

Wheat and faba bean intercropping stimulates non-phenolic organic acids exuded by roots but mitigates phenolic acids exudation



Jingxiu Xiao¹, Xinhua Yin², Li Tang¹ and Yi Zheng^{1, 3*}

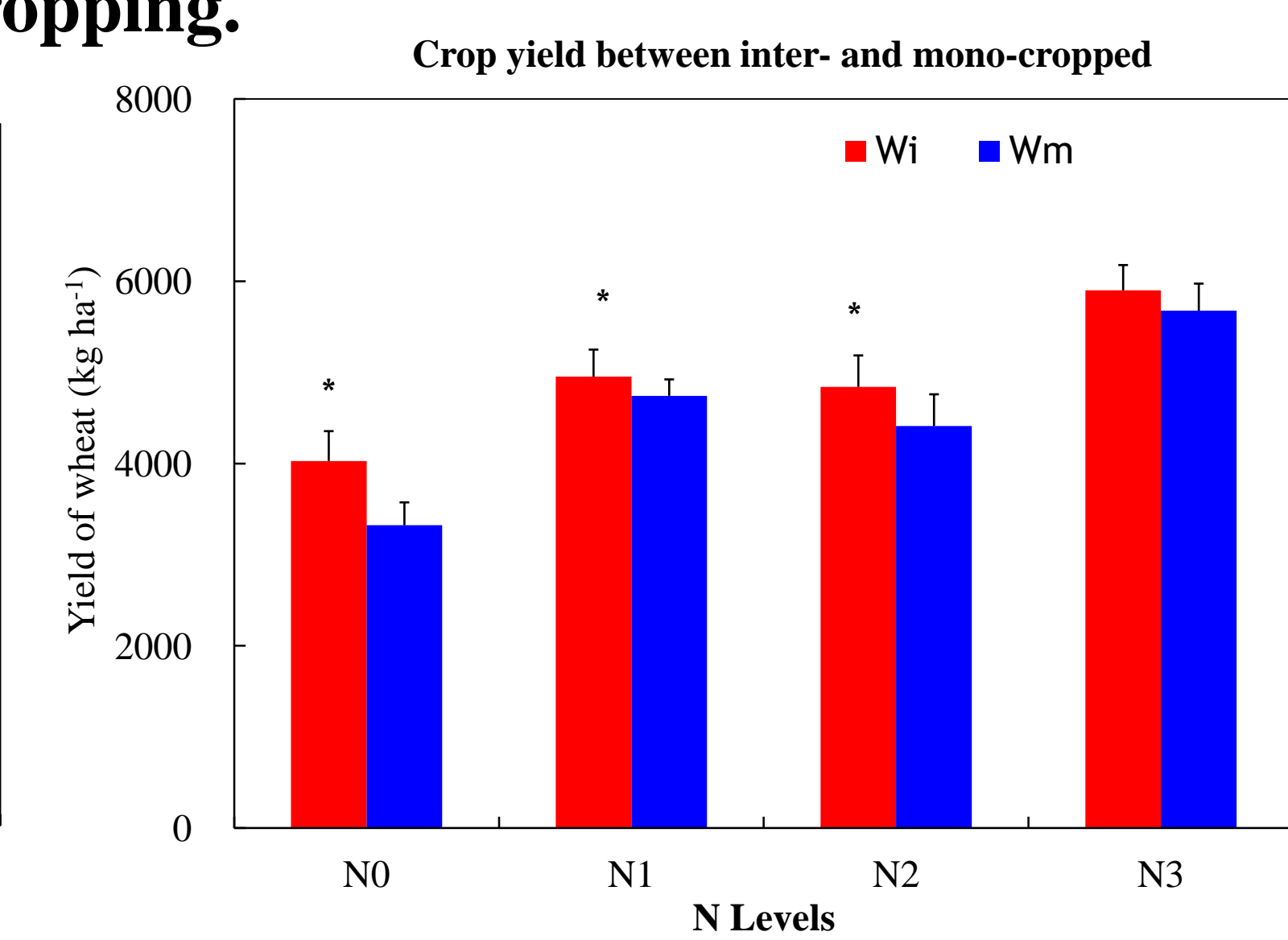
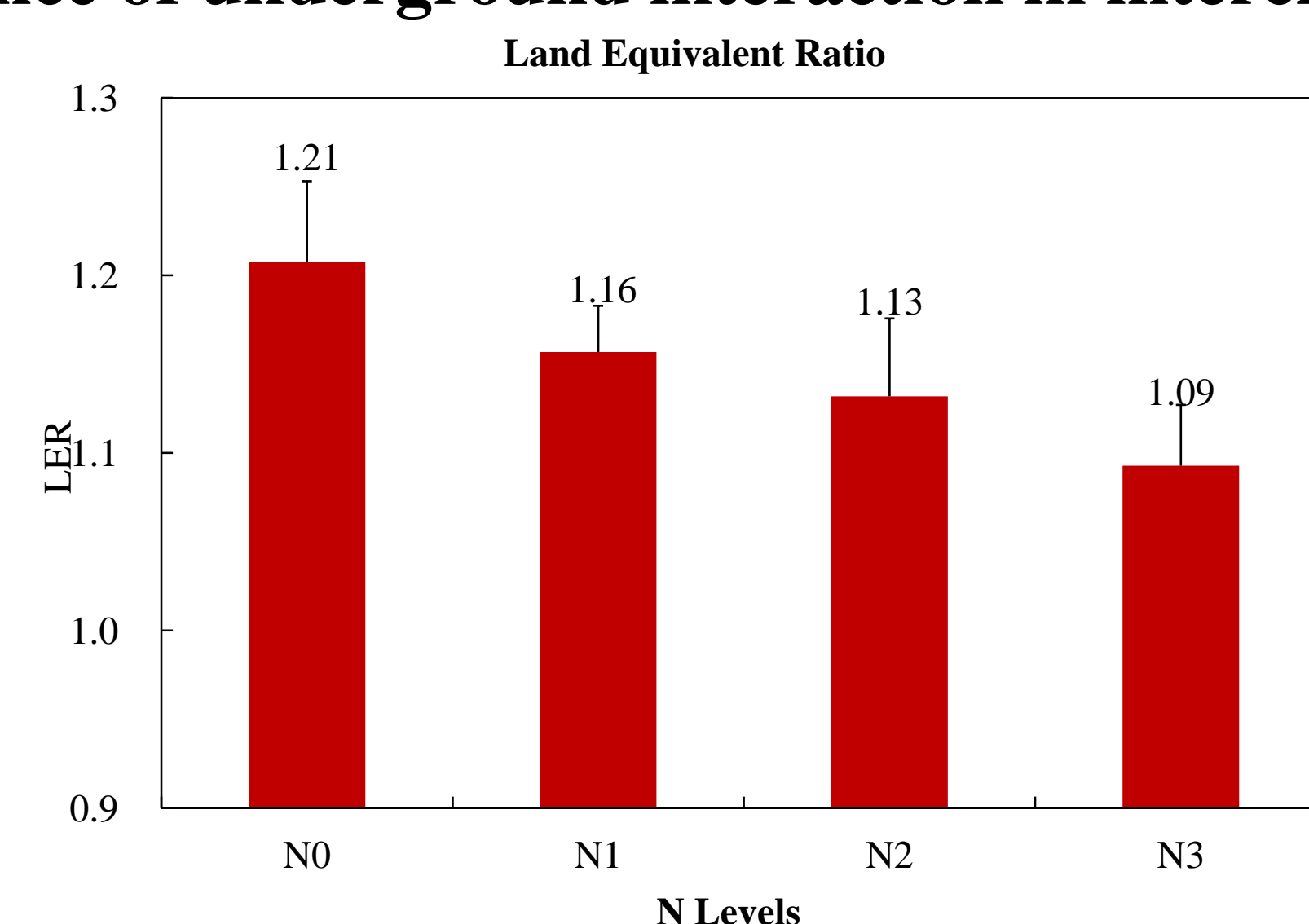
¹ College of Resources and Environment, Yunnan Agricultural University, Kunming, Yunnan, China; e-mail: xiaojingxiuxjx@126.com

² Department of Plant Sciences, The University of Tennessee, Jackson, Tennessee, United States of America; e-mail: xyin2@utk.edu

³ Yunnan Provincial Department of Education, Kunming, Yunnan, China; email: yzheng@ynau.edu.cn,

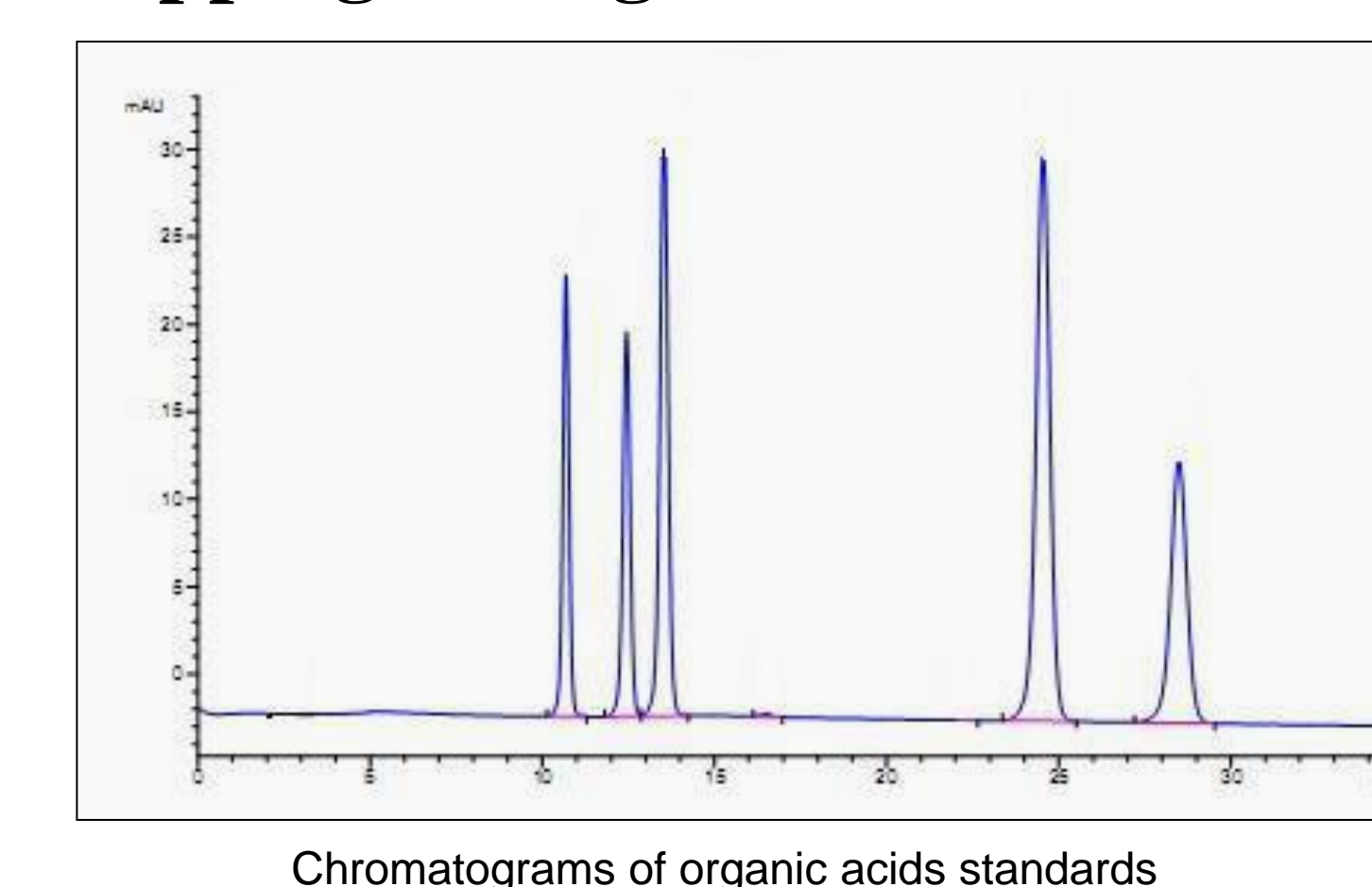
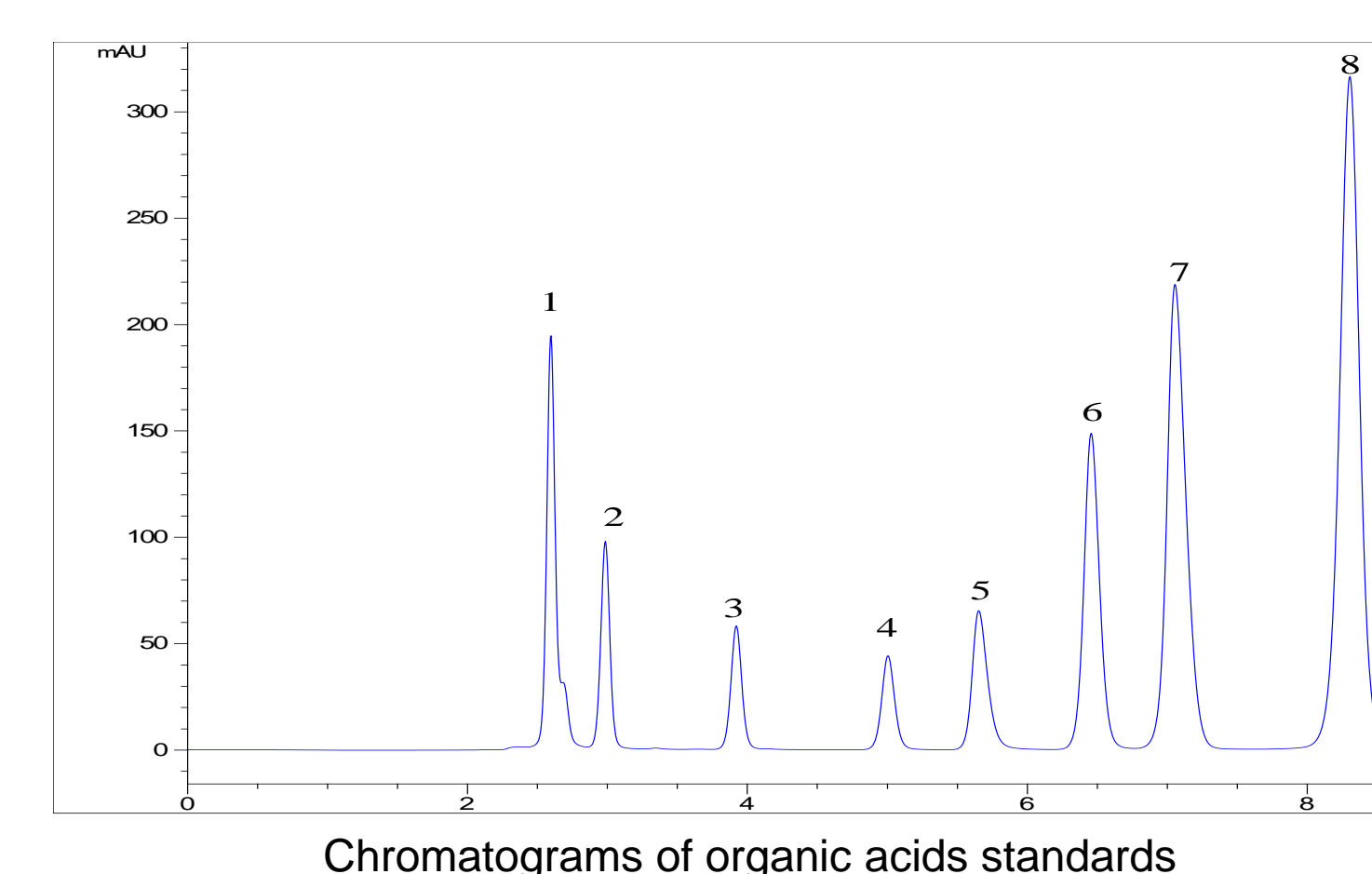
1. INTRODUCTION

Wheat and faba bean intercropping has been a traditional cropping system in Yunnan Province, China to improve grain yield. It still plays an important role in modern agriculture (Chen et al., 2007; Jiang et al., 2012). Previous study have revealed that the intercropping induced different rhizosphere processes, while the mechanism could not be fully understood due to lack of relevant knowledge about root exudation in intercropping. Organic acid as one of the most important constituents in root exudates, which highly relates to rhizospheric plant-microbe interactions (Bais et al., 2006). The objective of present study is to figure out the characteristic of non-phenolic and phenolic organic acids exuded by roots in legume and cereal intercropping, which would be the fundamental to explain the importance of underground interaction in intercropping.



2. MATERIALS AND METHODS

Hydroponic and soil culture experiments with three planting pattern treatments, mono-cropped wheat (*Tricum aestivum* L., cv Yunmai 42) (MW), mono-cropped faba bean (*Vicia faba* L., cv Yundou 8363) (MF), and wheat and faba bean intercropping (W//F) were carried out. Root exudations at different growth stages were collected, and main components of organic acids in root exudatio were detected by HPLC to evaluate the influence of intercropping on organic acids exudation.



3. RESULTS

3.1 Phenolic Acids

Table 1 Exudation rates of phenolic acids under mono- and inter-cropped planting patterns in the hydroponic experiment.

Sampling date	Planting pattern	ρ-Hydroxybenzoic acids	Vanillic acid	Syringic acid	Total exudation rate
		(μg pot ⁻¹ h ⁻¹)			(μg pot ⁻¹ h ⁻¹)
30d	W//F [†]	2.4a [†]	ND	8.0a	10.4b
	MW [‡]	2.5a	ND	8.0a	10.5b
	MF [‡]	2.4a	4.4	8.0a	14.9a
	W//F	ND [§]	4.8a	ND	4.8b
60d	MW	2.6	0.1b	ND	2.7c
	MF	3.3a	4.9a	ND	8.3a
	W//F	2.6a	4.7a	8.1a	15.4a
	MW	2.9a	5.1a	8.6a	16.6a
90d	MF	3.2a	4.9a	8.4a	16.5a

[†]The different letters after numbers at the same sampling date in a column indicate significant differences among treatments at P<0.05.

[‡]W//F, wheat//faba bean intercropping; MW, mono-cropped wheat; MF, mono-cropped faba bean.

[§] ND indicates not detected.

3.2 Non-Phenolic Organic Acids

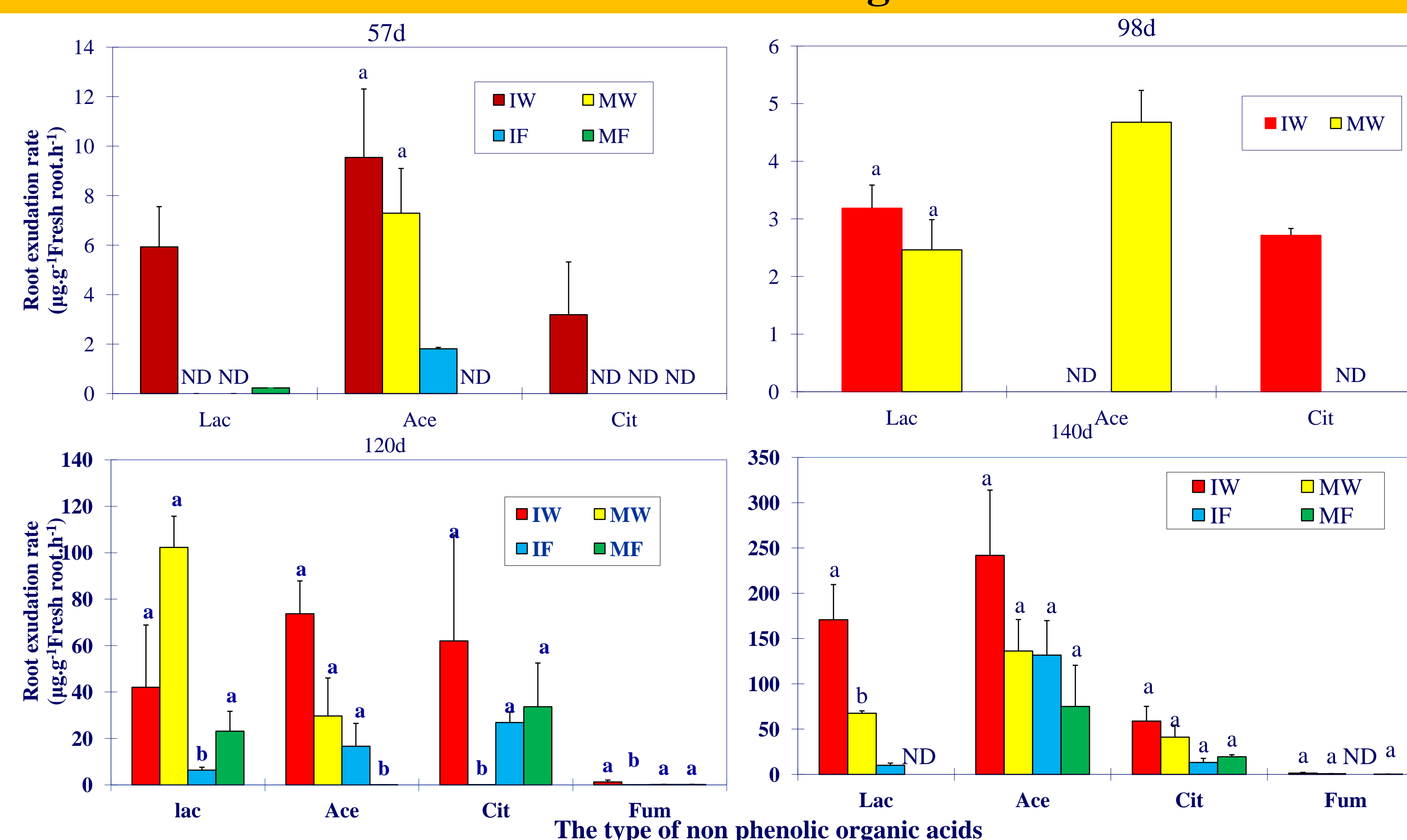


Fig.1 Exudation rate of each phenolic acid from the roots of wheat and faba bean (Soil experiment)

MW, mono-cropped wheat; MF, mono-cropped faba bean; IW, inter-cropped wheat; IF, inter-cropped faba bean. Lac, Ace, Cit, and Fum represents Lactate, Acetic acid, Citric acid, and Fumarate respectively.

ND indicates not detected. Significantly different in exudation rate of each organic acid between inter- and mono-cropped wheat or faba bean at P<0.05.

4. CONCLUSIONS

- ❖ Intercropping changed the root exudation pattern, maybe deducing different rhizodepositions.
- ❖ The total exudation rate of non-phenolic organic acids for wheat was increased by 35.6%-155% when wheat was intercropped with faba bean; while non-phenolic organic acids exuded by IF was increased by 38.7%-97.4% as compared to MF.
- ❖ Exudation rate of phenolic acids in root exudations was decreased by 30%-60% under the wheat and faba bean intercropping system compared with that from MF.

ACKNOWLEDGEMENTS

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