Effect on tobacco cultivars (*Nicotiana tabacum L. cv.* RK- 10 P3, RK-12 P3, RK-13 P4, RK-18 P8, RK-26 P3)

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

Crop: Tobacco (*Nicotiana tabacum* L. cv. RK-10 P3, RK-12 P3, RK-13 P4, RK-18 P8, RK-26 P3)
Stress 1: *Meloidogyne incognita*
Stress 2: *Pythium aphanidermatum*
Stage of plant: At sowing

The table shows the impact of nematode and oomycete alone and in combination on plant growth parameters in tobacco plants.

	Treatment	Plant response to stress (reduction over control %) Type A parameters*			
		Shoot length	Root length	Shoot dry weight	Root dry weight
RK- 10 P3	*Pythium aphanidermatum* (10^6 *cfu/g seed)*	7.1↓	13.8↓	11.0↓	20.6↓
	Meloidogyne incognita (2000 juveniles/plant)	24.8↓	23.4↓	17.0↓	19.7↓
	Meloidogyne incognita (2000 juveniles/plant) + *Pythium aphanidermatum* (10^6 *cfu/g seed) Simultaneous stress*	40.0↓	30.5↓	24.0↓	36.5↓
RK-18 P8	*Pythium aphanidermatum* (10^6 *cfu/g seed)*	8.5↓	16.0↓	7.5↓	19.8↓
	Meloidogyne incognita (2000 juveniles/plant)	14.8↓	19.3↓	23.4↓	25.9↓
	Meloidogyne incognita (2000 juveniles/plant) + *Pythium aphanidermatum* (10^6 *cfu/g seed) Simultaneous stress*	35.4↓	23.2↓	22.9↓	30.6↓

RK-26 P3	*Pythium aphanidermatum (10^6 cfu/g seed)*	19.9↓	9.4↓	10.9↓	8.7↓
	Meloidogyne incognita (2000 juveniles/plant)	19.0↓	15.5↓	12.7↓	15.9↓
	Meloidogyne incognita (2000 juveniles/plant) + Pythium aphanidermatum (10^6 cfu/g seed) Simultaneous stress	28.8↓	35.4↓	25.5↓	24.6↓
RK-13 P4	*Pythium aphanidermatum (10^6 cfu/g seed)*	6.9↓	10.5↓	2.5↓	5.8↓
	Meloidogyne incognita (2000 juveniles/plant)	7.9↓	11.0↓	7.4↓	11.5↓
	Meloidogyne incognita (2000 juveniles/plant) + Pythium aphanidermatum (10^6 cfu/g seed) Simultaneous stress	16.5↓	16.0↓	9.9↓	15.4↓
RK-12 P3	*Pythium aphanidermatum (10^6 cfu/g seed)*	1.1↓	1.8↓	-1.0↑	1.8↓
	Meloidogyne incognita (2000 juveniles/plant)	3.2↓	3.0↓	1.0↓	7.1↓
	Meloidogyne incognita (2000 juveniles/plant) + Pythium aphanidermatum (10^6 cfu/g seed) Simultaneous stress	8.5↓	12.2↓	5.0↓	11.8↓

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

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

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 induced gall index, egg mass index and nematode population and the effect of the nematode on oomycete induced root-rot index and oomycete population under combined stress treatment

	Treatment	Response to combined stress** Type B parameters*				
		Root rot index	**Gall index**	**Egg mass index**	**Soil population of nematode (J2/kg)**	**Soil population of oomycete (10^3 CFU/kg)**
RK- 10 P3	*Pythium aphanidermatum (10^6 cfu/g seed)*	2.6	N/A	N/A	N/A	5600
	Meloidogyne incognita (2000 juveniles/plant)	N/A	3	2.6	5814	N/A
	Meloidogyne incognita (2000 juveniles/plant) + Pythium aphanidermatum (10^6 cfu/g seed) Simultaneous stress	3	3.6	3	6019	7100
RK-18 P8	*Pythium aphanidermatum (10^6 cfu/g seed)*	2.3	N/A	N/A	N/A	5400
	Meloidogyne incognita (2000 juveniles/plant)	N/A	2.6	2	5421	N/A
	Meloidogyne incognita (2000 juveniles/plant) + Pythium aphanidermatum (10^6 cfu/g seed) Simultaneous stress	2.6	3.3	2.6	5817	6920
RK-26 P3	*Pythium aphanidermatum (10^6 cfu/g seed)*	1.3	N/A	N/A	N/A	2264
	Meloidogyne incognita (2000 juveniles/plant)	N/A	2.3	1.6	4354	N/A

	Meloidogyne incognita (2000 juveniles/plant) + Pythium aphanidermatum (10^6 cfu/g seed) Simultaneous stress	2	3	2	4860	3147
RK-13 P4	*Pythium aphanidermatum (10^6 cfu/g seed)*	1	N/A	N/A	N/A	2018
	Meloidogyne incognita (2000 juveniles/plant)	N/A	2	1.3	3842	N/A
	Meloidogyne incognita (2000 juveniles/plant) + Pythium aphanidermatum (10^6 cfu/g seed) Simultaneous stress	1.3	2.3	2	4008	2834
RK-12 P3	*Pythium aphanidermatum (10^6 cfu/g seed)*	0.3	N/A	N/A	N/A	510
	Meloidogyne incognita (2000 juveniles/plant)	N/A	1.3	1	2213	N/A
	Meloidogyne incognita (2000 juveniles/plant) + Pythium aphanidermatum (10^6 cfu/g seed) Simultaneous stress	1	1.6	1	2548	689

For raw data – Click here (.xlsx file)

Reference - Khan MR, Haque Z (2013) Morphological and biochemical responses of five tobacco cultivars to simultaneous infection with Pythium aphanidermatum and Meloidogyne incognita. Phytopathologia Mediterranea 52(1): 98-109

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: Khan and Haque (2013) studied the interaction of *Meloidogyne incognita* with *Pythium aphanidermatum* in five tobacco cultivars RK- 10 P3, RK-12 P3, RK-13 P4, RK-18 P8, RK-26 P3. Pathogens were inoculated singly and simultaneously. Plants were

then analyzed for their shoot length, root length, shoot dry weight, and root dry weight. All growth parameters showed an additive reduction under simultaneous inoculation. But this reduction was higher in the case of three cultivars RK- 10 P3, RK-18 P8, and RK-26 P3. Root rot index, gall index, and oomycete and nematode population levels were also high under combined stress treatment and similar to growth parameters disease index was high for cultivars RK- 10 P3, RK-18 P8, and RK-26 P3. This suggests that cultivars RK- 10 P3, RK-18 P8, and RK-26 P3 are susceptible to this pathogen combination. **Thus, this pathogen combination acts synergistically to reduce plant growth and forms a complex disease phenotype.**