

## Supplementary Material

### Effects of Reclaimed Water Irrigation on Grain Quality and Endogenous Estrogen Concentrations of Winter Wheat

Yu Chen <sup>1</sup>, Honglu Liu <sup>2</sup>, Taotao Lu <sup>1</sup>, Yan Li <sup>1\*</sup>, Zhenhao Zheng <sup>3</sup> and Yitong Wang <sup>1</sup>

1 College of Hydraulic Science and Engineering, Yangzhou University, Yangzhou 225009, China

2 Beijing Unconventional Water Resources Development and Utilization and Water Saving Engineering Technology Research Center, Beijing 100048, China;

3 Agricultural Technology Extension Station of Ningbo, Ningbo 315012, China;

#### Corresponding Author

Yan, Li

College of Hydraulic Science and Engineering, Yangzhou University, Yangzhou 225009, China

E-mail: liyan7986@126.com;

Tel.: +86-15252741669.

#### This Supporting Information contains 9 pages, 6 tables.

Table S1. Estrogen concentration in topsoil with different irrigation quality in 2015	2
Table S2. Estrogen concentration in topsoil with different irrigation quality in 2016	3
Table S3. Winter wheat quality index with different irrigation quality in 2015	4
Table S4. Winter wheat quality index with different irrigation quality in 2016	6
Table S5. Estrogen concentration in winter wheat grain with different irrigation quality in 2015	8
Table S6. Estrogen concentration in winter wheat grain with different irrigation quality in 2016	10

Table S1. Estrogen concentration in topsoil with different irrigation quality in 2015

Treatments	Number of samples	E1 (mg/kg)	EE2 (mg/kg)	E2 (mg/kg)	E3 (mg/kg)	Sum Content (mg/kg)
reclaimed water	1	0	ND	ND	0.0023	0.0023
	2	0.00319	ND	ND	0.0024	0.0056
	3	0.00066	ND	ND	0.0035	0.0042
alternating	1	0	ND	ND	0.0024	0.0024
	2	0.00060	ND	ND	0.0019	0.0025
	3	0	ND	ND	0.0032	0.0032
groundwater	1	0.00191	ND	ND	0.0016	0.0035
	2	0.00025	ND	ND	0.0023	0.0025
	3	0	ND	ND	0.0033	0.0033

Note: ND represents below the limits of detection; natural estrone (E1), 17 $\beta$ -estradiol (17 $\beta$ -E2) and estriol (E3), and synthetic estrogen (ethinyl estradiol, EE2).

Table S2. Estrogen concentration in topsoil with different irrigation quality in 2016

Treatments	Number of samples	E1 (mg/kg)	EE2 (mg/kg)	E2 (mg/kg)	E3 (mg/kg)	Sum Content (mg/kg)
reclaimed water	1	0.00110	ND	ND	0.0023	0.0023
	2	0.00050	ND	ND	0.0024	0.0056
	3	0.00030	ND	ND	0.0035	0.0042
alternating	1	0.00046	ND	ND	0.0024	0.0024
	2	0.00025	ND	ND	0.0019	0.0025
	3	0.00021	ND	ND	0.0032	0.0032
groundwater	1	0.00031	ND	ND	0.0016	0.0035
	2	0.00027	ND	ND	0.0023	0.0025
	3	0.00053	ND	ND	0.0033	0.0033

Note: ND represents below the limits of detection; natural estrone (E1), 17 $\beta$ -estradiol (17 $\beta$ -E2) and estriol (E3), and synthetic estrogen (ethinyl estradiol, EE2).

Table S3. Winter wheat quality index with different irrigation quality in 2015

Wheat variety	Treatments	Number of samples	crude protein %	total soluble sugar %	coarse ash %	starch %	reduction-type VC %
Jimai22	reclaimed water	1	14.8	1.5	2.62	59	4.11
		2	14.2	1.39	1.91	69	14.4
		3	12.9	1.07	2.73	68.6	14.4
	alternating water	1	13.1	2.14	2.84	63.3	6.16
		2	14.2	1.46	2.44	62.7	10.3
		3	12.1	1.14	2.89	70.6	10.3
	groundwater	1	13.6	1.61	1.91	58.3	10.3
		2	13.4	0.86	3.28	59.8	16.4
		3	12.2	1.14	2.43	75.1	16.4
Zhongmai175	reclaimed water	1	13.6	1.21	2.25	75.7	12.3
		2	13.7	1.07	2.45	64.3	16.4
		3	14.5	1.79	1.95	70.1	12.3
	alternating water	1	12.4	1.71	2.61	76.7	16.4
		2	13.5	1.25	3.04	70.3	16.4
		3	13.2	1.5	1.71	73	12.3
	groundwater	1	12.4	1.57	1.77	77.3	16.4
		2	13.6	1.93	1.74	72.2	14.4
		3	13	1.71	3.27	83.5	10.3
Shimai15	reclaimed water	1	15	2	2.56	61.4	10.3
		2	15.1	2.31	3.04	63.4	7.34
		3	15.1	0.99	2.41	72	4.08
	alternating water	1	14.6	2.32	2.75	64.9	12.3
		2	14.9	1.71	3.07	70.1	5.34
		3	15.1	1.46	2.47	74.5	4.08
	groundwater	1	14.5	1.96	4.88	62.6	6.12
		2	14.8	2.21	2.06	68	4.08
		3	15	1.89	2.39	59.4	6.12
Nongda211	reclaimed water	1	14.8	1.42	1.96	75.9	6.94
		2	13.2	2.21	2.04	68.7	5.71
		3	12.9	2.74	1.81	67.2	4.08
	alternating water	1	13.3	1.39	3.47	72.8	5.3
		2	12.6	1.78	2.99	74.1	6.12
		3	12.7	2.42	2.11	75.4	4.9
	groundwater	1	12.7	1.32	3.3	68.7	4.49
		2	12.8	1.86	2.37	62.4	5.3
		3	12	2.85	1.88	78.8	4.9
Shifu 20	reclaimed water	1	13.9	2.28	1.76	71.1	7.34
		2	13.8	1.32	1.9	67.5	4.49

	3	13.5	2.81	2.34	62.9	5.3
	1	13.2	1.46	1.92	59.8	4.9
alternating water	2	13.8	2.67	2.38	71.4	5.71
	3	14.2	2.31	2.2	68.3	6.12
	1	13.5	1.89	1.78	63.5	4.08
groundwater	2	13.2	1.92	1.96	76.9	4.08
	3	13.8	1.46	1.81	72.8	6.94

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Note: ND represents below the limits of detection; natural estrone (E1), 17 $\beta$ -estradiol (17 $\beta$ -E2) and estriol (E3), and synthetic estrogen (ethinyl estradiol, EE2).

Table S4. Winter wheat quality index with different irrigation quality in 2016

Wheat variety	Treatments	Number of samples	crude protein %	total soluble sugar %	coarse ash %	starch %	reduction-type VC %
Lunxuan518	reclaimed water	1	11.8	1.31	2.01	68.2	5.01
		2	12.9	0.62	2.5	62.4	15.8
		3	12.8	0.69	3.56	61.8	7.52
	alternating water	1	13.2	0.77	2.5	64	12.1
		2	13.6	0.77	2.69	70.6	17
		3	13.6	1.08	3.46	61.7	15
	groundwater	1	12.9	1.15	2.19	66.7	10.2
		2	13.2	0.62	2.23	66.2	19.9
		3	13.2	0.77	3.1	64.9	7.51
Zhongmai175	reclaimed water	1	12.8	0.62	2.68	65.2	12.2
		2	13.5	0.92	2.09	60.8	12.2
		3	15.4	1.08	2.18	62.8	10.6
	alternating water	1	12.6	1.15	2.29	64.2	19.6
		2	13.1	0.77	2.18	60.7	14.8
		3	15.3	0.79	2.16	61	12.2
	groundwater	1	13.2	0.92	2.1	63.7	10.4
		2	13.5	1.27	2.19	67	7.49
		3	15.4	1.38	2.29	60.6	21.9
Shimai15	reclaimed water	1	16.7	0.85	3.76	61.7	7.5
		2	16.6	1.15	2.33	60	5.4
		3	15.8	1.08	3.06	66.4	14.8
	alternating water	1	16.4	1.23	3.27	65.4	12.3
		2	15.4	0.85	3.6	62.7	5.3
		3	15.7	0.85	2.96	58.8	10.2
	groundwater	1	15.3	1.08	3.07	67.2	10.4
		2	15.2	1	3.05	61.7	5.2
		3	15.4	1	3.22	55.6	16.5
Nongda211	reclaimed water	1	16.4	0.85	2.63	59.8	7.5
		2	16.3	1.31	2.61	65.4	7.8
		3	15.6	1.15	2.96	59.9	16.8

Shifu20	alternating water	1	16	1	3.41	62	7.6
		2	16.2	1	3.51	63.5	10.4
		3	15.5	1.23	2.61	61.3	15
	groundwater	1	15.5	1.15	3.95	61	7.4
		2	16.1	1.08	2.66	63.7	12.2
		3	15.1	0.77	2.24	60.2	11.9
	reclaimed water	1	16.4	1.08	2.27	59.8	10.2
		2	16.1	1	2.09	65.2	10.3
		3	15.5	0.77	2.27	59.8	9.1
	alternating water	1	15.9	0.85	2.44	62.2	10.3
		2	15.4	1.15	2.31	63.2	16.6
		3	14.8	1.31	3.16	60.8	9.5
	groundwater	1	15.4	0.85	2.71	63.7	14.9
		2	14.4	1.08	2.7	61.3	12.4
		3	15.4	1.28	2.33	59.5	20.8

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Note: ND represents below the limits of detection; natural estrone (E1), 17 $\beta$ -estradiol (17 $\beta$ -E2) and estriol (E3), and synthetic estrogen (ethinyl estradiol, EE2).

Table S5. Estrogen concentration in winter wheat grain with different irrigation quality in 2015

Wheat Variety	Treatments	Number of samples	E1 (ug/kg)	EE2 (ug/kg)	E2 (ug/kg)	E3 (ug/kg)	Sum (ug/kg)
Jimai 22	reclaimed water	1	0.01037	ND	ND	ND	10.37
		2	0	ND	ND	ND	0
		3	0.00077	ND	ND	ND	0.77
	alternating	1	0.00061	ND	ND	ND	0.61
		2	0	ND	ND	ND	0
		3	0	ND	ND	ND	0
	groundwater	1	0.0015	ND	ND	ND	1.5
		2	0	ND	ND	ND	0
		3	0.00039	ND	ND	ND	0.39
Zhongmai 175	reclaimed water	1	0	ND	ND	ND	0
		2	0.00035	ND	ND	ND	0.35
		3	0	ND	ND	ND	0
	alternating	1	0.00692	ND	ND	ND	6.92
		2	0	ND	ND	ND	0
		3	0.00093	ND	ND	ND	0.93
	groundwater	1	0	ND	ND	ND	0
		2	0	ND	ND	ND	0
		3	0	ND	ND	ND	0
Shimai 15	reclaimed water	1	0	ND	ND	ND	0
		2	0.00079	ND	ND	ND	0.79
		3	0	ND	ND	ND	0
	alternating	1	0.00137	ND	ND	ND	1.37
		2	0.00049	ND	ND	ND	0.49
		3	0.00057	ND	ND	ND	0.57
	groundwater	1	0.00058	ND	ND	ND	0.58
		2	0.00198	ND	ND	ND	1.98
		3	0.00126	ND	ND	ND	1.26
Nongda 211	reclaimed water	1	0	ND	ND	ND	0
		2	0.00042	ND	ND	ND	0.42
		3	0	ND	ND	ND	0
	alternating	1	0.00129	ND	ND	ND	1.29
		2	0.0005	ND	ND	ND	0.5
		3	0.00092	ND	ND	ND	0.92



Shifu 20	groundwater	1	0.00093	ND	ND	ND	0.93
		2	0	ND	ND	ND	0
		3	0	ND	ND	ND	0
	reclaimed water	1	0	ND	ND	ND	0
		2	0	ND	ND	ND	0
		3	0	ND	ND	ND	0
	alternating	1	0.00131	ND	ND	ND	1.31
		2	0	ND	ND	ND	0
		3	0.00133	ND	ND	ND	1.33
	groundwater	1	0	ND	ND	ND	0
		2	0.00101	ND	ND	ND	1.01
		3	0.00318	ND	ND	ND	3.18

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Note: ND represents below the limits of detection; natural estrone (E1), 17 $\beta$ -estradiol (17 $\beta$ -E2) and estriol (E3), and synthetic estrogen (ethinyl estradiol, EE2).

Table S6. Estrogen concentration in winter wheat grain with different irrigation quality in 2016

Wheat Variety	Treatments	Number of samples	E1 (ug/kg)	EE2 (ug/kg)	E2 (ug/kg)	E3 (ug/kg)	Sum (ug/kg)
Jimai 22	reclaimed water	1	0.00052	ND	ND	0.00000	0.52
		2	0.00025	ND	ND	0.00000	0.25
		3	0.00096	ND	ND	0.00000	0.96
	alternating	1	0.00017	ND	ND	0.00000	0.17
		2	0.00022	ND	ND	0.00000	0.22
		3	0.00034	ND	ND	0.00048	0.82
	groundwater	1	0.00066	ND	ND	0.00000	0.66
		2	0.00043	ND	ND	0.00000	0.43
		3	0.00065	ND	ND	0.00000	0.65
Zhongmai 175	reclaimed water	1	0.00088	ND	ND	0.00048	1.36
		2	0.00060	ND	ND	0.00000	0.60
		3	0.00034	ND	ND	0.00156	1.90
	alternating	1	0.00068	ND	ND	0.00000	0.68
		2	0.00020	ND	ND	0.00113	1.32
		3	0.00000	ND	ND	0.00000	0.00
	groundwater	1	0.00038	ND	ND	0.00356	3.95
		2	0.00007	ND	ND	0.00041	0.48
		3	0.00014	ND	ND	0.00203	2.17

Note: ND represents below the limits of detection; natural estrone (E1), 17 $\beta$ -estradiol (17 $\beta$ -E2) and estriol (E3), and synthetic estrogen (ethinyl estradiol, EE2).