



Effect on tomato cultivars (*Solanum lycopersicum* L. cv. *Bonny best*, *Nematex*, *Rutgers*)

1. The net impact of individual and combined stress on plant growth

Crop: Tomato (*Solanum lycopersicum* L. cv. *Bonny best*, *Nematex*, *Rutgers*)
 Stress 1: *Meloidogyne incognita*
 Stress 2: *Fusarium oxysporum* f. sp. *lycopersici*
 Stage of plant: 14 day old Seedling

The table shows the impact of nematode and fungus alone and in combination on fresh shoot weight and fresh root weight of tomato cultivars.

	Treatment	Plant response to stress (reduction over control %) Type A parameters*	
		Fresh shoot weight	Fresh root weight
Bonny best	<i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot)	92.4 ↓	87.2 ↓
	<i>Meloidogyne incognita</i> (1000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	94.2 ↓	92.3 ↓
	<i>Meloidogyne incognita</i> (1000 eggs/pot)	40.4 ↓	-135.9 ↑
	<i>Meloidogyne incognita</i> (5000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	94.7 ↓	92.3 ↓
	<i>Meloidogyne incognita</i> (5000 eggs/pot)	74.7 ↓	-10.3 ↑
	<i>Meloidogyne incognita</i> (25000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	95.6 ↓	87.2 ↓
	<i>Meloidogyne incognita</i> (25000 eggs/pot)	75.1 ↓	17.9 ↓
	<i>Meloidogyne incognita</i> (50000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	97.8 ↓	89.7 ↓
	<i>Meloidogyne incognita</i> (50000 eggs/pot)	76.9 ↓	-69.2 ↑

Nematex	<i>Fusarium oxysporum</i> (30X106 conidia/pot)	3.7↓	-5.8↑
	<i>Meloidogyne incognita</i> (1000 eggs/pot) + <i>Fusarium oxysporum</i> (30X106 conidia/pot) Simultaneous stress	3.7↓	-48.1↑
	<i>Meloidogyne incognita</i> (1000 eggs/pot)	0.9↓	-7.7↑
	<i>Meloidogyne incognita</i> (5000 eggs/pot) + <i>Fusarium oxysporum</i> (30X106 conidia/pot) Simultaneous stress	4.2↓	-19.2↑
	<i>Meloidogyne incognita</i> (5000 eggs/pot)	4.2↓	-15.4↑
	<i>Meloidogyne incognita</i> (25000 eggs/pot) + <i>Fusarium oxysporum</i> (30X106 conidia/pot) Simultaneous stress	4.6↓	-42.3↑
	<i>Meloidogyne incognita</i> (25000 eggs/pot)	1.4↓	-26.9↑
	<i>Meloidogyne incognita</i> (50000 eggs/pot) + <i>Fusarium oxysporum</i> (30X106 conidia/pot) Simultaneous stress	7.4↓	-5.8↑
	<i>Meloidogyne incognita</i> (50000 eggs/pot)	5.1↓	-7.7↑
Rutgers	<i>Fusarium oxysporum</i> (30X106 conidia/pot)	76.8↓	57.6↓
	<i>Meloidogyne incognita</i> (1000 eggs/pot) + <i>Fusarium oxysporum</i> (30X106 conidia/pot) Simultaneous stress	91.8↓	86.4↓
	<i>Meloidogyne incognita</i> (1000 eggs/pot)	30.0↓	-47.5↑
	<i>Meloidogyne incognita</i> (5000 eggs/pot) + <i>Fusarium oxysporum</i> (30X106 conidia/pot) Simultaneous stress	92.7↓	91.5↓
	<i>Meloidogyne incognita</i> (5000 eggs/pot)	64.1↓	49.2↓
	<i>Meloidogyne incognita</i> (25000 eggs/pot) + <i>Fusarium oxysporum</i> (30X106 conidia/pot) Simultaneous stress	92.7↓	89.8↓

	<i>Meloidogyne incognita</i> (25000 eggs/pot)	84.1 ↓	74.6 ↓
	<i>Meloidogyne incognita</i> (50000 eggs/pot) + <i>Fusarium oxysporum</i> (30X106 conidia/pot) Simultaneous stress	97.7 ↓	91.5 ↓
	<i>Meloidogyne incognita</i> (50000 eggs/pot)	58.2 ↓	-33.9 ↑

Note: Values presented in the table were calculated using the formula described below.

$$\text{Reduction over control (\%)} = \frac{(\text{Value}_{\text{Control}} - \text{Value}_{\text{Stress}})}{\text{Value}_{\text{Control}}} \times 100$$

1) '↓' - indicates plant parameters affected by stress that lead to high susceptibility (higher the value more the damage).

2) '↑' - indicates plant parameters less/not affected by stress leading to improved resistance (higher the value lesser the damage).

'*' - For more information on parameters classification, please refer to 'methodology' tab.

2. The interaction between nematode and fungal pathogen under combined stress at plant interface

The table shows the effect of the fungal pathogen on nematode induced root gall index and effect of nematode on fungus induced necrosis index and total wilt index under combined stress treatment

	Treatment	Response to combined stress** Type B parameters*		
		Root gall index	Necrosis index	Total wilt index
Bonny best	<i>Fusarium oxysporum</i> (30X106 conidia/pot)	0	5	5
	<i>Meloidogyne incognita</i> (1000 eggs/pot) + <i>Fusarium oxysporum</i> (30X106 conidia/pot) Simultaneous stress	5	5	5
	<i>Meloidogyne incognita</i> (1000 eggs/pot)	5	2	1.3
	<i>Meloidogyne incognita</i> (5000 eggs/pot) + <i>Fusarium oxysporum</i> (30X106 conidia/pot) Simultaneous stress	5	5	5

	<i>Meloidogyne incognita</i> (5000 eggs/pot)	5	4.3	4
	<i>Meloidogyne incognita</i> (25000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	5	5	5
	<i>Meloidogyne incognita</i> (25000 eggs/pot)	5	4.5	3.8
	<i>Meloidogyne incognita</i> (50000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	5	5	4.8
	<i>Meloidogyne incognita</i> (50000 eggs/pot)	5	4	3.3
Nematex	<i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot)	0.3	0.7	0.2
	<i>Meloidogyne incognita</i> (1000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	0.5	0.7	0.2
	<i>Meloidogyne incognita</i> (1000 eggs/pot)	0.5	0.7	0
	<i>Meloidogyne incognita</i> (5000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	1.5	1.2	0
	<i>Meloidogyne incognita</i> (5000 eggs/pot)	0.7	0.7	0
	<i>Meloidogyne incognita</i> (25000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	1.7	0.7	0.2
	<i>Meloidogyne incognita</i> (25000 eggs/pot)	1.7	1	0
	<i>Meloidogyne incognita</i> (50000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	2.8	0.8	0.2
	<i>Meloidogyne incognita</i> (50000 eggs/pot)	1.7	0.8	0
Rutgers	<i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot)	0	1.5	4.8

<i>Meloidogyne incognita</i> (1000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	4.7	5	5
<i>Meloidogyne incognita</i> (1000 eggs/pot)	4.7	2.3	1
<i>Meloidogyne incognita</i> (5000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	5	5	5
<i>Meloidogyne incognita</i> (5000 eggs/pot)	5	4.2	3.7
<i>Meloidogyne incognita</i> (25000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	5	4.8	4.8
<i>Meloidogyne incognita</i> (25000 eggs/pot)	5	4.8	4.5
<i>Meloidogyne incognita</i> (50000 eggs/pot) + <i>Fusarium oxysporum</i> (30X10 ⁶ conidia/pot) Simultaneous stress	5	5	5
<i>Meloidogyne incognita</i> (50000 eggs/pot)	5	2.8	2

For raw data – Click here (.xlsx file)

Reference – Abawi GS, Barker KR (1984) Effects of Cultivar, soil temperature and Population levels of *Meloidogyne incognita* on root necrosis and fusarium wilt of tomatoes. *Phytopathology* 74: 433-438

Note:

‘***’ - Values are presented as it is from the source article without subjecting to the calculation.

‘*’ - For more information on parameter classification, please refer to the ‘methodology’ tab.

Inference From the study: Abawi GS and Barker KR 1984 studied interaction of *Meloidogyne incognita* and *Fusarium oxysporum* in three tomato cultivar bonny best, Nematex and Rutgers. Pathogens were inoculated singly and simultaneously. Plants were then analysed for their fresh shoot weight and fresh root weight. An additive reduction in both growth parameters was observed under simultaneous stress in cultivar Bonny best and Rutgers but not in cultivar Nematex. Higher nematode inoculum led to more reduced growth. Root gall index, Necrosis index, and total wilt index were high under combined stress treatment in cultivar bonny best and rutgers. **Thus, to conclude, cultivar bonny best and Rutgers are susceptible to this pathogen combination, whereas cultivar Nematex is resistant.**