



Effect on soybean cultivars (*Glycine max* cv. Corsoy, Dyer, Harosoy-63)

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

Crop: Soybean (*Glycine max* cv. Corsoy, Dyer, Harosoy-63)
 Stress 1: *Heterodera glycines*
 Stress 2: *Phytophthora megasperma* var. *sojae*
 Stage of plant: At sowing

The table shows the impact of nematode and oomycete alone and in combination on shoot dry weight in soybean plants.

	Treatment	Plant response to stress (reduction over control %)
		Type A parameters* Shoot dry weight
Corsoy	<i>Heterodera glycines</i> (500 larvae/plant)	20.0 ↓
	<i>Phytophthora megasperma</i> (4mm disc/plant)	80.0 ↓
	<i>Phytophthora megasperma</i> (4mm disc/plant) + <i>Heterodera glycines</i> (500 larvae/plant) Simultaneous stress	86.0 ↓
	<i>Heterodera glycines</i> (500 larvae/plant) + <i>Phytophthora megasperma</i> (4mm disc/plant) 5 days later (Sequential stress)	50.0 ↓
	<i>Heterodera glycines</i> (500 larvae/plant) + <i>Phytophthora megasperma</i> (4mm disc/plant) 10 days later (Sequential stress)	40.0 ↓
Dyer	<i>Heterodera glycines</i> (500 larvae/plant)	-2.0 ↑
	<i>Phytophthora megasperma</i> (4mm disc/plant)	59.2 ↓

	<i>Phytophthora megasperma</i> (4mm disc/plant) + <i>Heterodera glycines</i> (500 larvae/plant) Simultaneous stress	63.3↓
	<i>Heterodera glycines</i> (500 larvae/plant) + <i>Phytophthora megasperma</i> (4mm disc/plant) 5 days later (Sequential stress)	44.9↓
	<i>Heterodera glycines</i> (500 larvae/plant) + <i>Phytophthora megasperma</i> (4mm disc/plant) 10 days later (Sequential stress)	40.8↓
Harosoy-63	<i>Heterodera glycines</i> (500 larvae/plant)	20.0↓
	<i>Phytophthora megasperma</i> (4mm disc/plant)	11.1↓
	<i>Phytophthora megasperma</i> (4mm disc/plant) + <i>Heterodera glycines</i> (500 larvae/plant) Simultaneous stress	15.6↓
	<i>Heterodera glycines</i> (500 larvae/plant) + <i>Phytophthora megasperma</i> (4mm disc/plant) 5 days later (Sequential stress)	6.7↓
	<i>Heterodera glycines</i> (500 larvae/plant) + <i>Phytophthora megasperma</i> (4mm disc/plant) 10 days later (Sequential stress)	11.1↓

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 parameter classification, please refer to the 'methodology' tab.

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

The table shows the effect of the oomycete pathogen on nematode population and the effect of the nematode on oomycete induced disease rating under combined stress treatment

	Treatment	Response to combined stress**	
		Type B parameters*	
		Disease rating	No. of nematodes/ seedling
Corsoy	<i>Heterodera glycines</i> (500 larvae/plant)	N/A	88
	<i>Phytophthora megasperma</i> (4mm disc/plant)	2.9	N/A
	<i>Phytophthora megasperma</i> (4mm disc/plant) + <i>Heterodera glycines</i> (500 larvae/plant) Simultaneous stress	3.6	2
	<i>Heterodera glycines</i> (500 larvae/plant) + <i>Phytophthora megasperma</i> (4mm disc/plant) 5 days later (Sequential stress)	2.7	38
	<i>Heterodera glycines</i> (500 larvae/plant) + <i>Phytophthora megasperma</i> (4mm disc/plant) 10 days later (Sequential stress)	2.7	57
Dyer	<i>Heterodera glycines</i> (500 larvae/plant)	N/A	3
	<i>Phytophthora megasperma</i> (4mm disc/plant)	2.7	N/A
	<i>Phytophthora megasperma</i> (4mm disc/plant) + <i>Heterodera glycines</i> (500 larvae/plant) Simultaneous stress	3.3	2

	<i>Heterodera glycines</i> (500 larvae/plant) + <i>Phytophthora megasperma</i> (4mm disc/plant) 5 days later (Sequential stress)	1.7	4
	<i>Heterodera glycines</i> (500 larvae/plant) + <i>Phytophthora megasperma</i> (4mm disc/plant) 10 days later (Sequential stress)	1.6	2
Harosoy-63	<i>Heterodera glycines</i> (500 larvae/plant)	N/A	91
	<i>Phytophthora megasperma</i> (4mm disc/plant)	0	N/A
	<i>Phytophthora megasperma</i> (4mm disc/plant) + <i>Heterodera glycines</i> (500 larvae/plant) Simultaneous stress	0	85
	<i>Heterodera glycines</i> (500 larvae/plant) + <i>Phytophthora megasperma</i> (4mm disc/plant) 5 days later (Sequential stress)	0	78
	<i>Heterodera glycines</i> (500 larvae/plant) + <i>Phytophthora megasperma</i> (4mm disc/plant) 10 days later (Sequential stress)	0	83

For raw data – Click here (.xlsx file)

Reference - Adeniji MO, Edwards DI, Sinclair JB, Malek RB (1975) Interrelationship of *Heterodera glycines* and *Phytophthora megasperma* var. *sojae* in soybeans. *Phytopathology* 65: 722-725

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: Adeniji et al., (1975) studied the interaction of *Heterodera glycines* with *Phytophthora megasperma* in three soybean cultivars Corsoy, Dyer, Harosoy-63. Pathogens were inoculated singly, sequentially, and simultaneously. Plants were then analyzed for their shoot dry weight. Cultivars corsoy and dyer showed an additive reduction under simultaneous inoculation of the pathogen but not when pathogens were inoculated sequentially. Cultivar harsoy-63 did not show an additive reduction in shoot dry weight upon combined stress treatment. Disease rating was high under simultaneous inoculation compared to sequential

inoculation in cultivars corsoy and dyer. However, cultivar harsoy-63 did not show any disease rating. Nematode population decreased under combined stress treatment for all cultivars. **Thus, this pathogen combination acts synergistically to reduce plant growth and forms a complex disease phenotype in soybean cultivars corsoy and dyer.**