International Journal of Botany Studies
ISSN: 2455-541X; Impact Factor: RJIF 5.12
Received: 26-01-2019; Accepted: 07-02-2019
www.botanyjournals.com
Volume 4; Issue 2; March 2019; Page No. 128-130

Micronutrient and heavy metal status of sewage irrigated cauliflower

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Abstract
In present study micronutrient and heavy metal status of cauliflower grown on sewage water is evaluated. The study was carried out during year 2018-2019. The study revealed that micronutrients as well as heavy metals are in high concentration in sewage irrigated cauliflower than sewage un-irrigated one.

Keywords: Sewage water, micronutrients, trace elements cauliflower

Introduction
Use of sewage water for irrigation especially for vegetable crops is increasing worldwide. Sewage water varies from well water in its contents. The micronutrients and heavy metals are beneficial for vegetable crops. But prolonged use of sewage water can lead to accumulation of toxic chemicals in soils and crops This can cause long term toxic effect on human health through food chain.
Ahmednagar, a growing city of Maharashtra (India) produces large domestic waste water. From past few decades this sewage water is used for irrigation of vegetable crops in areas adjoining to Sina river. In present investigation, a comparative study of micronutrient and heavy metal status of sewage irrigated and non-irrigated cauliflower is carried out.

Material and Method
Collection of plant samples
The samples of cauliflower (five) were collected at each site selected at Nalegaon and Burudgaon road. The cauliflower samples (two) were also collected from area where cauliflower is grown on the soil where sewage water is not used for irrigation. Thus in all 7 plant samples were collected (Table 3)

Table 1: Details of plant sampling

Sr No	Name of site/village	Sample No
A	**Sewage water**	
1	Nalegaon	Nalegaon Plant 1
2	Nalegaon	Nalegaon Plant 2
3	Nalegaon	Nalegaon Plant 3
4	Burudgoan	Burudgaon Plant 1
5	Burudgoan	Burudgaon Plant 2
B	**Sewage Unirrigated**	
1	Nepti	Nepti Plant 1
2	Nepti	Vilad Plant 1

Collection and preparation of plant samples
Representative composite cauliflower samples were collected and oven dried at 55o C. The samples were processed by using Willey grinding Mill and preserved for analysis.

Plant analysis
Nitrogen-Nitrogen from plant sample was estimated by Microkjeldahl method as described by Parkinson and Allen (1975).

Phosphorous -It was estimated by Vanadomolybdate phosphoric acid yellow colour method as described by Jackson (1973).

Potassium-It was estimated by Flame photometric method as described by Jackson (1973).

Calcium-It was estimated by Versanated titration method as by Chapman and Pratt (1961).

Micronutrients Fe, Mn, Zn, Cu-The micronutrients in plant were estimated on Atomic absorption spectrophotometer as described by Zoroski and Burau (1977).

Heavy metals Cd, Cr, Ni, As-The heavy metals were estimated on Atomic absorption spectrophotometer As described by Page et al. (1982)

Ascorbic acid-It is estimated by Titrimetric 2, 6 dichlorophenol indophenol dye (reduction) method as described by Ranganna (1977).

Total Soluble Solids (T.S.S.)- It was estimated by Refractometer as described by A.O.A.C. (1975).

Reducing Sugar-It was estimated by colorimetric (Nelson and Somogyi) method as described by Nelson (1944).

Statistical analysis: The correlation between soil properties and the total and available concentration of trace elements was carried out as suggested by Panse and Sukhatme (1985).

Table 2: Nutrient and trace element concentration in cauliflower

Parameter	Sewage irrigated cauliflower					Sewage unirrigated cauliflower	
	Nalegaon	Nalegaon	Nalegaon	Burudgaon	Burudgaon	Nepti	Vilad
Nitrogen %	4.05	4.30	3.50	4.30	4.80	1.72	1.10
Phosphorus %	0.330	0.245	0.270	0.472	0.345	0.220	0.123
Potassium %	2.08	1.80	1.40	2.50	2.10	2.30	2.00
Calcium %	2.00	2.40	2.10	2.30	2.20	2.20	2.00
Fe, mg kg^{-1}	514.00	759.25	617.25	1361.00	867.25	781.00	700.00
Mn, mg kg^{-1}	102.25	118.75	114.50	132.50	160.75	29.50	28.50
Zn, mg kg^{-1}	119.75	121.00	124.00	134,75	139.20	74.25	70.00
Cu, mg kg^{-1}	119.75	120.00	126.00	135.25	138.00	3.20	3.80
B, mg kg^{-1}	7.180	7.568	6.810	7.660	6.870	6.710	6.990
Cd, mg kg^{-1}	2.20	2.45	2.40	1.620	1.70	1.70	1.50
Cr, mg kg^{-1}	3.00	2.75	2.25	135.75	142.75	76.00	65.00
Ni, mg kg^{-1}	123.75	135.25	135.00	130.20	140.00	78.00	70.00
As, mg kg^{-1}	7.50	6.00	9.00	8.00	7.00	0.50	0.50

Table3: Nutrient and trace element concentration in Cauliflower

Parameter	Sewage irrigated Cauliflower					Sewage unirrigated Cauliflower	
	Nalegaon	Nalegaon	Nalegaon	Burudgaon	Burudgaon	Nepti	Vilad
Ascerbic acid mg 100 g^{-1}	32.5	31.5	17.3	36.1	23.3	36.8	40.5
T.S.S. %	13,20	8,3	8.0	6.0	7.2	7.9	8.1
Reducing sugar %	16.75	20.00	21.00	16.50	14.00	22.25	23.50

The concentration of nutrients as well as trace in elements in the cauliflower grown on sewage irrigation was studied in order to know the accumulation of heavy metals in plant. Similarly the concentration of these elements was also estimated in the cauliflower grown on the soils of sewage free areas.

Nitrogen-The nitrogen concentration in cauliflower grown on sewage irrigated soils ranged from 3.50to 4.80percent (Table 2). The nitrogen concentration in cauliflower grown on sewage free soils ranged from 1.10 to 1.72 percent.

Phosphorus-The phosphorus content in cauliflower grown on sewage irrigated soils ranged from 0.24 to 0.47 percent. The phosphorus concentration in cauliflower grown on sewage free soils ranged from 0.123 to 0.224 percent.

Pottassium-The potassium content of cauliflower grown on sewage irrigated soils ranged from 1.4 to 2.50 percent (Table 2). The potassium content of cauliflower of grown on sewage free soils ranged from 2.0 to 2.30 percent (Table 2). The potassium content of cauliflower of grown on sewage free soils ranged from 1.27 to 1.625 percent indicating low concentration of potassium

Calcium -The concentration of calcium in cauliflower grown on sewage irrigated soils ranged from 2.0 to 2.4 percent while in cauliflower grown on sewage from 2.0 to 2.4 percent

Nutrient and trace elements concentration in cauliflower as influenced by sewage irrigation

The concentration of nutrients as well as trace in elements in the cauliflower grown on sewage irrigation was studied in order to know the accumulation of heavy metals in plant. Similarly the concentration of these elements was also estimated in the cauliflower grown on the soils of sewage free areas.

Quality of vegetable as influenced by sewage irrigation

Ascorbic acid: The ascorbic acid content in cauliflower grown on sewage irrigated soils ranged from 17.3 to 36.1 mg 100 g^{-1} (Table 2) sewage unirrigated cauliflower ranged from36.8 to40.5 percent

Total soluble solids: The total soluble solids of sewage irrigated cauliflower ranged from 6.0 to 13.20 percent. The total soluble solids of sewage unirrigated cauliflower ranged from 7.9 to 8.1 percent (Table 2)

Reducing sugars: The reducing sugars in the cauliflower grown in sewage water ranged from 14.0 to 21.00 percent. The reducing sugars of sewage unirrigated**.** Cauliflower ranged from 22.25 to 23.50 percent (Table 2)

Cauliflowers, grown on sewage irrigate soils as compared cab with cauliflower, grown on sewage free areas.

The use of sewage water as irrigation although observed to increase the essential plant nutrient status in respect of N, P, K and Ca the higher concentration of trace elements added through sewage may cause potential toxicity problems.

Thus, it was observed that the concentration of Fe, Mn and Cu was considerably higher in cauliflower grown on sewage irrigated soils which being excessive as compared to standard nutrient norms may cause imbalance of nutrients in plant. Further, the concentration of trace elements like Cu, higher than the phytotoxicity limits of 50 mg Kg^{-1} and Chromium more than 2 mg Kg^{-1} in grown cauliflower, on sewage irrigated soils may be phytotoxic and become potentially harmful affecting optimal growth and development of plant. Similarly, the Cadmium concentration above the suggested permissible limit may enter the food chain resulting into human health hazard.

Acknowledgements

Mrs. J. R. Mulay is thankful to University Grant Commision, New Delhi for granting facilities of minor research project Authors are thankful to Principal of the

College and Secretary, AJMVPS Ahemadnagar for support and facilities

References

1. Adhikari S, Mishra A, Gupta SK, Banarjee SK. Pollutant metal contents of vegetables irrigated with sewage water. J. Indian soc. Soil Sci. 1998; 46:153-155.
2. Bansal OP. Heavy metal pollution of soils and plants due to sewage irrigation. Indian J. Environ. H1th. 1998; 40:51:57.
3. Khurana MPS, Singh Meharban, Nayyar VK. Assessment of heavy metal contamination in soil and plants irrigated with sewage water containing industrial effluents in district Amritsar, Punjab. India. Indian. J. environment and ecoplan. 2004; 8(1):221-228.
4. Mitra A, Gupta SK. Effect of sewage water irrigation on essential plant nutrient and pollutant elements status in vegetable growing area around Calcutta. J. Indian Soc. Soil Sci. 1999; 47:99-104.
5. Nayyar VK, Bansal RL, Khurana MPS. Progress report of Adhoc project Assessment and characterization of heavy metal contamination in agricultural soils and plants in peri urban areas. Dept. of soil, PAU, Ludhiana, 2001.
6. Page AL, Miller RH, Keeny DR. Methods of soils analysis Part 2 – Chemical and Microbiological properties, second Ed American Soc. Agron. Inc. and Soil Sci. Am. Inc. Madison USA, 1982, 1159.
7. Prasada Rao AAN. Water quality monitoring of River Godavari Near Rajahmudry A case study. In proc. 2nd International conference on Water Quality Management, 13-15 February, New Delhi, India, 2003,, 67-IV 73.
8. Prasad Jagdish, Gajbhiye KS. Characterization of sewage water irrigated and non irrigated soil in Nag river eco-system Nagpur district Maharashtra. Proc. International Conference on Soil Water and Environmental quality issues and strategies. 2005; 28 2005.
9. Prashant M. Mastiholi Effect of sewage water irrigation on quality of vegetable crop grown around Hadpsar Area Near Pune city.
10. Sikka R, Nayyar VK, Sidhu SS. Distribution and accumulation of Cd in Soils and Plants grown on sewage irrigated soils. Proc International Conference on Soil Water and Environmental quality issues and strategies. New Delhi. 2005.
11. Singh MV, Saha JK. 27th Annual Report of the All India Cordinated Research Project of Micro and Secondary Nutrient and Pollutant Elements in soils and Plants, Indian Institute of Soil Science, Bhopal, 1997, 108.
12. Singh MV. 28th Annual Report of the All India Cordinated Research Project of Micro and Secondary Nutrients and Pollutant Elements in Soils and Plants, Indian Institute of Soil Science, Bhopal, 1998, 137.
13. Singh RS, Singh RP. Distribution of DTPA extractable Cd, Pb, Cr, Cu, An, Mn, and Fe in soil profiles contaminated by sewage and industrial effluents. J. Indian Soc. Soil. Sci. 1994; 42(3):466-468.
14. Singh SS. Heavy metal pollution of soil through sewage irrigation. Indian J. Agric. Chem. 1996; 29:123.
15. Som S, Gupta SK, Banerjee SK. Assessment of the quality of sewage effluents from Howrah sewage treatment plant. J. Indian Soc. Soil Sci. 1994; 42:571-575.
16. Somashekhar Siddaramaiah RK. Heavy metal concentrations in soil and crops grown with metal rich industrial waste waters. J. Ind. Poll. Contr. 1997; 13(1):29-40.
17. Sree Ramulu US. Utilization of sewage and sludge for increasing crop production. J. Indian Soc. Soil Sci. 1994; 42:525-532.
18. Srikanth R, Reddy S. Lead, cadmium and chromium levels in vegetables grown in urban sewage slude. Food Chem. 1991; 40:229-234.
19. Sterrett SB, Chaney RL, Reynolds CW, Schales FD, Douglass LW. Transplant quality and metal concentrations in vegetable transplants grown in media containing sewage sludge compost. Hort. Sci. 1982; 17(6):920-922.
20. Sterrett SB, Chaney RL, Reynolds CW, Schales FD, Douglass LW. Transplant quality, yield and heavy metal accumulation of tamato, Muskmelon and cabbage frown in media containing sewage sludge compast. J. Amer. Soc. Hort. Sci. 1983; 108(1):36-41.
21. Tiwari RC, Arvind Kumar, Mistro AK. Influence of treated sewage and tube well irrigation on rice and soil properties J. Indian Soc. Soil Sci. 1996; 54(3):547-549.
22. Tiwari RC, Saraswat P, Tripathi Sanjeev. Utilization of Urban Treated Sewage Water and digested sludge for crop production Proc International Conference on Soil Water and Environmental quality issues and strategies. 2005.
23. Tiwari RC, Saraswat PK, Agrawal HP. Changes in macro nutrient status of soils irrigated with treated sewage water and tube well water. J. Indian Soc Soil Sci. 2003; 51(2):150-155.
24. Vangronsveld I, Clijsters H. Tosic effect of metals. In : plant and chemical elements (Ed : M.E Forago). VCH verlagsgesell schaft, 1984, 149-177.