Wastewater Reuse for Irrigation

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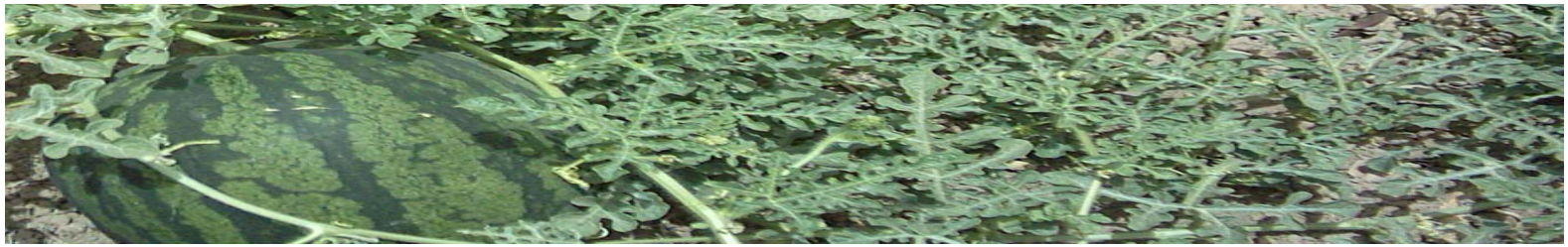
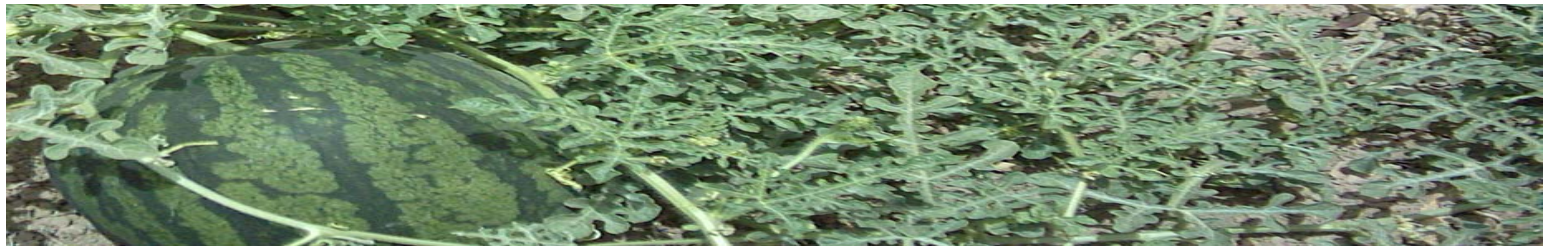
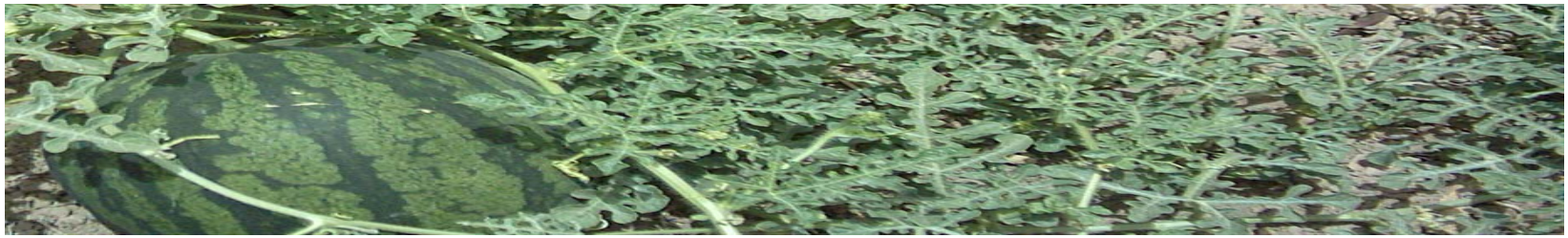


- **In desert climates, because of water shortage, municipal wastewater may be considered sources of water for irrigation of crop plants, and could be used both for water and fertilizer for crop growth.**

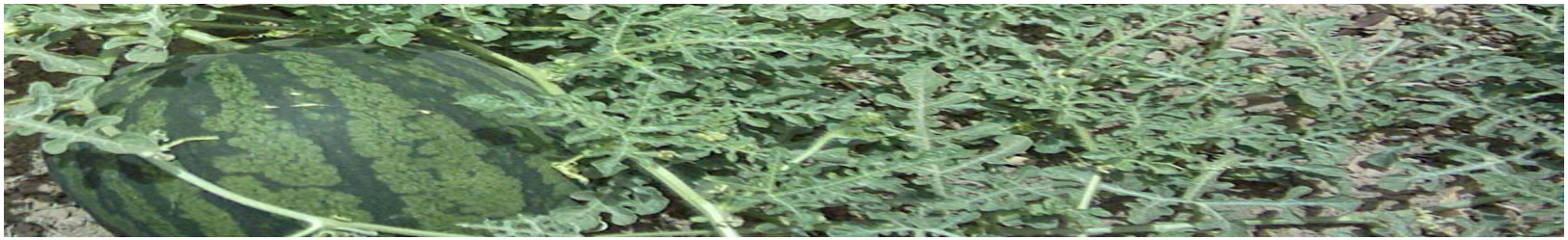
- **It is believed that health problems may be developed as a results of dietary accumulation of Cd, Cr, Cu, Zn and others such heavy metals in human body tissue**.



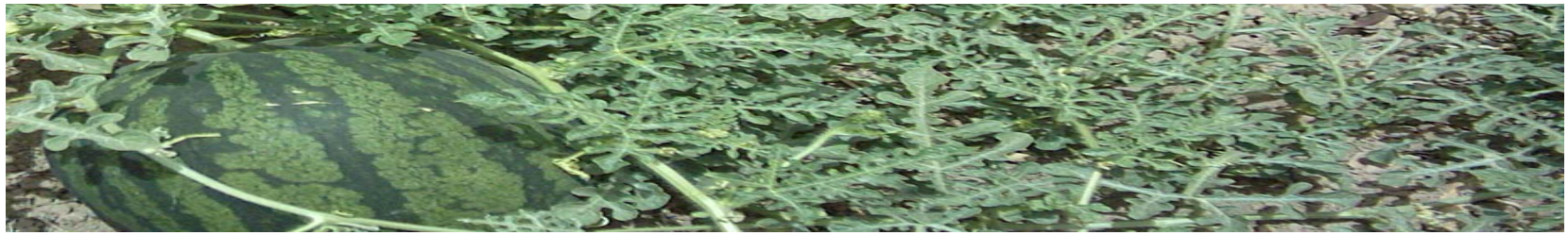
- **Heavy metals are types of contaminants that can be found in wastewater, and as a result can also be found on the surface and in the tissue of fresh vegetables.**



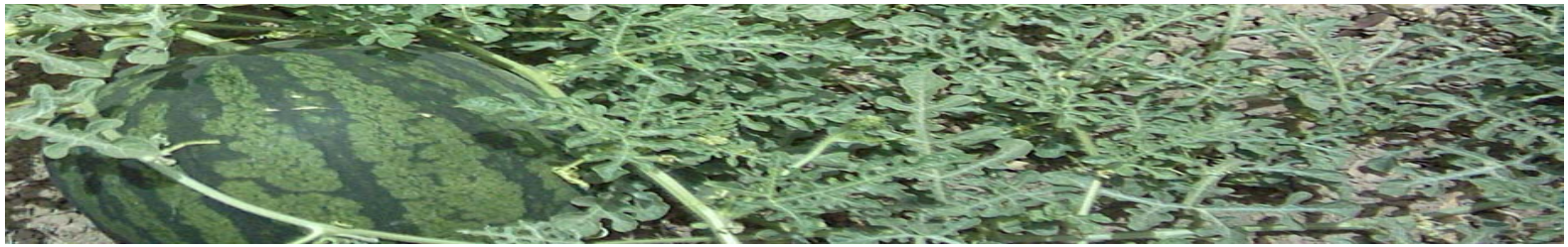
- **There is therefore significant cause for concern regarding contamination.**
- **Heavy metal concentration in edible portions of the plants should be well under the standard levels to make it safe for consumer health.**



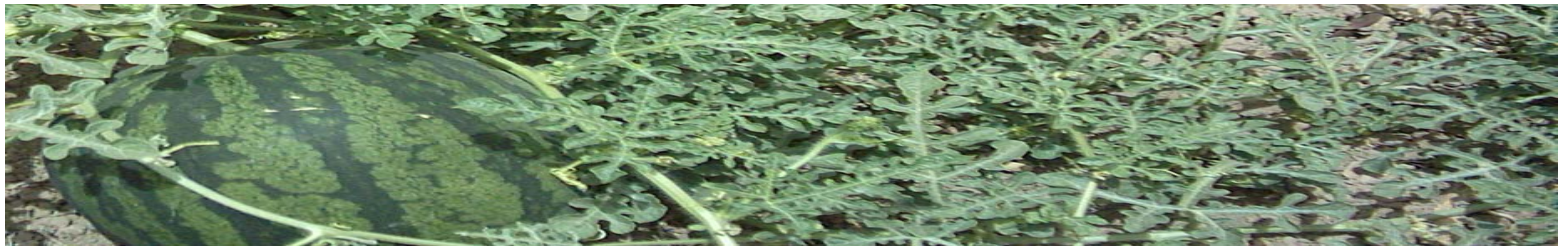
- **Concentration of heavy metals in vegetables irrigated by urban wastewater is a cause of serious concern due to the potential health problems of consuming contaminated produce.**



- **Prolonged consumption of heavy metals may lead to the disruption of numerous biological and biochemical processes in the human body.**



- **Watermelon has a good adaptability to arid and semi arid climatic conditions and therefore is of high economic importance in these regions**.



- **In Iran due to special climatic conditions watermelon could be grown all around the year.**

- **In order to investigate concentration of heavy metals in different tissues of watermelon plants, an experiment was conducted at the Shahid Bahonar University of Kerman, IRAN.**

Irrigation with Wastewater

MEASURING IRRIGATION WASTEWATER

- **Seeds of watermelon were sown in experimental plots and were irrigated by wastewater during growth. Plant samples including leaves, stems and fruits were analyzed for different heavy metals.**

Watermelon Farm

Watermelon Farm

- **Samples were analyzed for concentrations of Lead (Pb), Copper (Cu), Zinc (Zn) and Cadmium (Cd)…..**

Sampling

Sampling

- **Heavy metals in watermelon are associated with wastewater irrigation or soil pollution and deposition.**
- **Heavy metals may come from different local industries, transportation, or dust and other sources.**

Fig (1) Mean Heavy metal concentration in watermelon roots steams and fruits

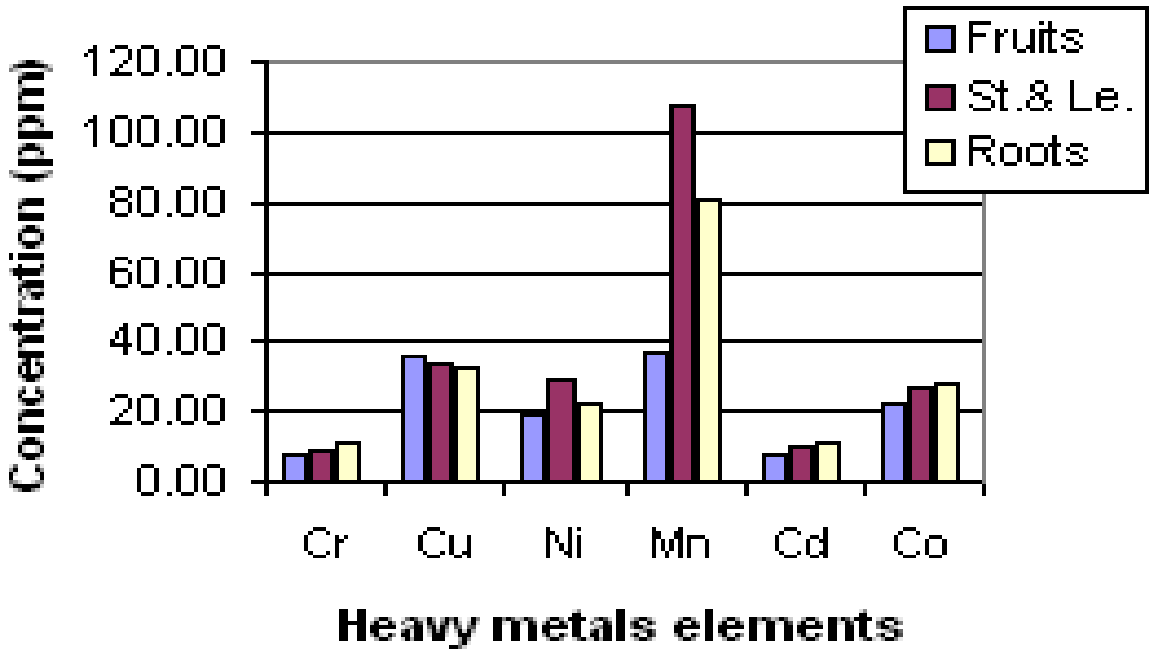
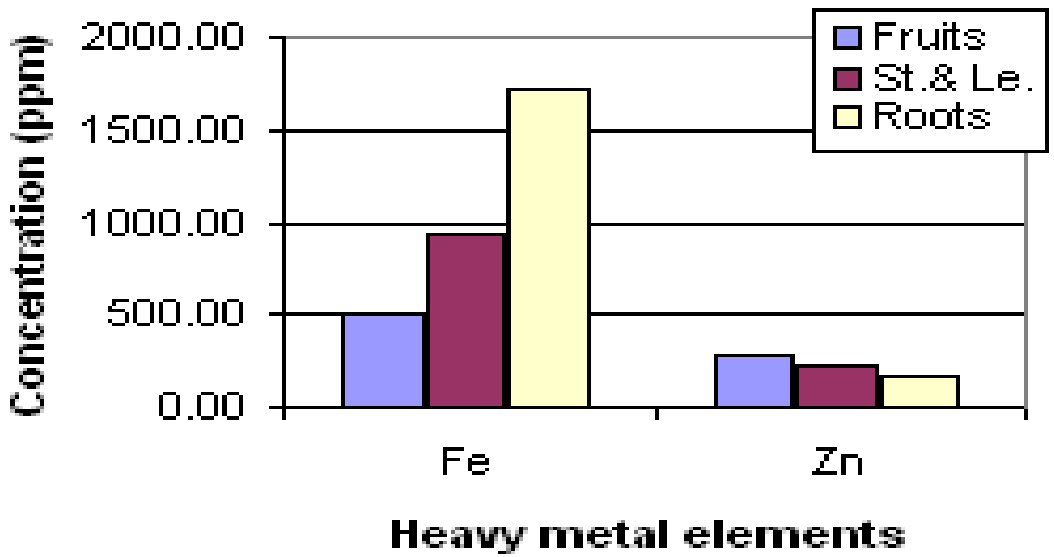


Fig (2) Mean heavy metal concentration in watermelon roots, stems and fruits



Heavy metals		Max. (ppm).	Min. (ppm).	Count (ppm).	Stan.Dev (ppm)	St. Er. (ppm)	Mean (ppm)
Fruits	Zn	480.1	190	11	89.831	27.085	283.771
Stems		349.3	141.67	12	56.625	16.346	221.569
Roots		281.85	349.3	10	68.314	21.603	168.77
Fruits	Co	23.425	22.15	3	0.638	0.368	22.792
Stems		40.15	16.375	6	10.508	4.29	26.925
Roots		32.45	20.225	4	5.367	28.9	27.619
Fruits	Mn	49.65	27.057	11	7.422	2.238	36.695
Stems		148.525	72.125	12	27.756	8.013	107.452
Roots		146.025	46.65	10	34.032	10.762	80.598

Table (1): descriptive analytical results of heavy metal

in watermelon irrigated by wastewater

Heavy metals		Max. (ppm).	Min. (ppm).	Count (ppm).	Stan.Dev (ppm)	Stan.Er. (ppm)	Mean (ppm)
Fruits	Cd	14.625	0	7	4.296	1.624	8.193
Stems		12.4	7.8	8	1.731	0.612	10.069
Roots		14.375	8.3	6	2.226	0.929	10.704
Fruits	Cr	14.3	3.3	12	3.35	0.97	7.62
Stems		14.3	5.95	12	2.85	0.82	9.42
Roots		20.6	6.4	10	4.47	1.41	11.11
Fruits	Fe	2262.05	178.23	13	549.83	152.5	496.23
Stems		2247.45	367.68	10	561.62	177.6	935.79
Roots		4318.88	433.38	10	1040.07	328.9	1711.73

Table (1): Continued

Regression Equation

- $Y = C_0 + C_1 * R + C_2 * S$
- Y is watermelon's fruit heavy metal concentration in ppm,
- R and S are concentration in root and stem in ppm,
- C_0, C_1 and C_2 are regression coefficients.

Heavy	Intercept	Coeff. Of	Coeff. Of	Mutiple	R Square
Metals,Y	C0, ppm	Stem, C1	Root, C2	R	R2
Zn	85.304	0.533	0.389	0.601	0.362
Mn	26.097	0.038	0.099	0.623	0.389
Cd	-31.908	1.988	1.695	0.996	0.992
Cr	6.278	0.222	-0.058	0.16	0.025
Fe	-188.64	1.093	-0.163	0.92	0.847
Cu	10.222	0.076	0.708	0.657	0.847
Ni	-10.76	1.006	-0.087	0.756	0.572

Table(2): Regression coefficient and details

- **This study shows that watermelon irrigated by wastewater has high concentration of heavy metals in fruit, stem and root.**

- **Concentrations of most heavy metals are in descending order from roots, stems and fruits. It means that there is a filtration processes from roots to fruits.**

- **Linear regression analysis shows that there in good relationships between concentration of heavy metals in fruits and concentration of them in roots and stems for most of collected data**

- **These type of mathematical models may be used to estimate the concentrations of heavy metal in watermelon fruits before harvesting and marketing in regard of human health impacts.**

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