Attenuation of inorganic arsenic and cadmium in rice grains using by-product iron materials from the casting industry combined with different water management practices

Supplemental Materials

Original article / Full-length paper

Attenuation of inorganic arsenic and cadmium in rice grains using by-product iron materials from the casting industry combined with different water management practices

Aomi Suda* and Tomoyuki Makino

Institute for Agro-Environmental Sciences, NARO, 3-1-3, Kannondai, Tsukuba, Ibaraki 305-8604, Japan

**** Correspondence*:**

A. Suda, National Institute for Agro-Environmental Sciences, Kannondai 3-1-3, Tsukuba, Ibaraki 305-8604, Japan

E-mail: suda_aomi@affrc.go.jp

Tel: +81-29-838-8314

Fax: +81-29-838-8314

Table S1 Simple linear regression analyses for uptake of phosphorus (P), silicon (Si), and manganese (Mn) by the shoot (Y) in relation to Fe material application rate (X).

X: Application rate (t ha^{-1})	Y: Uptake in shoot P (mg pot^{-1})		Si (g pot^{-1})		Mn (mg pot^{-1})	
	CF	WS	CF	WS	CF	WS
SSS						
0	86.9±6.6	79.8±3.2	1.64±0.13	1.70±0.06	18.1±1.3	71.8±3.7
10	82.2±3.0	79.8±1.7	1.61±0.08	1.73±0.04	16.1±1.4	69.4±2.3
30	87.7±3.2	75.8±3.9	1.62±0.04	1.81±0.07	15.3±1.1	65.7±4.1
Regression						
Slope	0.0632	-0.1446	-0.0003	0.0038	-0.0861	-0.2012
Intercept	84.7	80.4	1.63	1.70	17.6	71.7
R^2	0.031	0.300	0.003	0.481	0.462	0.407
Significance	*ns*	*ns*	*ns*	$p < 0.05$	$p < 0.05$	$p < 0.05$
RIM						
0	86.9±6.6	79.8±3.2	1.64±0.13	1.70±0.06	18.1±1.3	71.8±3.7
10	89.3±2.6	78.5±1.7	1.55±0.02	1.71±0.04	17.7±0.5	71.8±1.2
30	88.0±0.9	77.5±2.6	1.51±0.05	1.79±0.03	17.4±0.5	70.1±2.6
Regression						
Slope	0.0250	-0.0740	-0.0039	0.0032	-0.0201	-0.0631
Intercept	87.7	79.6	1.62	1.69	18.0	72.1
R^2	0.008	0.143	0.328	0.480	0.111	0.100
Significance	*ns*	*ns*	*ns*	$p < 0.05$	*ns*	*ns*

CF; Continuously flooded, WS; water-saving, SSS; spent steel shot, RIM; residual iron material, *ns*; not significant (p > 0.05)

Uptake of each element by the shoot was calculated using the concentrations in straw, husk, and grain and their weight (oven-dried basis) per pot. However, shoot in Si was calculated from straw and husk.

Table S2 Simple linear regression analyses for arsenic (As) and Cadmium (Cd) uptake by the shoot (Y) in relation to the Fe material application rate (X).

X: Application rate (t ha^{-1})	Y: Uptake in shoot As (µg pot^{-1})		Cd (µg pot^{-1})	
	CF	WS	CF	WS
SSS				
0	174±14	40.9±7.7	0.855-0.980	14.0±0.9
10	54.8±8.7	32.3±8.2	0.792-0.870	12.9±0.9
30	33.4±6.0	17.7±2.2	0.745-0.832	10.9±1.0
Slope	-4.16	-0.765	-	-0.102
Intercept	143	40.5	-	13.9
R^2	0.695	0.736	-	0.709
Significance	$p < 0.01$	$p < 0.001$	-	$p < 0.001$
RIM				
0	174±14	40.9±7.7	0.855-0.980	14.0±0.9
10	44.8±2.2	23.2±2.5	0.676-0.762	11.7±0.8
30	19.5±0.4	14.0±0.8	0.607-0.677	9.05±0.93
Slope	-4.58	-0.833	-	-0.160
Intercept	140	37.1	-	13.7
R^2	0.710	0.768	-	0.862
Significance	$p < 0.01$	$p < 0.001$	-	$p < 0.001$

CF; continuously flooded, WS; water-saving, SSS; spent steel shot, RIM; residual iron material

Uptake of each element by the shoot was calculated using the concentration in straw, husk, and grain and their weight (oven-dried basis) per pot. For Cd under CF cultivation, the values contain uncertainty derived from Cd in grains (<LOD or <LOQ).

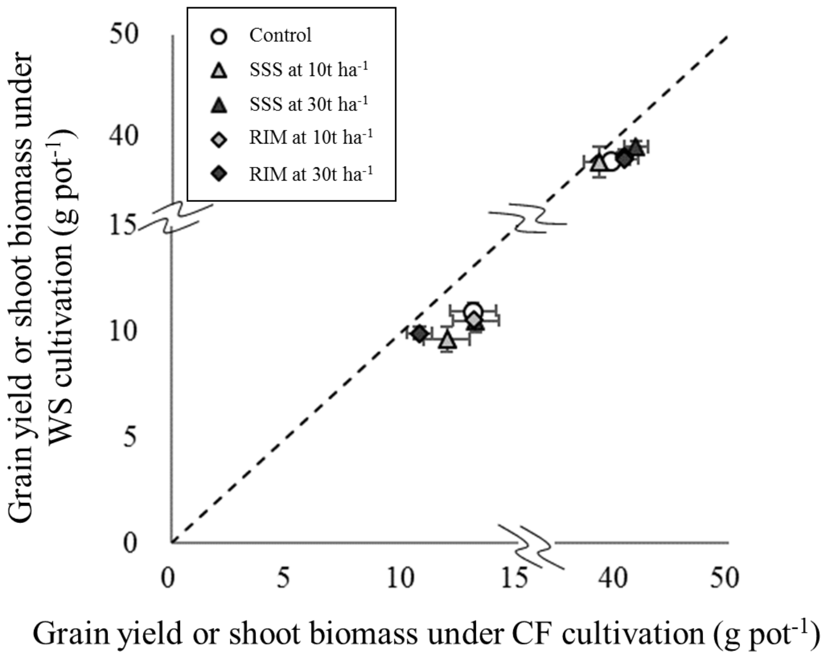

Fig. S1 Relationship between grain yield or shoot biomass obtained under continuously flooded (CF) cultivation and that under water-saving (WS) cultivation. Bars represent standard deviations. The broken line indicates y = x.

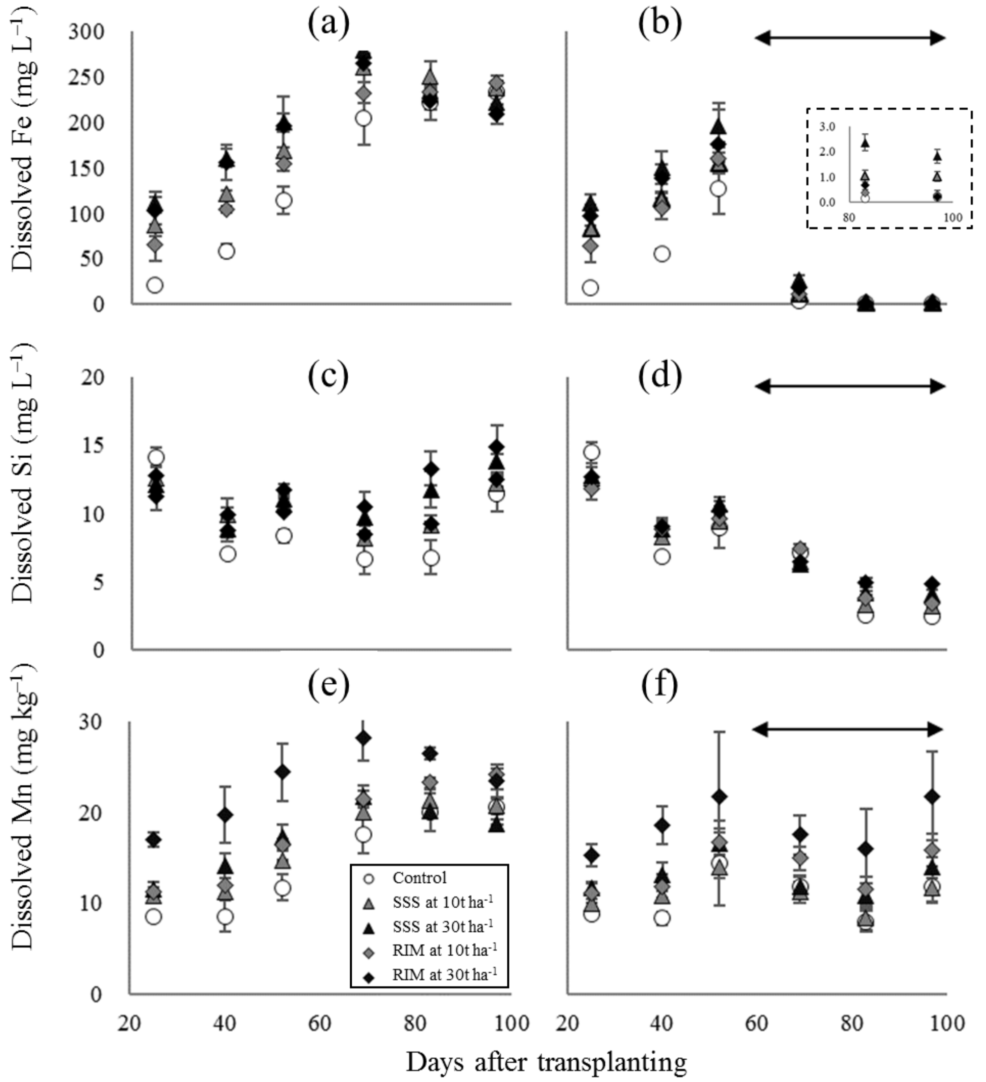

Fig. S2 Time course of concentrations of dissolved iron [Fe; (a), (b)], silicon [Si; (c), (d)], and manganese [Mn; (e), (f)] in soil solution during the cultivation period. (a), (c), and (e) are under continuously flooded cultivation and (b), (d), and (f) are under water-saving cultivation. The plot and error bar represent the average and standard deviation, respectively. The double-headed arrow indicates the intermittent irrigation period.