



Effect on rice cultivars (*Oryza sativa* L. cv. Supa, SARO-5)

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

Crop: Rice (*Oryza sativa* L. cv. Supa, SARO-5)
 Stress 1: Flooding (till plant maturity)
 Stress 2: *Pratylenchus zaeae*
 Stage of plant: 14 days old seedling

The table shows the impact of nematode and flooding alone and in combination on growth and yield in rice plants.

		Plant response to stress (reduction over control %)				
		Type A parameters*				
	Treatment	Growth rate	Dry shoot weight	Root weight	Days to 50% flowering	Height at harvest
Supa	<i>Pratylenchus zaeae</i> (200 nematodes/plant)	10.1 ↓	24.6 ↓	9.7 ↓	-17.4 ↑	8.1 ↓
	<i>Pratylenchus zaeae</i> (500 nematodes/plant)	-9.2 ↑	39.7 ↓	31.0 ↓	-20.4 ↑	1.2 ↓
	<i>Pratylenchus zaeae</i> (1000 nematodes/plant)	12.6 ↓	36.9 ↓	21.5 ↓	-28.6 ↑	0.5 ↓
	<i>Pratylenchus zaeae</i> (3000 nematodes/plant)	14.3 ↓	28.8 ↓	6.3 ↓	-35.3 ↑	11.4 ↓
	<i>Pratylenchus zaeae</i> (10000 nematodes/plant)	28.6 ↓	39.3 ↓	23.5 ↓	-49.7 ↑	10.0 ↓
	Flooding (till plant maturity)	-22.7 ↑	25.6 ↓	55.3 ↓	13.3 ↓	-11.2 ↑
	<i>Pratylenchus zaeae</i> (200 nematodes/plant) + Flooding (1 week later) (Sequential stress)	-38.7 ↑	40.1 ↓	74.5 ↓	1.5 ↓	-5.7 ↑

	<i>Pratylenchus zaeae</i> (500 nematodes/plant) + Flooding (1 week later) (Sequential stress)	-42.9↑	66.7↓	80.0↓	-5.2↑	-6.9↑
	<i>Pratylenchus zaeae</i> (1000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	-51.3↑	58.9↓	80.0↓	-14.1↑	-20.0↑
	<i>Pratylenchus zaeae</i> (3000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	-40.3↑	55.3↓	80.7↓	-13.2↑	8.1↓
	<i>Pratylenchus zaeae</i> (10000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	-52.9↑	47.4↓	72.5↓	-14.9↑	-19.3↑
SARO-5	<i>Pratylenchus zaeae</i> (200 nematodes/plant)	5.4↓	53.6↓	6.5↓	-34.4↑	4.3↓
	<i>Pratylenchus zaeae</i> (500 nematodes/plant)	-2.7↑	61.9↓	22.4↓	-37.9↑	3.2↓
	<i>Pratylenchus zaeae</i> (1000 nematodes/plant)	20.3↓	63.7↓	23.1↓	-49.9↑	3.5↓
	<i>Pratylenchus zaeae</i> (3000 nematodes/plant)	29.7↓	53.2↓	40.6↓	-49.9↑	12.4↓
	<i>Pratylenchus zaeae</i> (10000 nematodes/plant)	62.2↓	60.1↓	62.8↓	-69.8↑	13.1↓
	Flooding (till plant maturity)	-31.1↑	37.8↓	47.1↓	28.5↓	-17.1↑
	<i>Pratylenchus zaeae</i> (200 nematodes/plant) + Flooding (1 week later) (Sequential stress)	-37.8↑	60.5↓	66.1↓	1.7↓	-11.8↑
	<i>Pratylenchus zaeae</i> (500 nematodes/plant) + Flooding (1 week later) (Sequential stress)	-37.8↑	60.9↓	63.7↓	-3.4↑	-6.4↑

	<i>Pratylenchus zaeae</i> (1000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	-17.6↑	65.5↓	74.4↓	-37.1↑	3.5↓
	<i>Pratylenchus zaeae</i> (3000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	-1.4↑	57.4↓	77.8↓	-41.3↑	5.3↓
	<i>Pratylenchus zaeae</i> (10000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	-2.7↑	67.3↓	85.2↓	-52.6↑	1.4↓
		Plant response to stress (reduction over control %) Type A parameters*				
	Treatment	No. of filled grains/panicle	Filled grain weight	Spikelet fertility** (%)	Yield loss** (%)	
Supa	<i>Pratylenchus zaeae</i> (200 nematodes/plant)	47.9↓	20.1↓	54.3	15.3	
	<i>Pratylenchus zaeae</i> (500 nematodes/plant)	50.0↓	23.1↓	52.9	26.9	
	<i>Pratylenchus zaeae</i> (1000 nematodes/plant)	75.5↓	38.1↓	23.5	36.5	
	<i>Pratylenchus zaeae</i> (3000 nematodes/plant)	84.1↓	54.5↓	30.8	50.8	
	<i>Pratylenchus zaeae</i> (10000 nematodes/plant)	92.6↓	83.6↓	14.2	83.0	
	Flooding (till plant maturity)	-26.6↑	-41.0↑	97.2	0.0	
	<i>Pratylenchus zaeae</i> (200 nematodes/plant) + Flooding (1 week later) (Sequential stress)	50.0↓	-16.4↑	47.4	15.1	

	<i>Pratylenchus zaeae</i> (500 nematodes/plant) + Flooding (1 week later) (Sequential stress)	40.4↓	-1.5↑	57.1	28.0
	<i>Pratylenchus zaeae</i> (1000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	58.5↓	-8.2↑	46.5	21.5
	<i>Pratylenchus zaeae</i> (3000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	74.5↓	-4.5↑	69.5	24.7
	<i>Pratylenchus zaeae</i> (10000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	44.7↓	8.2↓	54.8	27.0
SARO-5	<i>Pratylenchus zaeae</i> (200 nematodes/plant)	-5.5↑	31.7↓	35.4	28.1
	<i>Pratylenchus zaeae</i> (500 nematodes/plant)	47.3↓	58.5↓	23.0	59.9
	<i>Pratylenchus zaeae</i> (1000 nematodes/plant)	100.0↓	100.0↓	0.0	99.5
	<i>Pratylenchus zaeae</i> (3000 nematodes/plant)	98.2↓	100.0↓	0.0	99.5
	<i>Pratylenchus zaeae</i> (10000 nematodes/plant)	100.0↓	100.0↓	0.0	99.5
	Flooding (till plant maturity)	-256.4↑	-790.2↑	99.5	0.0
	<i>Pratylenchus zaeae</i> (200 nematodes/plant) + Flooding (1 week later) (Sequential stress)	-63.6↑	-204.9↑	64.0	61.1
	<i>Pratylenchus zaeae</i> (500 nematodes/plant) + Flooding (1 week later) (Sequential stress)	-7.3↑	-39.0↑	52.9	83.7

<i>Pratylenchus zaeae</i> (1000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	100.0↓	100.0↓	0.0	99.8
<i>Pratylenchus zaeae</i> (3000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	100.0↓	100.0↓	0.0	99.8
<i>Pratylenchus zaeae</i> (10000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	90.9↓	90.2↓	63.1	98.4

Reference - Nzogela YB, Landschoot S, Kihupi AL, Coyne DL, Gheysen G (2020) Pathogenicity of the root-lesion nematode, *Pratylenchus zaeae*, on rice genotypes under different hydro-ecologies in Tanzania. *Nematology* 22: 221-233.

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).

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

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

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

The table shows the effect of the nematode and flooding on nematode population and multiplication factor under combined stress treatment

	Treatment	Response to combined stress**	
		Type B parameters*	
		No. of nematodes/ g root	Multiplication factor
Supa	<i>Pratylenchus zaeae</i> (200 nematodes/plant)	0.00	0.80
	<i>Pratylenchus zaeae</i> (500 nematodes/plant)	12.70	0.80
	<i>Pratylenchus zaeae</i> (1000 nematodes/plant)	12.70	0.80
	<i>Pratylenchus zaeae</i> (3000 nematodes/plant)	12.70	0.40
	<i>Pratylenchus zaeae</i> (10000 nematodes/plant)	12.70	0.20
	Flooding (till plant maturity)	0.00	0.00
	<i>Pratylenchus zaeae</i> (200 nematodes/plant) + Flooding (1 week later) (Sequential stress)	0.00	0.40
	<i>Pratylenchus zaeae</i> (500 nematodes/plant) + Flooding (1 week later) (Sequential stress)	6.30	0.21
	<i>Pratylenchus zaeae</i> (1000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	12.70	0.21
	<i>Pratylenchus zaeae</i> (3000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	12.70	0.21
<i>Pratylenchus zaeae</i> (10000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	25.50	0.21	
SARO-5	<i>Pratylenchus zaeae</i> (200 nematodes/plant)	108.50	46.10
	<i>Pratylenchus zaeae</i> (500 nematodes/plant)	127.60	20.30

<i>Pratylenchus zaeae</i> (1000 nematodes/plant)	236.10	16.90
<i>Pratylenchus zaeae</i> (3000 nematodes/plant)	319.10	5.70
<i>Pratylenchus zaeae</i> (10000 nematodes/plant)	714.00	2.10
Flooding (till plant maturity)	0.00	0.00
<i>Pratylenchus zaeae</i> (200 nematodes/plant) + Flooding (1 week later) (Sequential stress)	108.50	12.90
<i>Pratylenchus zaeae</i> (500 nematodes/plant) + Flooding (1 week later) (Sequential stress)	140.40	7.20
<i>Pratylenchus zaeae</i> (1000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	255.30	4.80
<i>Pratylenchus zaeae</i> (3000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	268.00	1.40
<i>Pratylenchus zaeae</i> (10000 nematodes/plant) + Flooding (1 week later) (Sequential stress)	370.20	0.40

Reference - Nzogela YB, Landschoot S, Kihupi AL, Coyne DL, Gheysen G (2020) Pathogenicity of the root-lesion nematode, *Pratylenchus zaeae*, on rice genotypes under different hydro-ecologies in Tanzania. *Nematology* 22: 221-233.

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 the ‘methodology’ tab.

Inference From the study: Nzogela et al. studied the interaction of *Pratylenchus zaeae* and flooding in two rice cultivars Supa and SARO-5. Stress was given singly and sequentially. Parameters like growth rate, days to 50% flowering, height at harvest, and filled grain weight increased under combined stress compared to single nematode stress. Dry shoot weight and root weight show an additive reduction under combined stress. The number of filled grains per panicle decreased under combined stress but not additively. The reduction was more under single nematode stress. Spikelet fertility was more under combined stress than individual nematode stress, and cultivar Supa showed less spikelet fertility. Yield loss was more under single

nematode stress, and cultivar SARO-5 showed more yield loss than cultivar Supa under combined stress. Nematode population and multiplication factor was less under combined stress. Cultivar SARO-5 showed a higher nematode multiplication rate. Overall, flooding stress does not show a negative effect on rice plants. Moreover, flooding antagonizes the effect of nematode stress. **Thus, this stress combination does not reduce rice growth and yield synergistically and is not detrimental to the plant.**