Effect on barley cultivars (*Hordeum vulgare* cv. Steptoe, Luther)

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

Crop: Barley (*Hordeum vulgare* cv. Steptoe, Luther)
Stress 1: High/Low temperature (15°C, 30°C)
Stress 2: *Meloidogyne chitwoodi* Idaho race (R1) and Utah race (R2) (2, 10, 20 eggs/cm3)
Stage of plant: 12 days after emergence

The table shows the impact of high/low temperature and nematode alone and in combination on growth of barley cultivars.

	Treatment	Plant response to stress** Type A parameters*			
		Plant height (cm)	**Tillers per plant**	**Root dry weight (g)**	**Shoot dry weight (g)**
Steptoe	Low temperature (15°C)	65.0	5.5	3.7	0.97
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R1; 2 eggs/cm3) (Simultaneous stress)	57.5	5.2	3.4	0.93
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R1; 10 eggs/cm3) (Simultaneous stress)	56.1	4.9	3.1	0.79
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R1; 20 eggs/cm3) (Simultaneous stress)	54.7	3.8	2.8	0.71
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R2; 2 eggs/cm3) (Simultaneous stress)	62.2	4.9	3.1	0.87
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R2; 10 eggs/cm3) (Simultaneous stress)	62.1	4.5	3.0	0.75
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R2; 20 eggs/cm3) (Simultaneous stress)	59.4	3.6	2.8	0.63
	High temperature (30°C)	49.5	6.0	4.1	0.89
	High temperature (30°C) + *Meloidogyne chitwoodi* (R1; 2 eggs/cm3) (Simultaneous stress)	41.0	5.7	3.9	0.77

	High temperature (30°C) + *Meloidogyne chitwoodi* (R1; 10 eggs/cm3) (Simultaneous stress)	40.4	4.2	2.8	0.63
	High temperature (30°C) + *Meloidogyne chitwoodi* (R1; 20 eggs/cm3) (Simultaneous stress)	39.0	3.0	2.3	0.40
	High temperature (30°C) + *Meloidogyne chitwoodi* (R2; 2 eggs/cm3) (Simultaneous stress)	44.5	5.2	3.4	0.77
	High temperature (30°C) + *Meloidogyne chitwoodi* (R2; 10 eggs/cm3) (Simultaneous stress)	47.3	4.4	2.9	0.67
	High temperature (30°C) + *Meloidogyne chitwoodi* (R2; 20 eggs/cm3) (Simultaneous stress)	41.8	3.1	2.5	0.44
Luther	Low temperature (15°C)	48.8	3.6	3.1	0.47
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R1; 2 eggs/cm3) (Simultaneous stress)	43.3	3.6	3.0	0.46
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R1; 10 eggs/cm3) (Simultaneous stress)	46.3	3.1	2.8	0.36
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R1; 20 eggs/cm3) (Simultaneous stress)	49.0	2.6	2.5	0.35
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R2; 2 eggs/cm3) (Simultaneous stress)	42.8	3.3	2.8	0.43
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R2; 10 eggs/cm3) (Simultaneous stress)	44.1	2.9	2.6	0.35
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R2; 20 eggs/cm3) (Simultaneous stress)	48.2	2.1	2.4	0.32
	High temperature (30°C)	28.0	4.9	3.7	0.43
	High temperature (30°C) + *Meloidogyne chitwoodi* (R1; 2 eggs/cm3) (Simultaneous stress)	27.2	4.1	3.0	0.38

	High temperature (30°C) + *Meloidogyne chitwoodi* (R1; 10 eggs/cm3) (Simultaneous stress)	25.2	3.1	2.5	0.31
	High temperature (30°C) + *Meloidogyne chitwoodi* (R1; 20 eggs/cm3) (Simultaneous stress)	27.4	2.0	2.1	0.23
	High temperature (30°C) + *Meloidogyne chitwoodi* (R2; 2 eggs/cm3) (Simultaneous stress)	29.9	4.9	3.1	0.38
	High temperature (30°C) + *Meloidogyne chitwoodi* (R2; 10 eggs/cm3) (Simultaneous stress)	28.8	3.1	2.7	0.37
	High temperature (30°C) + *Meloidogyne chitwoodi* (R2; 20 eggs/cm3) (Simultaneous stress)	27.1	2.1	2.3	0.23

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

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

2. The interaction between high/low temperature and nematode under combined stress at plant interface

The table shows the effect of high/low temperature on nematode reproduction number and root galling index under combined stress treatment.

	Treatment	**Response to combined stress**** **Type B parameters***	
		Reproduction number (Pf/Pi)	**Root galling index**
Steptoe	Low temperature (15°C)	N/A	N/A
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R1; 2 eggs/cm3) (Simultaneous stress)	3.10	1.90
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R1; 10 eggs/cm3) (Simultaneous stress)	2.20	1.90

	Low temperature (15°C) + *Meloidogyne chitwoodi* (R1; 20 eggs/cm3) (Simultaneous stress)	1.20	2.40
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R2; 2 eggs/cm3) (Simultaneous stress)	4.40	2.10
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R2; 10 eggs/cm3) (Simultaneous stress)	2.70	2.20
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R2; 20 eggs/cm3) (Simultaneous stress)	1.90	2.80
	High temperature (30°C)	N/A	N/A
	High temperature (30°C) + *Meloidogyne chitwoodi* (R1; 2 eggs/cm3) (Simultaneous stress)	4.90	1.80
	High temperature (30°C) + *Meloidogyne chitwoodi* (R1; 10 eggs/cm3) (Simultaneous stress)	3.40	2.50
	High temperature (30°C) + *Meloidogyne chitwoodi* (R1; 20 eggs/cm3) (Simultaneous stress)	2.90	3.10
	High temperature (30°C) + *Meloidogyne chitwoodi* (R2; 2 eggs/cm3) (Simultaneous stress)	4.40	2.40
	High temperature (30°C) + *Meloidogyne chitwoodi* (R2; 10 eggs/cm3) (Simultaneous stress)	3.10	2.30
	High temperature (30°C) + *Meloidogyne chitwoodi* (R2; 20 eggs/cm3) (Simultaneous stress)	2.10	2.40
Luther	Low temperature (15°C)	N/A	N/A
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R1; 2 eggs/cm3) (Simultaneous stress)	2.20	1.40
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R1; 10 eggs/cm3) (Simultaneous stress)	1.40	1.80

	Low temperature (15°C) + *Meloidogyne chitwoodi* (R1; 20 eggs/cm3) (Simultaneous stress)	0.80	2.20
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R2; 2 eggs/cm3) (Simultaneous stress)	4.10	1.80
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R2; 10 eggs/cm3) (Simultaneous stress)	1.40	2.00
	Low temperature (15°C) + *Meloidogyne chitwoodi* (R2; 20 eggs/cm3) (Simultaneous stress)	1.00	2.80
	High temperature (30°C)	N/A	N/A
	High temperature (30°C) + *Meloidogyne chitwoodi* (R1; 2 eggs/cm3) (Simultaneous stress)	4.00	1.10
	High temperature (30°C) + *Meloidogyne chitwoodi* (R1; 10 eggs/cm3) (Simultaneous stress)	2.20	2.30
	High temperature (30°C) + *Meloidogyne chitwoodi* (R1; 20 eggs/cm3) (Simultaneous stress)	1.60	3.30
	High temperature (30°C) + *Meloidogyne chitwoodi* (R2; 2 eggs/cm3) (Simultaneous stress)	3.70	2.20
	High temperature (30°C) + *Meloidogyne chitwoodi* (R2; 10 eggs/cm3) (Simultaneous stress)	2.50	2.10
	High temperature (30°C) + *Meloidogyne chitwoodi* (R2; 20 eggs/cm3) (Simultaneous stress)	0.90	3.10

Reference – Griffin GD (1993) Influence of Temperature on the Virulence of Two Races of *Meloidogyne chitwoodi* on Wheat and Barley. Journal of nematology 25(3): 454–460.

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

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

Inference from the study: Griffin 1993 studied the interaction of high/low temperature and nematode (two strains R1 and R2) interaction in two barley cultivars; Steptoe and Luther. Plants were grown at a low temperature of 15°C and high temperature of 30°C, along with three concentrations of *Meloidogyne chitwoodi* inoculum. Plant height, tillers per plant, root dry

weight, and shoot dry weight reduced under combined stress conditions. This reduction was more at higher temperatures and strain R1 showed a more detrimental effect compared to R2 strain. Reproduction number decreased at higher nematode inoculum whereas root galling index increased with higher nematode inoculum. **Thus, this stress combination is detrimental to both barley cultivars.**