and exhibited 4.3% thicker fruit walls (Table 2). A typical 'Truhart-NR' fruit weighs 67.8 g and is conical- or heart-shaped (5.64 cm wide $\times$ 7.36 cm long). The shape of the calyx attachment end of the fruit is truncate, the neck at the base of the fruit is absent, and the shape at the blossom end of the fruit is pointed. The cross-section of a typical fruit exhibits a slightly corrugated shape. The fruit wall is thick (4.41 mm). The color of immature fruit is dark green; the color of harvest-stage fruits is a deep dark red (Munsell color rating: 5.8 R 3.5/8.0). The fruits are sweet (non-pungent), and a typical fruit has three locules.

'Truhart-NR' is homozygous for the dominant *N* gene that conditions a high level of resistance to root-knot nematodes. The new cultivar has exhibited a high level of resistance to the southern root-knot nematode in all greenhouse tests; the numbers of galls and egg masses on the roots have always been minimal (Table 3). The resistance exhibited by 'Truhart-NR' is equal to that exhibited by the root-knot nematode resistant bell-type cultivar Charleston Belle.

The root-knot nematode-resistant 'Truhart-NR' is recommended for use by both home gardeners and commercial growers. It is recommended particularly for use by organic farmers and growers of specialty crops because these segments of the pepper industry do not have easy access to alternative production sites or the needed nematicides and nematicide application equipment. Because the gene conditioning the root-knot nematode resistance trait is dominant, 'Truhart-NR' is potentially a valuable parental line for developing root-knot nematode-resistant hybrid pimento-type cultivars. 'Truhart-NR' should perform well in all areas where 'Truhart Perfection' has been grown successfully.

Availability

A limited quantity of 'Truhart-NR' breeder's seed is available for distribution to all interested research personnel and bona fide pepper seed producers. Genetic material of this release will be deposited in the National Plant Germplasm System where it will be available for research purposes, including the development and commercialization of new cultivars. It is requested that appropriate recognition of source be given when this germplasm contributes to research or development of a new breeding line or cultivar.

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