Supplementary materials

Assessment of nutrients and heavy metals content in soil and some vegetables cultivated in agricultural land around El-Khashab canal (Helwan-El Saff area)

Mervat Z. Elliethy, Abdel Aziz M. Ragab, Ramadan I. Bedair, Om Mohamed A. Khafagi

S 1. Chemical characteristics of irrigation water of the different sites (average of two winter seasons; Dec. 20118 and Dec. 2019)

Site No.	EC dS m^{-1}	SAR	pH	Soluble ions (meq L^{-1})							Macronutrients (mg L^{-1})		
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{--}	N	P	K
Sites under wastewater irrigation													
1	0.68e	1.41d	6.99ab	3.19cd	1.79de	2.23d	0.14cd	1.87d	2.12de	3.34de	10.73 b	0.17 b	5.84 d
2	0.69e	1.34d	6.97b	3.38c	1.69e	2.14d	0.14cd	2.07c	1.97e	3.29de	9.10 b	0.09 b	5.84 d
3	0.65ef	1.36d	7.07ab	2.87de	1.94cde	2.11d	0.14cd	1.90cd	2.12de	3.03de	9.10 b	0.04 b	5.71 d
4	1.00c	1.93c	6.95b	3.80b	2.00cde	3.28c	0.29a	2.81a	3.05c	3.51cd	14.93 a	0.26 b	12.46 a
5	1.23a	2.76a	6.98b	4.23a	2.22c	4.96a	0.15c	1.98cd	4.81a	4.78b	7.70 b	0.65 a	6.59 c
6	1.11b	2.42b	7.00ab	3.19cd	3.64a	4.47b	0.14cd	2.01cd	3.79b	5.64a	7.00 b	0.04 b	5.84 d
7	0.81d	1.80c	7.00ab	2.77ef	2.86b	3.03c	0.20b	2.36b	2.37d	4.12c	8.40 b	0.13 b	8.46 b
8	0.58g	1.34d	7.00ab	2.16g	2.12cd	2.00d	0.13d	1.98cd	1.53f	2.89de	7.00 b	0.02 b	5.34 d
9	0.59fg	1.35d	7.10a	2.39fg	1.91cde	1.97d	0.13d	2.01cd	1.58f	2.80de	7.00 b	0.11 b	5.34 d
L.S.D at 0.05	**0.06**	**0.15**	**0.15**	**0.40**	**0.39**	**0.32**	**0.01**	**0.17**	**0.36**	**0.63**	**3.75**	**0.35**	**0.70**
Mean	0.82	1.75	7.01	3.11	2.24	2.91	0.16	2.11	2.59	3.71	9.00	0.17	6.82
Sites under Nile water irrigation (control)													
10	0.32	0.15	7.10	1.21	1.90	0.19	0.07	1.42	0.85	1.11	10.35	0.54	3.36
11	0.36	0.36	7.20	1.82	1.56	0.47	0.08	1.51	1.02	1.40	13.82	0.71	3.77
12	0.35	0.42	7.20	1.67	1.58	0.54	0.08	1.60	0.93	1.33	12.43	0.64	3.44
Mean	0.34	0.31	7.17	1.57	1.68	0.40	0.08	1.51	0.93	1.28	12.20	0.63	3.52
L.S.D at 0.05 WW× control	**0.41***	**0.82***	**0.11***	**1.07***	**0.52***	**1.70***	**0.04***	**0.22***	**1.52***	**1.23***	**2.83***	**0.27***	**1.93***

*: Significant at 0.05 L.S.D.

Supplementary materials

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S2. Heavy metals content (mg L^{-1}) of irrigation water of the different sites (average of two winter seasons; Dec. 2018 and Dec. 2019)

Site No.	Micronutrients (mg L^{-1})						
	Fe	**Mn**	**Zn**	**Cu**	**Co**	**Cr**	**Pb**
Sites under wastewater irrigation							
1	0.38a	0.09 b	0.47abc	0.010b	0.002 a	0.029a	0.08 a
2	0.20 a	0.06 b	0.22 bc	0.002b	0.002 a	0.035a	0.06 a
3	0.32 a	0.05 b	0.19 bc	0.002b	0.002 a	0.005a	0.10 a
4	0.20 a	0.04 b	0.09 c	0.002b	0.002 a	0.014a	0.03 a
5	0.27 a	0.08 b	0.29 bc	0.101a	0.002 a	0.042a	0.09 a
6	0.08 a	0.05 b	0.26 bc	0.002b	0.002 a	0.016a	0.04 a
7	0.07 a	0.24 a	0.14 bc	0.002b	0.003 a	0.024a	0.04 a
8	0.17 a	0.10 b	0.84 a	0.001b	0.002 a	0.046a	0.03 a
9	0.20 a	0.10 b	0.63 ab	0.010b	0.002 a	0.032a	0.05 a
L.S.D at 0.05	**0.32**	**0.13**	**0.50**	**0.057**	**0.002**	**0.049**	**0.12**
Mean	0.38	0.24	0.84	0.101	0.003	0.046	0.10
Sites under Nile water irrigation (control)							
10	0.002	0.002	0.002	0.001	0.001	0.001	0.001
11	0.001	0.001	0.001	0.001	0.001	0.002	0.003
12	0.002	0.001	0.001	0.001	0.001	0.001	0.003
Mean	0.002	0.001	0.001	0.001	0.001	0.001	0.002
L.S.D at 0.05 WW× control	**0.05***	**0.08***	**0.34***	**0.13**	**0.001***	**0.016***	**0.03***
The permissible level [35]	**0.30**	**0.10**	**1.0**	**0.05**	**-**	**0.05**	**0.10**

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S3. Chemical characteristics of soil samples of the different sites (average of two winter seasons; Dec. 2018 and Dec. 2019)

Site No.	EC dS m^{-1}	pH	Soluble ions (meq L^{-1})							Macronutrients (mg kg^{-1})		
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{--}	N	P	K
Sites under wastewater irrigation (WW)												
1	1.09c	7.93ab	4.8c	3.62b	3.11c	0.23b	1.58b	5.08c	5.13c	138.83bc	3.43ab	269.45c
2	0.84c	7.87b	3.07c	2.94b	2.53c	0.62b	1.81b	4.66c	2.70c	135.33c	3.47 ab	371.25bc
3	2.58bc	7.97ab	9.65c	7.81b	10.52c	0.30b	1.42b	12.15c	14.72bc	120.17c	1.29de	217.60c
4	3.20bc	7.87b	11.63c	7.58b	14.46bc	0.15b	1.73b	14.40c	17.68bc	180.83b	2.37bcd	170.08c
5	12.56a	8.00ab	46.93a	24.08a	60.35a	2.69a	2.52a	75.71a	55.76a	257.83a	4.21a	1104.23a
6	1.54c	8.06a	6.80c	2.80b	6.47c	0.24b	1.73b	8.19c	6.39c	123.67c	2.01bcde	267.29c
7	6.32b	7.93ab	32.67ab	9.53b	28.25b	0.71b	1.42b	37.85b	31.90b	112.00c	2.81abc	313.33c
8	4.09 bc	8.00ab	20.61bc	9.82b	12.49bc	2.32a	1.89ab	19.78bc	23.96bc	99.17c	1.82cde	629.82b
9	2.74bc	8.00ab	14.25c	6.40b	8.38c	0.61b	2.50a	13.84c	13.28bc	98.00c	0.83e	339.92bc
L.S.D at 0.05	**3.82**	**0.15**	**18.26**	**8.79**	**17.09**	**1.09**	**0.67**	**22.17**	**21.99**	**45.25**	**1.48**	**304.04**
Mean	3.88	7.96	16.71	8.29	16.28	0.92	1.84	21.30	19.06	140.65	2.47	409.22
Sites under Nile water irrigation (control)												
10	2.07	7.80	7.58	5.41	4.87	0.59	4.72	5.93	7.80	115.15	10.86	660.01
11	2.25	8.00	9.09	8.44	6.40	0.62	5.66	6.78	12.11	184.24	12.49	739.21
12	1.51	7.90	6.06	6.93	3.22	0.40	3.77	3.39	9.44	115.15	11.86	620.41
Mean	1.94	7.90	7.58	6.93	4.83	0.54	4.72	5.37	9.78	138.18	11.70	673.21
L.S.D at 0.05 WW× control	**4.87**	**0.11**	**19.34**	**8.69**	**24.24**	**1.26**	**0.83***	**30.23**	**22.14**	**37.18**	**1.56***	**389.61**

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Assessment of nutrients and heavy metals content in soil and some vegetables cultivated in agricultural land around El-Khashab canal (Helwan-El Saff area)

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S4. Calcium carbonate, organic matter content (%), mechanical analyses and heavy metals content (mg kg $^{-1)}$ of soil samples of the different sites (average of two winter seasons; Dec. 2018 and Dec. 2019)

Site No.	$CaCO_3$ %	OM %	Particles size distribution %				Texture	Micronutrients (mg kg^{-1})						
			Coarse sand	Fine sand	Silt	Clay		Fe	Mn	Zn	Cu	Co	Cr	Pb
Sites under wastewater irrigation (WW)														
1	10.28c	2.68bc	1.46ab	37.56c	16.03c	44.95c	Clayey	158.75ab	260.94b	48.03a	17.72a	2.71b	0.66a	3.73bc
2	15.70a	3.24ab	1.36ab	43.23a	12.62e	42.79de	Clayey	129.38abc	265.79b	51.46a	16.58 a	2.76b	0.13b	3.51c
3	8.88cd	3.01abc	1.22b	40.77b	15.66cd	42.35de	Clayey	161.94a	244.08b	21.35b	6.94b	1.76b	0.14b	3.52c
4	8.82cd	2.70abc	1.35ab	38.40c	16.26c	43.99cd	Clayey	98.12c	267.41b	16.09b	7.53b	2.46b	0.09b	4.14bc
5	6.45d	3.17abc	1.70a	34.62d	16.26c	47.42b	Clayey	108.82c	391.97a	23.90b	10.06b	5.09a	0.19b	5.68a
6	9.99c	3.05abc	1.71a	33.85d	16.02c	48.42b	Clayey	106.38c	349.66ab	23.43b	8.88b	2.88b	0.16b	4.01bc
7	11.17bc	2.49c	1.29ab	27.52f	14.71d	56.48a	Clayey	126.42bc	387.62a	8.90b	5.32b	3.29ab	0.20b	3.76bc
8	9.11c	3.17abc	1.56ab	37.33c	19.57a	41.54e	Clayey	107.19c	406.82a	12.57b	8.89b	5.05a	0.06b	5.06ab
9	13.52ab	4.00a	1.42ab	31.35e	18.10b	49.13b	Clayey	103.05c	309.93ab	8.66b	7.18b	2.85b	0.06b	4.70abc
L.S.D at 0.05	**2.65**	**0.72**	**0.45**	**2.10**	**1.11**	**2.03**	_	**35.49**	**113.86**	**17.52**	**5.84**	**2.11**	**0.21**	**1.42**
Mean	10.44	3.06	1.45	36.07	16.14	46.34	_	122.23	320.47	23.82	9.90	3.21	0.19	4.23
Sites under Nile water irrigation (control)														
10	5.72	2.16	7.80	24.20	55.00	13.00	Silt loam	26.86	25.04	1.34	6.01	0.001	0.001	5.02
11	4.90	2.48	11.40	28.10	47.50	13.00	Loam	30.89	28.80	1.54	6.91	0.001	0.001	5.77
12	4.90	1.88	5.10	26.90	55.00	13.00	Silt loam	22.83	21.28	1.14	5.11	0.001	0.001	4.27
Mean	5.17	2.17	8.10	26.40	52.50	13.00	-	26.86	25.04	1.34	6.01	0.001	0.001	5.02
L.S.D at 0.05 WW× control	**3.67***	**0.62***	**2.11***	**6.30***	**3.87***	**6.08***	-	**31.92***	**3.29***	**14.13***	**5.80**	**1.25***	**0.24**	**1.12**
The permissible level [35]								**100**	**100**	**10**	**35**	-	-	**0.25**

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S5. Nitrogen, phosphorus, potassium, crude protein, and ash content (%) in root and shoot of *Brassica oleracea* var. *capitata* (cabbage) and *Lactuca sativa* L. (lettuce) plants grown in the different sites (average of two samples; Dec. 2018 and Dec. 2019)

Site No.	Cabbage										Lettuce									
	N		P		K		crude protein		ash		N		P		K		crude protein		ash	
	Root	Shoot	Root	shoot	Root	Shoot	root	Shoot	Root	shoot	Root	Shoot	root	shoot	root	shoot	root	shoot	root	shoot
1	1.77 a	1.77 c	0.75 c	0.61 bc	1.16 d	2.48 a	11.06 a	11.09 c	22.31 bc	20.28 a	1.77 a	3.02 a	1.01 a	0.54 b	4.14 a	5.02 a	11.06 a	18.89 a	20.28 b	12.17 c
2	–	–	–	–	–	–	–	–	–	–	1.25 c	2.13 b	0.96 a	0.82 a	2.95 b	4.80 a	7.81 c	13.31 b	15.21 c	14.20 ab
3	1.77 a	1.96 c	1.62 a	0.67 b	0.80 e	1.59 e	11.06 a	12.23 c	23.33 b	14.20 c	–	–	–	–	–	–	–	–	–	–
4	1.60 ab	2.31 b	0.62 de	0.57 cd	0.93 e	1.68 de	10.00 ab	14.45 b	20.28 c	18.26 b	–	–	–	–	–	–	–	–	–	–
5	1.42 bc	1.77 c	0.48 f	0.54 cd	1.24 cd	2.29 ab	8.88 bc	11.09 c	27.38 a	20.28 a	1.33 bc	1.42 c	0.81 b	0.57 b	1.73 d	4.80 a	8.31 bc	8.87 c	24.34 a	15.21 a
6	1.25 c	1.51 d	0.68 cd	0.52 d	2.03 a	2.08 bc	7.81 c	9.44 d	16.23d	10.14 d	1.51 b	1.96 b	0.81 b	0.41 c	2.38 c	4.14 b	9.44 b	12.23 b	14.20 c	13.18 bc
7	1.42 bc	2.84 a	0.53 ef	0.93 a	1.33 c	1.82 de	8.88 bc	17.75 a	21.30bc	13.18 c	–	–	–	–	–	–	–	–	–	–
8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
9	1.42 bc	1.96 c	0.95 b	0.58 cd	1.50 b	1.86 cd	8.88 bc	12.23 c	15.21 d	11.16 d	–	–	–	–	–	–	–	–	–	–
L.S.D at 0.05	**0.19**	**0.26**	**0.11**	**0.08**	**0.17**	**0.25**	**1.19**	**1.60**	**2.65**	**1.98**	**0.2**	**0.30**	**0.12**	**0.08**	**0.4**	**0.63**	**1.25**	**1.86**	**2.55**	**1.84**
Mean	1.52	2.02	0.80	0.63	1.28	1.97	9.51	12.61	20.86	15.36	1.47	2.13	0.90	0.59	2.80	4.69	9.16	13.33	18.51	13.69

(-): means that the plant was not cultivated in this site

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S6. Nitrogen, phosphorus, potassium, crude protein, and ash content (%) in root and shoot of *Allium sativum* L. (garlic) and *Allium cepa* L. (onion) plants grown in the different sites (average of two samples; Dec. 2018 and Dec. 2019)

Site No.	Garlic										Onion									
	N		P		K		crude protein		Ash		N		P		K		crude protein		Ash	
	Root	shoot	Root	Shoot	Root	Shoot	root	Shoot	Root	Shoot	Root	shoot	Root	shoot	root	shoot	root	shoot	root	Shoot
1	1.77 b	3.55 a	0.49 d	0.62 d	1.95 c	2.25 bc	11.06 b	22.19 a	23.33 c	8.11 b	1.07 a	1.42 b	0.76 b	0.37 b	2.48 a	1.59 a	6.69 a	8.87 b	25.35 d	6.09 c
2	1.60 bc	1.96 d	0.98 b	0.85 b	2.08 bc	1.86 d	10.00 bc	12.23 d	28.40 a	8.11 b	0.89 b	1.25 b	0.59 c	0.37 b	2.29 a	1.50 ab	5.56 b	7.80 b	24.34 d	5.07 c
3	2.13 a	2.13 d	1.09 a	0.50 e	1.24 d	2.21 c	13.31 a	13.31 d	21.30 c	7.10 b	0.89 b	1.77 a	0.46 de	0.75 a	0.81 c	1.42 b	5.56 b	11.09 a	29.41 c	12.17 b
4	–	–	–	–	–	–	–	–	–	–	0.89 b	1.25 b	0.40 e	0.76 a	0.89 c	1.11 c	5.56 b	7.80 b	24.34 d	11.16 b
5	1.51 c	1.60 e	0.67 c	0.74 c	0.84 e	2.65 b	9.44 c	10.02 e	28.40 a	10.14 a	1.07 a	1.07 c	0.88 a	0.45 b	1.37 b	0.97 c	6.69 a	6.65 c	40.57 a	15.21 a
6	1.25 d	1.60 e	0.31 e	0.87 b	1.95 c	2.48 bc	7.81 d	10.02 e	27.38 ab	11.16 a	0.89 b	1.42 b	0.52 cd	0.81 a	0.93 c	1.07 c	5.56 b	8.87 b	35.50 b	16.23 a
7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
8	1.60 bc	2.57 c	0.36 e	0.50 e	3.08 a	3.14 a	10.00 bc	16.10 c	24.34 bc	10.14 a	–	–	–	–	–	–	–	–	–	–
9	1.60 bc	3.02 b	0.93 b	1.03 a	2.21 b	3.04 a	10.00 bc	18.89 b	24.34 bc	11.16 a	–	–	–	–	–	–	–	–	–	–
L.S.D at 0.05	**0.21**	**0.30**	**0.09**	**0.09**	**0.25**	**0.32**	**1.31**	**1.91**	**3.18**	**1.19**	**0.12**	**0.17**	**0.08**	**0.08**	**0.20**	**0.16**	**0.75**	**1.10**	**3.87**	**1.49**
Mean	1.64	2.35	0.69	0.73	1.88	2.52	10.23	14.68	25.36	9.42	0.95	1.36	0.60	0.59	1.46	1.25	5.94	8.51	29.92	10.99

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S7. Nitrogen, phosphorus, potassium, crude protein, and ash content (%) in root and shoot of *Brassica rapa* L. (turnip) plant grown in the different sites (average of two samples; Dec. 2018 and Dec. 2019)

Site No.	N		P		K		Crude protein		Ash	
	Root	Shoot	root	Shoot	Root	Shoot	root	Shoot	root	shoot
1	1.60 b	2.84 a	0.70 c	1.14 a	5.02 a	4.14 a	10.00 b	17.75 a	25.35 a	26.37 a
2	1.96 a	2.31 b	0.47 d	0.77 c	3.70 bc	2.48 c	12.25 a	14.45 b	18.26 cd	20.28 b
5	1.07 c	1.60 c	0.92 b	0.56 d	3.04 d	2.48 c	6.69 c	10.02 c	20.28 bc	25.35 a
6	0.89 c	1.07 d	1.18 a	0.81 c	2.48 e	1.73 d	5.56 c	6.65 d	17.24 d	21.30 b
8	1.77 b	2.31 b	0.53 d	1.01 b	3.96 b	3.00 b	11.06 b	14.45 b	21.30 b	25.35 a
9	0.89 c	1.07 d	1.28 a	0.64 d	3.27 cd	2.61 c	5.56 c	6.65 d	16.23 d	15.21 c
L.S.D at 0.05	**0.18**	**0.25**	**0.11**	**0.11**	**0.47**	**0.36**	**1.13**	**1.57**	**2.54**	**2.87**
Mean	1.36	1.87	0.85	0.82	3.58	2.74	8.52	11.66	19.78	22.31

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S8. Heavy metals content (mg kg $^{-1}$) in root and shoot of *Brassica oleracea* var. *capitata* (cabbage) and *Lactuca sativa* L. (lettuce) plants grown in the different sites (average of two samples; Dec. 2018 and Dec. 2019)

Site No.	Cabbage													
	Fe		Mn		Zn		Cu		Co		Cr		Pb	
	Root	Shoot	root	Shoot	root	Shoot	root	shoot	root	shoot	root	shoot	Root	shoot
1	5350.81	4968.10	306.64	328.04	98.41	84.62	4.52	4.99	84.33	83.35	289.55	381.56	155.19	170.32
3	7155.02	4186.04	404.10	377.96	75.83	121.23	3.09	3.33	84.41	86.01	277.52	311.44	167.11	159. 50
4	3924.56	5255.73	411.24	311.40	97.70	50.87	2.61	3.80	83.81	85.87	256.32	242.46	171.23	195.07
5	5124.99	5208.19	370.83	370.83	51.11	111.72	4.52	4.52	87.02	85.02	238.79	252.65	167.29	204.69
6	4174.16	3258.98	451.65	411.24	29.48	50.16	3.57	2.61	85.02	86.33	229.28	271.67	172.79	178.29
7	3710.63	3967.35	377.96	263.86	82.96	60.85	2.14	1.19	85.10	87.39	214.27	201.55	157.67	192.31
9	4257.36	4399.98	501.56	496.81	82.96	97.70	3.09	4.52	88.07	89.77	197.88	216.33	183.70	160.69
L.S.D at 0.05	**443.57**	**405.39**	**36.59**	**33.43**	**6.97**	**7.79**	**0.31**	**0.34**	**12.46**	**12.59**	**35.79**	**40.01**	**24.52**	**26.39**
Mean	4813.93	4463.48	403.43	365.73	74.06	82.45	3.36	3.57	85.39	86.25	243.37	268.24	167.85	183.56
Plant mean	4638.71		384.58		78.25		3.47		85.82		255.81		175.71	
Site No.	**Lettuce**													
	Root	**Shoot**	**root**	**Shoot**	**root**	**Shoot**	**root**	**shoot**	**root**	**shoot**	**root**	**shoot**	**Root**	**shoot**
1	4732.77	4174.16	370.83	330.41	75.83	97.70	2.61	3.80	91.05	87.39	350.38	360.13	165.00	177.38
2	4067.19	5158.27	335.17	290.00	74.88	50.63	4.52	4.99	86.33	90.67	309.94	325.99	166.38	184.53
5	5455.41	5695.49	330.41	309.02	83.44	99.60	7.37	5.94	89.22	88.46	334.13	338.02	175.36	198.55
6	2973.73	4019.65	451.65	370.83	78.68	76.07	4.52	4.99	88.53	90.29	299.06	305.13	186.08	189.11
L.S.D at 0.05	**452.09**	**464.59**	**36.22**	**31.52**	**7.56**	**8.05**	**0.49**	**0.48**	**13.93**	**13.99**	**27.81**	**52.22**	**27.20**	**29.42**
Mean	4307.28	4761.89	372.02	325.07	78.21	81.00	4.76	4.93	88.78	89.20	323.38	332.32	173.21	187.39
Plant mean	4534.59		348.55		79.61		4.85		88.99		327.85		180.30	
The permissible level [35]	**450**	**450**	**300**	**300**	**60**	**60**	**40**	**40**	**-**	**-**	**-**	**-**	**5**	**5**

Supplementary materials

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S9. Heavy metals content (mg kg $^{-1}$) in root and shoot of *Allium sativum* L. (garlic) and *Allium cepa* L. (onion) plants grown in the different sites (average of two samples; Dec. 2018 and Dec. 2019)

Site No.	Garlic													
	Fe		Mn		Zn		Cu		Co		Cr		Pb	
	Root	Shoot	root	Shoot	root	Shoot	root	Shoot	root	shoot	root	shoot	Root	shoot
1	2129.87	2985.62	330.41	294.76	60.38	99.60	7.37	5.23	96.34	94.88	277.06	289.44	159.04	154.73
2	2783.56	2179.79	370.83	394.60	73.93	59.19	3.57	4.75	53.75	44.90	270.19	265.15	183.15	150.61
3	7492.57	5445.90	370.83	406.48	52.06	78.68	3.57	3.09	52.16	39.26	146.90	137.04	163.44	151.71
5	5179.66	4875.40	316.17	425.50	60.85	35.42	3.33	2.61	41.16	36.94	129.82	95.42	199.65	144.19
6	4932.45	5053.68	363.69	316.15	52.53	75.83	2.38	2.85	68.60	30.10	110.84	110.55	162.25	178.11
8	5308.03	4637.69	401.73	373.20	51.11	33.04	4.52	4.99	41.48	50.26	123.87	120.65	158.40	124.94
9	4794.58	4209.81	316.15	370.83	56.81	55.39	2.38	3.57	40.18	32.85	106.52	98.60	161.33	99.28
L.S.D at 0.05	**443.48**	**389.73**	**31.79**	**33.35**	**5.27**	**5.95**	**0.38**	**0.36**	**8.65**	**7.48**	**26.28**	**25.77**	**24.84**	**21.18**
Mean	4660.10	4198.27	352.83	368.79	58.24	62.45	3.87	3.87	56.24	47.03	166.46	159.55	169.61	143.37
Plant mean	4429.19		360.81		60.35		3.87		51.64		163.01		156.49	
Site No.	**Onion**													
	Root	**Shoot**	**Root**	**Shoot**	**root**	**Shoot**	**root**	**Shoot**	**Root**	**shoot**	**root**	**shoot**	**Root**	**shoot**
1	4970.48	4259.73	294.76	259.10	97.70	74.88	2.61	3.57	41.71	32.22	302.50	312.69	150.33	136.86
2	3734.40	4031.53	311.40	290.00	59.19	78.68	4.52	4.99	35.54	32.13	239.13	221.83	154.00	126.78
3	3591.77	3501.44	256.73	370.83	95.32	75.83	4.28	4.99	35.93	30.23	185.28	190.09	137.23	139.15
4	5443.52	4233.59	342.30	294.76	98.65	56.81	2.61	2.85	30.98	24.29	206.02	206.36	132.00	144.19
5	2137.00	2405.61	311.40	370.83	121.23	75.83	3.57	4.52	28.95	29.55	164.54	172.90	140.07	135.03
6	3211.44	4257.36	290.00	330.41	51.58	60.85	4.04	3.09	34.61	17.83	162.02	158.46	183.88	154.28
L.S.D at 0.05	**365.00**	**350.33**	**27.57**	**29.37**	**8.26**	**6.48**	**0.34**	**0.37**	**5.17**	**4.18**	**31.95**	**32.06**	**22.31**	**20.69**
Mean	3848.10	3781.54	301.10	319.32	87.28	70.48	3.61	4.00	34.62	27.71	209.92	210.39	149.59	139.38
Plant mean	3814.82		310.21		78.88		3.81		31.17		210.16		144.49	
The permissible level [35]	**450**	**450**	**300**	**300**	**60**	**60**	**40**	**40**	**-**	**-**	**-**	**-**	**5**	**5**

Supplementary materials

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S10. Heavy metals content (mg kg $^{-1}$) in root and shoot of *Brassica rapa* L. (turnip) plant grown in the different sites (average of two samples; Dec. 2018 and Dec. 2019)

Site No.	Fe		Mn		Zn		Cu		Co		Cr		Pb	
	Root	Shoot	root	Shoot	Root	Shoot	Root	Shoot	Root	shoot	Root	shoot	Root	shoot
1	1	4411.87	4197.93	259.10	330.41	170.91	74.88	2.61	2.85	35.36	40.96	347.53	349.36	161.33
2	2	3087.83	2747.91	344.68	465.91	46.83	68.70	2.61	2.38	42.31	33.76	334.46	347.75	141.63
3	5	4228.83	4423.75	316.15	294.76	51.11	33.04	4.52	4.04	24.50	55.73	257.69	252.8	130.44
5	6	5124.99	2930.94	285.25	263.86	70.36	37.08	4.52	3.57	26.11	40.55	331.61	344.78	132.00
6	8	3720.14	4252.60	320.91	259.10	71.07	74.88	4.28	3.57	22.81	21.91	221.15	232.71	154.46
8	9	4780.31	3256.60	449.27	370.83	66.08	81.77	2.38	4.52	19.37	35.52	205.33	210.83	147.86
L.S.D at 0.05	**L.S.D at 0.05**	**390.29**	**337.27**	**30.53**	**30.87**	**8.19**	**5.90**	**0.33**	**0.32**	**4.37**	**5.84**	**42.79**	**43.82**	**21.49**
Mean	4225.66	3634.96	329.23	330.81	79.39	61.73	3.49	3.49	28.41	38.58	282.96	289.72	147.46	169.09
Plant mean	3930.31		330.02		70.56		3.49		33.50		286.34		158.28	
The permissible level [35]	**450**	**450**	**300**	**300**	**60**	**60**	**40**	**40**	**-**	**-**	**-**	**-**	**5**	**5**

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S11. The contamination factor and pollution load index of soil samples collected from different sites (average of two winter seasons Dec. 2019 & Dec. 2020)

Site No.	The contamination factor for studied heavy metals							Pollution load index (PLI)
	Fe	Mn	Zn	Cu	Co	Cr	Pb	
1	5.91	10.42	35.84	2.95	2710.00	660.00	0.74	26.26
2	4.82	10.61	38.40	2.76	2760.00	130.00	0.70	20.18
3	6.03	9.75	15.93	1.15	1760.00	140.00	0.70	15.18
4	3.65	10.68	12.01	1.25	2460.00	90.00	0.82	14.02
5	4.05	15.65	17.84	1.67	5090.00	190.00	1.13	21.41
6	3.96	13.96	17.49	1.48	2880.00	160.00	0.80	17.62
7	4.71	15.48	6.64	0.89	3290.00	200.00	0.75	15.48
8	3.99	16.25	9.38	1.48	5050.00	60.00	1.01	16.06
9	3.84	12.38	6.46	1.19	2850.00	60.00	0.94	12.88
Mean	**4.55**	**12.80**	**17.78**	**1.65**	**3205.56**	**187.78**	**0.84**	**17.68**

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S12. The translocation factor of some heavy metals by *Brassica oleracea* var. *capitata* (cabbage), *Lactuca sativa* L. (lettuce) *Allium sativum* L. (garlic) *Allium cepa* L. (onion) and *Brassica rapa* L. (turnip) plants grown in the different sites

Site No.	Cabbage							Lettuce							Turnip						
	Fe	Mn	Zn	Cu	Co	Cr	Pb	Fe	Mn	Zn	Cu	Co	Cr	Pb	Fe	Mn	Zn	Cu	Co	Cr	Pb
1	0.93	1.07	0.86	1.10	0.99	1.32	1.10	0.88	0.89	1.29	1.46	0.96	1.03	1.08	0.95	1.28	0.44	1.09	1.16	1.01	0.90
2	_	_	_	_	_	_	_	1.27	0.87	0.68	1.10	1.05	1.05	1.11	0.89	1.35	1.47	0.91	0.80	1.04	0.96
3	0.59	0.94	1.60	1.08	1.02	1.12	0.95	_	_	_	_	_	_	_	-	-	-	-	-	-	-
4	1.34	0.76	0.52	1.46	1.02	0.95	1.14	_	_	_	_	_	_	_	-	-	-	-	-	-	-
5	1.02	1.00	2.19	1.00	0.98	1.06	1.22	1.04	0.94	1.19	0.81	0.99	1.01	1.13	1.05	0.93	0.65	0.89	2.27	0.98	1.34
6	0.78	0.91	1.70	0.73	1.02	1.18	1.03	1.35	0.82	0.97	1.10	1.02	1.02	1.02	0.57	0.93	0.53	0.79	1.55	1.04	1.23
7	1.07	0.70	0.73	0.56	1.03	0.94	1.22	_	_	_	_	_	_	_	-	-	-	-	-	-	-
8	_	_	_	_	_	_	_	_	_	_	_	_	_	_	1.14	0.81	1.05	0.83	0.96	1.05	1.17
9	1.03	0.99	1.18	1.46	1.02	1.09	0.87	_	_	_	_	_	_	_	0.68	0.83	1.24	1.90	1.83	1.03	1.24
Mean	**0.97**	**0.91**	**1.25**	**1.06**	**1.01**	**1.09**	**1.08**	**1.14**	**0.88**	**1.03**	**1.12**	**1.01**	**1.03**	**1.09**	**0.88**	**1.02**	**0.90**	**1.07**	**1.43**	**1.03**	**1.14**

Site No.	Garlic							Onion						
1	1.40	0.89	1.65	0.71	0.98	1.04	0.97	0.86	0.88	0.77	1.37	0.77	1.03	0.91
2	0.78	1.06	0.80	1.33	0.84	0.98	0.82	1.08	0.93	1.33	1.10	0.90	0.93	0.82
3	0.73	1.10	1.51	0.87	0.75	0.93	0.93	0.97	1.44	0.80	1.17	0.84	1.03	1.01
4	_	_	_	_	_	_	_	0.78	0.86	0.58	1.09	0.78	1.00	1.09
5	0.94	1.35	0.58	0.78	0.90	0.74	0.72	1.13	1.19	0.63	1.27	1.02	1.05	0.96
6	1.02	0.87	1.44	1.20	0.44	1.00	1.10	1.03	1.14	1.18	0.76	0.52	0.98	0.84
7	_	_	_	_	_	_	_	_	_	_	_	_	_	_
8	0.87	0.93	0.65	1.10	1.21	0.97	0.79	_	_	_	_	_	_	_
9	0.88	1.17	0.98	1.50	0.82	0.93	0.62	_	_	_	_	_	_	_
Mean	**0.95**	**1.05**	**1.09**	**1.07**	**0.85**	**0.94**	**0.85**	**0.98**	**1.07**	**0.88**	**1.13**	**0.81**	**1.00**	**0.94**

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S13. The bioaccumulation factor of Fe, Mn, Zn, and Cu by different plants grown in the different sites

Plant name	Fe		Mn		Zn		Cu		Co		Cr		Pb	
	Root	Shoot	Root	shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	shoot
Cabbage	39.27	37.61	1.32	1.20	4.85	5.08	0.39	0.41	30.93	31.33	1761.16	1876.80	40.57	43.42
Lettuce	34.83	39.07	1.20	1.05	2.47	2.61	0.42	0.42	28.29	28.46	1635.68	1684.85	42.23	45.56
Garlic	38.75	35.10	1.15	1.20	2.94	2.95	0.37	0.38	19.84	16.11	1251.90	1186.33	40.36	34.73
Onion	31.28	30.81	1.04	1.10	3.51	2.66	0.37	0.40	13.16	10.43	1298.16	1288.53	37.59	34.90
Turnip	36.63	31.19	1.03	1.06	3.82	3.54	0.35	0.36	8.93	11.53	2272.69	2347.08	33.58	37.24