



Effect on chickpea cultivars (*Cicer arietinum* L. cv. Avrodhi, K850, JG74)

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

Crop: Chickpea (*Cicer arietinum* cv. Avrodhi, K850, JG74)
 Stress 1: *Meloidogyne javanica*
 Stress 2: *Fusarium oxysporum* f. sp. *ciceris*
 Stage of plant: Sowing

The table shows the impact of nematode and fungus alone and in combination on fresh shoot weight, dry shoot weight and fresh root weight of chickpea plants.

	Treatment	Plant response to stress (reduction over control %) Type A parameters*		
		Fresh shoot weight	Dry shoot weight	Fresh root weight
Avrodhi	<i>Meloidogyne javanica</i> (2500J2/kg soil)	0.9↓	9.3↓	9.1↓
	<i>Fusarium oxysporum</i> (50g/kg soil)	10.3↓	20.9↓	12.5↓
	<i>Meloidogyne javanica</i> (2500J2/kg soil) + <i>Fusarium oxysporum</i> (50g/kg soil) (simultaneous stress)	-8.1↑	4.7↓	25.0↓
	<i>Meloidogyne javanica</i> (2500J2/kg soil) + <i>Fusarium oxysporum</i> (50g/kg soil) 4 days later (sequential stress)	15.8↓	30.2↓	29.8↓
	<i>Fusarium oxysporum</i> (50g/kg soil) + <i>Meloidogyne javanica</i> (2500J2/kg soil) 4 days later (sequential stress)	12.4↓	27.9↓	30.8↓
K850	<i>Meloidogyne javanica</i>	-9.6↑	12.3↓	-25.0↑
	<i>Fusarium oxysporum</i>	4.4↓	12.3↓	-39.7↑
	<i>Meloidogyne javanica</i> (2500J2/kg soil) + <i>Fusarium oxysporum</i> (50g/kg soil) (simultaneous stress)	0.3↓	12.3↓	-38.8↑
	<i>Meloidogyne javanica</i> (2500J2/kg soil) + <i>Fusarium oxysporum</i> (50g/kg soil) 4 days later (sequential stress)	-6.8↑	1.5↓	-53.4↑

	<i>Fusarium oxysporum</i> (50g/kg soil) + <i>Meloidogyne javanica</i> (2500J2/kg soil) 4 days later (sequential stress)	3.8↓	9.2↓	-24.1↑
JG74	<i>Meloidogyne javanica</i> (2500J2/kg soil)	-14.3↑	-27.8↑	17.3↓
	<i>Fusarium oxysporum</i> (50g/kg soil)	10.0↓	16.7↓	30.7↓
	<i>Meloidogyne javanica</i> (2500J2/kg soil) + <i>Fusarium oxysporum</i> (50g/kg soil) (simultaneous stress)	-12.0↑	-44.4↑	54.0↓
	<i>Meloidogyne javanica</i> (2500J2/kg soil) + <i>Fusarium oxysporum</i> (50g/kg soil) 4 days later (sequential stress)	-27.4↑	-20.4↑	34.7↓
	<i>Fusarium oxysporum</i> (50g/kg soil) + <i>Meloidogyne javanica</i> (2500J2/kg soil) 4 days later (sequential stress)	-16.6↑	-9.3↑	41.6↓

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 population and effect of the nematode on fungus induced leaf chlorosis under combined stress treatment

	Treatment	Response to combined stress** Type B parameters*	
		Leaf Chlorosis (%)	Nematodes/ root
Avrodhi	<i>Meloidogyne javanica</i> (2500J2/kg soil)	20	325
	<i>Fusarium oxysporum</i> (50g/kg soil)	5	N/A
	<i>Meloidogyne javanica</i> (2500J2/kg soil) + <i>Fusarium oxysporum</i> (50g/kg soil) (simultaneous stress)	50	261
	<i>Meloidogyne javanica</i> (2500J2/kg soil) + <i>Fusarium oxysporum</i> (50g/kg soil) 4 days later (sequential stress)	30	N/A
	<i>Fusarium oxysporum</i> (50g/kg soil) + <i>Meloidogyne javanica</i> (2500J2/kg soil) 4 days later (sequential stress)	20	N/A
K850	<i>Meloidogyne javanica</i> (2500J2/kg soil)	20	371
	<i>Fusarium oxysporum</i> (50g/kg soil)	40	N/A
	<i>Meloidogyne javanica</i> (2500J2/kg soil) + <i>Fusarium oxysporum</i> (50g/kg soil) (simultaneous stress)	60	136
	<i>Meloidogyne javanica</i> (2500J2/kg soil) + <i>Fusarium oxysporum</i> (50g/kg soil) 4 days later (sequential stress)	50	N/A
	<i>Fusarium oxysporum</i> (50g/kg soil) + <i>Meloidogyne javanica</i> (2500J2/kg soil) 4 days later (sequential stress)	40	N/A
JG74	<i>Meloidogyne javanica</i> (2500J2/kg soil)	10	312
	<i>Fusarium oxysporum</i> (50g/kg soil)	5	N/A
	<i>Meloidogyne javanica</i> (2500J2/kg soil) + <i>Fusarium oxysporum</i> (50g/kg soil) (simultaneous stress)	25	199
	<i>Meloidogyne javanica</i> (2500J2/kg soil) + <i>Fusarium oxysporum</i> (50g/kg soil) 4 days later (sequential stress)	40	N/A
	<i>Fusarium oxysporum</i> (50g/kg soil) + <i>Meloidogyne javanica</i> (2500J2/kg soil) 4 days later (sequential stress)	20	N/A

For raw data – Click here (.xlsx file)

Reference - Maheshwari TU, Sharma SB, Reddy DDR, Haware MP (1997) Interaction of *Fusarium oxysporum* f. sp. *ciceri* and *Meloidogyne javanica* on *Cicer arietinum*. Journal of Nematology 29(1):117-126

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: Maheshwari TU (1997) studied interaction of *Meloidogyne javanica* with *Fusarium oxysporum* in chickpea cultivar avrodhi, K850 and JG74 . Pathogens were inoculated singly, sequentially, and simultaneously. An additive reduction in fresh shoot weight was observed under sequential stress in cultivar avrodhi but not in K850 and JG74. Other growth parameters like dry shoot weight and fresh shoot weight showed an additive reduction in both simultaneous and sequential stress. Leaf chlorosis was high under simultaneous stress and maximum in cultivar avrodhi and K850. **Thus, this pathogen combination acts synergistically and reduces growth parameters and forms a severe disease phenotype in cultivar avrodhi and K850.**