Journal of Plant Protection Research eISSN 1899-007X

ORIGINAL ARTICLE

Synergistic use of iron nanofertilizers and biotic elicitors to induce defensive volatile organic compound emissions from *Brassica napus*

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DOI: 10.24425/jppr.2024.151819

Received: February 28, 2024
Accepted: May 13, 2024
Online publication: December 02, 2024

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Responsible Editor:
Iwona Adamska

SUPPLEMENTARY MATERIAL

The authors are fully responsible for both the content and the formal aspects of the supplementary material. No editorial adjustments were made.

Table S1. The correlation matrix for the VOCs studied for MeJa (below diagonal) and MeSa (above diagonal)

VOCs	*Z*-3-HAL	*E*-2-HAL	*Z*-3-HOL	*Z*-3-HAC	*Z*-OCI	LIN	BAC	MeSa	IND	β-CAR	*E*-β-FAR
Z-3-HAL	1	0.74***	0.72***	0.89***	0.41***	0.26*	0.74***	0.50***	0.41***	0.86***	0.03
E-2-HAL	0.81***	1	0.64***	0.71***	0.34**	0.19	0.72***	0.35**	0.38**	0.72***	0.01
Z-3-HOL	0.78***	0.82***	1	0.72***	0.40**	0.29*	0.76***	0.37**	0.58***	0.63***	0.12
Z-3-HAC	0.88***	0.86***	0.81***	1	0.38**	0.26*	0.7***	0.48***	0.38**	0.83***	0.01
Z-OCI	0.46***	0.35**	0.42***	0.43***	1	0.61***	0.67***	0.75***	0.68***	0.55***	0.61***
LIN	0.40**	0.28*	0.44***	0.37**	0.80***	1	0.42***	0.79***	0.75***	0.44***	0.83***
BAC	0.70***	0.71***	0.79***	0.69***	0.63***	0.52***	1	0.61***	0.71***	0.76***	0.36**
MeSa	0.45***	0.22	0.30*	0.41***	0.56***	0.64***	0.43***	1	0.75***	0.65***	0.70***
IND	0.44***	0.44***	0.59***	0.42***	0.66***	0.74***	0.59***	0.58***	1	0.48***	0.70***
β-CAR	0.62***	0.62***	0.63***	0.51***	0.56***	0.54***	0.62***	0.39**	0.64***	1	0.27*
E-β-FAR	0.05	–0.02	0.1	–0.03	0.67***	0.80***	0.26*	0.54***	0.63***	0.52***	1

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table S2. Correlation coefficients between the first two (V1 and V2) canonical variates and observed VOCs for MeJa and MeSa

VOCs	MeJa		MeSa	
	V_1	V_2	V_1	V_2
Z-3-HAL	0.9574***	0.0433	0.9684***	0.241
E-2-HAL	0.9816***	0.1829	0.948***	0.2932
Z-3-HOL	0.9761***	0.0478	0.898**	0.1647
Z-3-HAC	0.9427***	0.0967	0.9584***	0.2585
Z-OCI	0.5873	–0.7862*	0.7078*	–0.6831
LIN	0.5012	–0.858**	0.5209	–0.8395**
BAC	0.9471***	–0.1765	0.9627***	–0.1894
MeSa	0.5131	–0.7443*	0.6604	–0.7118*
IND	0.7024	–0.641	0.6667	–0.6499
β-CAR	0.7445*	–0.294	0.9774***	–0.0202
E-β-FAR	0.1438	–0.9465***	0.2906	–0.9531***
Percentage variance accounted	67.67%	23.38%	63.09%	29.81%

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table S3. Mahalanobis distances between application for MeJa

Applications	After iron-NPs application (+ 4 days), concentration 1	After iron-NPs application (+ 4 days), concentration 2	After MeJa application (+ 24 h), without iron-NPs	After MeJa application (+ 72 h), without iron-NPs	After MeJa application, (+24 h), with iron-NPs, concentration 1	After MeJa application, (+72 h), with iron-NPs, concentration 1	After MeJa application, (+24 h), with iron-NPs, concentration 2
After iron-NPs application (+ 4 days), concentration 2	1.211						
After MeJa application (+ 24 h), without iron-NPs	10.002	9.546					
After MeJa application (+ 72 h), without iron-NPs	8.768	8.822	9.722				
After MeJa application, (+24 h), with iron-NPs, concentration 1	12.901	12.137	8.524	11.763			
After MeJa application, (+72 h), with iron-NPs, concentration 1	10.246	10.125	9.557	2.602	10.877		
After MeJa application, (+24 h), with iron-NPs, concentration 2	23.58	22.618	16.215	21.45	13.088	19.838	
After MeJa application, (+72 h), with iron-NPs, concentration 2	13.243	13.084	10.595	5.674	11.348	3.584	19.113

Table S4. Mahalanobis distances between application for MeSa

Applications	After iron-NPs application (+ 4 days), concentration 1	After iron-NPs application (+ 4 days), concentration 2	After MeSa application (+ 24 h), without iron-NPs	After MeSa application (+ 72 h), without iron-NPs	After MeSa application, (+24 h), with iron-NPs, concentration 1	After MeSa application, (+72 h), with iron-NPs, concentration 1	After MeSa application, (+24 h), with iron-NPs, concentration 2
After iron-NPs application (+ 4 days), concentration 2	0.518						
After MeSa application (+ 24 h), without iron-NPs	8.64	8.413					
After MeSa application (+ 72 h), without iron-NPs	6.502	6.453	7.578				
After MeSa application, (+24 h), with iron-NPs, concentration 1	11.407	11.159	3.259	9.312			
After MeSa application, (+72 h), with iron-NPs, concentration 1	8.761	8.684	7.779	2.709	8.732		
After MeSa application, (+24 h), with iron-NPs, concentration 2	16.495	16.124	9.62	14.29	7.378	13.118	
After MeSa application, (+72 h), with iron-NPs, concentration 2	12.089	12.017	9.268	5.839	9.225	3.844	13.272

Table S5. Results of contrasts analysis between MeJa and MeSa dla particular VOCs

Contrasts	Z-3-HAL	*E*-2-HAL	Z-3-HOL	Z-3-HAC	Z-OCI	LIN	BAC	MeSa	IND	β-CAR	*E*-β-FAR
Control MeJa vs. Control MeSa	0	0.1	0.4	–2	0	1	0	1	0.7	0	0
Control after the experiments (+ 7 days) MeJa vs. control after the experiments (+ 7 days) MeSa	1	1.8	–1.1	–4	0	–4	1	–2	–2.3	0	1
After iron-NPs application (+ 4 days), concentration 1 MeJa vs. after iron-NPs application (+ 4 days), concentration 1 MeSa	-2	–0.8	–0.5	–8	–3	7	8	3	0.5	7	5
After iron-NPs application (+ 4 days), concentration 2 MeJa vs. after iron-NPs application (+ 4 days), concentration 2 MeSa	8	–0.3	5.6	–3	2	1	6	0	–2	8	5
After MeJa application (+ 24 h), without iron-NPs vs. after MeSa application (+ 24 h), without iron-NPs	360***	3.1	–3.7	370***	126**	132***	–235***	–291***	2.9	633***	484***
After MeJa application (+ 72 h), without iron-NPs vs. after MeSa application (+ 72 h), without iron-NPs	104	–2.7	3.3	97	175***	289***	–132***	–251***	–2	241***	806***
After MeJa application, (+24h), with iron-NPs, concentration 1 vs. after MeSa application, (+24 h), with iron-NPs, concentration 1	411***	6.8	14.4	669***	212***	213***	–310***	–353***	–4.9	–257***	–127
After MeJa application, (+72 h), with iron-NPs, concentration 1 vs. after MeSa application, (+72 h), with NANO, concentration 1	132*	0.5	–0.8	144*	200***	293***	–237***	–271***	7.4	320***	973***
After MeJa application, (+24 h), with iron-NPs, concentration 2 vs. after MeSa application, (+24 h), with NANO, concentration 2	544***	14.3**	2.2	724***	272***	349***	–600***	–326***	8.1	840***	671***
After MeJa application, (+72 h), with iron-NPs, concentration 2 vs. after MeSa application, (+72 h), with iron-NPs, concentration 2	219***	–0.5	1.5	209**	365***	319***	–314***	–451***	–11.6	449***	1083***

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$