



Effect on potato cultivars (*Solanum tuberosum* L. cv. Marfona, Sante)

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

Crop: Potato (*Solanum tuberosum* L. cv. Sante, Marfona)
 Stress 1: *Globodera rostochiensis*
 Stress 2: *Rhizoctonia solani*
 Stage of plant: At sowing

The table shows the impact of nematode and fungus alone and in combination on the number of stolon, stem, total dry weight, shoot dry weight, and below ground dry weight of potato plants.

	Treatment	Plant response to stress (reduction over control %) Type A parameters*				
		No. of Stolon	No. of Stem	Total dry weight	Shoot dry weight	Below ground dry weight
Sante	<i>Globodera rostochiensis</i> (50 cysts/pot)	13.3↓	11.1↓	8.6↓	12.8↓	5.2↓
	<i>Globodera rostochiensis</i> (75 cysts/pot)	17.8↓	0.0	13.3↓	17.0↓	10.3↓
	<i>Globodera rostochiensis</i> (100 cysts/pot)	22.2↓	0.0	16.2↓	19.1↓	13.8↓
	<i>Rhizoctonia solani</i> (15g/pot)	-10.0↑	-33.3↑	13.3↓	29.8↓	0.0
	<i>Globodera rostochiensis</i> (50 cysts/pot) + <i>Rhizoctonia solani</i> (15g/pot) Simultaneous stress	-23.3↑	-44.4↑	24.8↓	31.9↓	19.0↓
	<i>Globodera rostochiensis</i> (75 cysts/pot) + <i>Rhizoctonia solani</i> (15g/pot) Simultaneous stress	-31.1↑	-50.0↑	27.6↓	34.0↓	22.4↓
	<i>Globodera rostochiensis</i> (100 cysts/pot) + <i>Rhizoctonia solani</i> (15g/pot) Simultaneous stress	-32.2↑	-55.6↑	31.4↓	29.8↓	32.8↓

Marfona	<i>Globodera rostochiensis</i> (50 cysts/pot)	-26.7↑	-35.0↑	37.6↓	33.3↓	42.1↓
	<i>Globodera rostochiensis</i> (75 cysts/pot)	-27.8↑	-40.0↑	41.9↓	36.7↓	47.4↓
	<i>Globodera rostochiensis</i> (100 cysts/pot)	-30.0↑	-40.0↑	54.7↓	51.7↓	57.9↓
	<i>Rhizoctonia solani</i> (15g/pot)	-23.3↑	-45.0↑	32.5↓	30.0↓	35.1↓
	<i>Globodera rostochiensis</i> (50 cysts/pot) + <i>Rhizoctonia solani</i> (15g/pot) Simultaneous stress	-32.2↑	-75.0↑	59.8↓	65.0↓	54.4↓
	<i>Globodera rostochiensis</i> (75 cysts/pot) + <i>Rhizoctonia solani</i> (15g/pot) Simultaneous stress	-40.0↑	-80.0↑	68.4↓	70.0↓	66.7↓
	<i>Globodera rostochiensis</i> (100 cysts/pot) + <i>Rhizoctonia solani</i> (15g/pot) Simultaneous stress	-48.9↑	-90.0↑	78.6↓	78.3↓	78.9↓

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).
- 3) "0.0" value indicates plant parameter behaved similarly under control and stress condition (no damage).

* - For more information on parameter classification, please refer to the '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 disease severity and effect of the nematode on fungus induced disease severity under combined stress treatment

	Treatment	Response to combined stress** Type B parameters*	
		<i>R. Solani</i> disease severity	Cyst Nematode disease severity
Sante	<i>Globodera rostochiensis</i> (50 cysts/pot)	0	1.2
	<i>Globodera rostochiensis</i> (75 cysts/pot)	0	1.6
	<i>Globodera rostochiensis</i> (100 cysts/pot)	0	1.6
	<i>Rhizoctonia solani</i> (15g/pot)	1.2	0
	<i>Globodera rostochiensis</i> (50 cysts/pot) + <i>Rhizoctonia solani</i> (15g/pot) Simulateneous stress	1.4	1.8
	<i>Globodera rostochiensis</i> (75 cysts/pot) + <i>Rhizoctonia solani</i> (15g/pot) Simulateneous stress	1.8	2
	<i>Globodera rostochiensis</i> (100 cysts/pot) + <i>Rhizoctonia solani</i> (15g/pot) Simulateneous stress	2.2	2
Marfona	<i>Globodera rostochiensis</i> (50 cysts/pot)	0	2.4
	<i>Globodera rostochiensis</i> (75 cysts/pot)	0	2.6
	<i>Globodera rostochiensis</i> (100 cysts/pot)	0	3
	<i>Rhizoctonia solani</i> (15g/pot)	1.8	0
	<i>Globodera rostochiensis</i> (50 cysts/pot) + <i>Rhizoctonia solani</i> (15g/pot) Simulateneous stress	2.2	2.8
	<i>Globodera rostochiensis</i> (75 cysts/pot) + <i>Rhizoctonia solani</i> (15g/pot) Simulateneous stress	3.4	3.6
	<i>Globodera rostochiensis</i> (100 cysts/pot) + <i>Rhizoctonia solani</i> (15g/pot) Simulateneous stress	4	4

For raw data – Click here (.xlsx file)

Reference - Kiani Z, Zafari D, Rezaee S, Arjmandian A, Gitti M, Struik PC (2013) Co-limitation of potato growth by Potato Cyst Nematode (*Globodera rostochiensis*) and *Rhizoctonia solani*. Archives Of Phytopathology And Plant Protection 46: 2401-2408

Note:

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

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

Inference From the study: Kiani Z (2013) studied the interaction of *Globodera rostochiensis* and *Rhizoctonia solani* in potato cultivar sante and marfona. Pathogens were inoculated singly and simultaneously. Plants were then analysed for their on number of stolon, stem, total dry weight, shoot dry weight, and below ground dry weight. Below ground dry weight showed additive reduction under simultaneous inoculation in both cultivars. This reduction was higher in cultivar marfona. Although number of stem and and number of stolons were increased under combined stress. Nematode induced disease severity and fungus induced disease severity was also high under combined stress treatment. Disease severity increased with increased nematode inoculum. **Thus, this pathogen combination acts synergistically to reduce plant growth and forms a complex disease under combined stress treatment in cultivars sante and marfona. Cultivar Marfona is more susceptible to this pathogen combination.**