Effect on wheat cultivars (*Triticum aestivum* L.)

The interaction between the fungal pathogens under combined stress at plant interface

Stress 1: *Zymoseptoria tritici*
Stress 2: *Blumeria graminis*
Stage of plant: 14 days old seedlings

The table shows the effect of fungus *Z. tritici* on *B. graminis* in wheat cultivars Flame and Longbow in relation to the germination of spores, colony area, conidiophore quantity and DNA sample of *B. graminis* on leaves

Effect of decreasing concentrations of *Z. tritici* on *B. graminis* colonies		
Cultivar	**Treatment**	**Response under combined stress (Type B parameters*)**
		Mean mildew colonies/leaf
Longbow	*Z. tritici* IPO323 (10^7 spores/mL) + 4 days interval + *B. graminis* (Sequential stress)	36.76
	Z. tritici IPO323 (10^6 spores/mL) + 4 days interval + *B. graminis* (Sequential stress)	36.25
	Z. tritici IPO323 (10^5 spores/mL) + 4 days interval + *B. graminis* (Sequential stress)	57.70
	*Z. tritici*IPO323 (10^4 spores/mL) + 4 days interval + *B. graminis* (Sequential stress)	77.10
	Z. tritici IPO323 (10^3 spores/mL) + 4 days interval + *B. graminis* (Sequential stress)	82.72

Early development of *B. graminis* on preinoculation with *Z. tritici*				
Cultivar	**Treatment**	**Germinated spores (%)**		
		Hours after inoculation		
		8	**24 (Appressoria)**	**48 (ESH)**
Flame	*Z. tritici* IPO323 (10^7 spores/mL) + 1-day interval + *B. graminis* (Sequential stress)	74.39	58.26	26.20
	Z. tritici (10^7 spores/mL) + 1-day interval + *B. graminis* (Sequential stress) Mock	69.19	51.79	40.68
	Z. tritici IPO323 (10^7 spores/mL) + 6 days interval + *B. graminis* (Sequential stress)	61.90	49.94	7.93
	Z. tritici (10^7 spores/mL) + 6 days interval + *B. graminis* (Sequential stress) Mock	72.83	58.72	18.27
Longbow	*Z. tritici* IPO323 (10^7 spores/mL) + 1-day interval + *B. graminis* (Sequential stress)	74.9	46.24	44.5
	Z. tritici (10^7 spores/mL) + 1-day interval + *B. graminis* (Sequential stress) Mock	60.34	59.19	42.41
	Z. tritici IPO323 (10^7 spores/mL) + 6 days interval + *B. graminis* (Sequential stress)	71.8	42.54	13.4

	Z. tritici (10^7 spores/mL) + 6 days interval + *B. graminis* (Sequential stress) Mock	76.99	52.71	21.03

Later development of *B. graminis* on preinoculation with *Z. tritici*

Cultivar	Treatment	Colony Area (Sqrt) µm				Conidiophore quantity			
		Days after inoculation				Days after inoculation			
		5	6	8	9	5	6	8	9
Longbow	*Z. tritici* IPO323 (10^7 spores/mL) + 6 days interval + *B. graminis* (Sequential stress)	29.68	39.21	55.33	51.69	No effect	0.09	1.2	2.2
	Z. tritici (10^7 spores/mL) + 6 days interval + *B. graminis* (Sequential stress) Mock	31.60	43.48	65.72	76.66	No effect	0.02	1.9	3.3

DNA quantification to determine *B. graminis* biomass on preinoculation with *Z. tritici*

Cultivar	Treatment	*B. graminis* DNA (pg/50ng sample DNA)	
		Days after inoculation	
		5	10
Flame	*Z. tritici* IPO323(10^7 spores/mL) + 1-day interval + *B. graminis* (Sequential stress)	0.68	3.68
	Z. tritici (10^7 spores/mL) + 1-day interval + *B. graminis* (Sequential stress) Mock	0.87	15.22
	Z. tritici IPO323(10^7 spores/mL) + 6 days interval + *B. graminis* (Sequential stress)	0.36	0.64
	Z. tritici (10^7 spores/mL) + 6 days interval + *B. graminis* (Sequential stress) Mock	1.25	7.05
Longbow	*Z. tritici* IPO323 (10^7 spores/mL) + 1-day interval + *B. graminis* (Sequential stress)	0.68	3.68
	Z. tritici (10^7 spores/mL) + 1-day interval + *B. graminis* (Sequential stress) Mock	0.87	15.22
	Z. tritici IPO323 (10^7 spores/mL) + 6 days interval + *B. graminis* (Sequential stress)	0.36	0.64
	Z. tritici (10^7 spores/mL) + 6 days interval + *B. graminis* (Sequential stress) Mock	1.25	7.05

(*IPO323- compatible strain of Z. tritici; Mock- inoculated with an incompatible strain of Z. tritici; ESH- Elongated secondary hyphae; pg- pictogram; ng- nanogram*)

For raw data – Click here (.xlsx file)

Reference– Orton ES, Brown James KM (2016) Reduction of growth and reproduction of the biotrophic fungus *Blumeria graminis* in the presence of a necrotrophic pathogen. Front. Plant Sci. **44:** 173-182
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*

The inference from the study: Orton and Brown, 2016 have studied the interaction between the *B. graminis* (causal agent of powdery mildew) and *Z. tritici* (causal agent of *Septoria tritici* blotch) in wheat. The studies performed on two cultivars Flame and Longbow revealed that the preinoculation of *Z. tritici* on leaves reduced the germination, quantity, and size of virulent *B. graminis* mildew colonies. Thus, the predisposition of *Z. tritici* around the infection site has reduced the susceptibility of the leaf to *B. graminis.* **The overall observations lead to the conclusion that the effect of *Z. tritici* induced on *B. graminis* is either takes place between both the pathogens or mediated by host plants.**