



Effect on alfalfa genotypes (*Medicago sativa* L. cv. Ranger, Nev Syn XX & Moapa 69)

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

Crop: Alfalfa (*Medicago sativa* L.) cv. Ranger, Nev Syn XX, Moapa 69
 Stress 1: *Meloidogyne hapla*
 Stress 2: *Fusarium oxysporum* f.sp. *medicaginis*
 Stage of plant: 28 days after germination

The table shows the impact of nematode and fungus alone and in combination on shoot and root weight of alfalfa genotypes

Cultivar	Treatment	Plant response to stress (reduction over control %)	
		Type A parameters*	
		Shoot weight	Root weight
Nev Syn XX	<i>Meloidogyne hapla</i> (1000 J2)	4↓	2.75↓
	<i>Fusarium oxysporum</i> (12×10^7 microconidia)	2.55↓	-3.61↑
	<i>Meloidogyne hapla</i> (1000 J2) + <i>Fusarium oxysporum</i> (12×10^7 microconidia) (simultaneous stress)	1.45↓	3.61↓
	<i>Meloidogyne hapla</i> (1000 J2) + <i>Fusarium oxysporum</i> (12×10^7 microconidia) (28 days later) (sequential stress)	-2.18↑	6.5↓
Moapa 69	<i>Meloidogyne hapla</i> (1000 J2)	17.4↓	12.1↓
	<i>Fusarium oxysporum</i> (12×10^7 microconidia)	-5.03↑	5.86↓
	<i>Meloidogyne hapla</i> (1000 J2) + <i>Fusarium oxysporum</i> (12×10^7 microconidia) (simultaneous stress)	28.5↓	34.6↓
	<i>Meloidogyne hapla</i> (1000 J2) + <i>Fusarium oxysporum</i> (12×10^7 microconidia) (28 days later)	43.3↓	43↓

	<i>later) (sequential stress)</i>		
Range r	<i>Meloidogyne hapla (1000 J2)</i>	25.4 ↓	21 ↓
	<i>Fusarium oxysporum (12X10⁷ microconidia)</i>	-9 ↑	5.38 ↓
	<i>Meloidogyne hapla (1000 J2) + Fusarium oxysporum (12X10⁷ microconidia) (simultaneous stress)</i>	33.3 ↓	25.6 ↓
	<i>Meloidogyne hapla (1000 J2) + Fusarium oxysporum (12X10⁷ microconidia) (28 days later) (sequential stress)</i>	70.6 ↓	53.2 ↓

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

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

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 reproduction and root galling under combined stress treatment

Cultivar	Treatment	Response to combined stress**	
		Type B parameters*	
		Nematode indices	
		Reproduction	Root galling
Nev	<i>Meloidogyne hapla (1000 J2)</i>	N/A	N/A

Syn XX	<i>Fusarium oxysporum</i> (12×10^7 microconidia)	N/A	N/A
	<i>Meloidogyne hapla</i> (1000 J2) + <i>Fusarium oxysporum</i> (12×10^7 microconidia) (simultaneous stress)	N/A	N/A
	<i>Meloidogyne hapla</i> + <i>Fusarium oxysporum</i> (12×10^7 microconidia) (28 days later) (sequential stress)	N/A	N/A
Moap a 69	<i>Meloidogyne hapla</i> (1000 J2)	N/A	N/A
	<i>Fusarium oxysporum</i> (12×10^7 microconidia)	N/A	N/A
	<i>Meloidogyne hapla</i> (1000 J2) + <i>Fusarium oxysporum</i> (12×10^7 microconidia) (simultaneous stress)	N/A	N/A
	<i>Meloidogyne hapla</i> + <i>Fusarium oxysporum</i> (12×10^7 microconidia) (28 days later) (sequential stress)	N/A	N/A
Range r	<i>Meloidogyne hapla</i> (1000 J2)	16.3	5
	<i>Fusarium oxysporum</i> (12×10^7 microconidia)	0	0
	<i>Meloidogyne hapla</i> (1000 J2) + <i>Fusarium oxysporum</i> (12×10^7 microconidia) (simultaneous stress)	12.8	4.2
	<i>Meloidogyne hapla</i> (1000 J2) + <i>Fusarium oxysporum</i> (12×10^7 microconidia) (28 days later) (sequential stress)	8.4	3.1

For raw data – Click here (.xlsx file)

Reference- Griffin G D, Thyr BD (1988) Interaction of *Meloidogyne hapla* and *Fusarium oxysporum* f. sp. *medicaginis* on alfalfa. *Phytopathology* 78:421-425.

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: Griffin GD, Thyr BD (1988) studied interaction of *Meloidogyne hapla* and *Fusarium oxysporum f. sp. medicaginis* in alfalfa three cultivars. Simultaneous and sequential inoculation of both pathogens resulted in reduction of shoot and root weight additively in cultivar ranger and moapa69 but not in nev syn XX. However, root galling and reproduction of nematodes did not increase additively under combined stress treatment in cultivar ranger. **Thus, pathogens are working synergistically to reduce plant growth only in some genotypes.**