Micronutrient and heavy metal status of sewage irrigated Amranthus

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Abstract -In present study micronutrient and heavy metal status of Amranthus grown on sewage water is evaluated. The study was carried out during year 2013. The study revealed that micronutrients as well as heavy metals are in high concentration in sewage irrigated Amranthus than sewage un-irrigated one.

Keywords: Sewage water, micronutrients, traces elements Amranthus

I. 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 Maharashatra (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 Amranthus is carried out.

Collection and preparation of plant samples

Representative composite Amaranthus samples were collected during year 2013 and oven dried at 55oC. The samples were processed by using Willey grinding Mill and preserved for analysis.

Nitrogen from plant sample was estimated by Microkjeldahl method as described by Parkinson and Allen (1975). Phosphorous was estimated by Vanadomolybdate phosphoric acid yellow colour method as described by Jackson (1973). Potassium was estimated by Flame photometric method as described by Jackson (1973). Calcium was estimated by Versanated titration method as by Chapman and Pratt (1961). Micronutrients Fe, Mn, Zn, Cu in plant were estimated on Atomic absorption spectrophotometer as described by Zoroski and Burau (1977). Heavy metals Cd, Cr, Ni, As were estimated on Atomic absorption spectrophotometer as described by Page et al. (1982)

Table 1. Nutrient and trace element concentration in Amaranthus

Parameter	Sewage irrigated amaranthus					Sewage unirrigated amaranthus	
	Nalegaon	Nalegaon	Nalegaon	Burudgaon	Burudgaon	Nepti	Vilad
Nitrogen %	3.05	4.20	3.30	4.20	4.70	1.82	1.20
Phosphorus %	0.320	0.240	0.275	0.475	0.340	0.210	0.123
Potassium %	2.00	1.90	1.30	2.30	2.20	2.20	2.10
Calcium %	2.00	2.40	2.10	2.30	2.20	2.10	2.00
Fe,mg kg^{-1}	525.00	760.25	618.00	1365.00	865.00	774.75	776.75
Mn, mg kg^{-1}	101.25	118.75	114.50	133.50	137.00	31.25	27.50
Zn, mg kg^{-1}	119.00	120.00	122.00	132.50	138	18.25	15.75
Cu, mg kg^{-1}	118.00	121.00	125.00	133.00	137.00	17.55	15.65
B, mg kg^{-1}	7.253	7.567	6.800	1.662	6.896	6.700	6.995
Cd, mg kg^{-1}	3.00	3.80	2.25	2.50	3.30	0.60	0.75
Cr, mg kg^{-1}	3.oo	2.70	2.25	135.75	140.75	760.00	65.00
Ni, mg kg^{-1}	125.75	135.25	130.00	120.00	142.00	78.00	72.00
As, mg kg^{-1}	7.30	6.20	9.10	8.00	8.00	0.50	0.50

Table 2. Nutrient and trace element concentration in Amaranthus Leaf

Parameter	Sewage irrigated Amaranthus Leaf					Sewage unirrigated Amaranthus Leaf	
	Nalegaon	Nalegaon	Nalegaon	Burudgaon	Burudgaon	Nepti	Vilad
Ascorbic acid	32.5	30.3	16.2	32.00	22.3	37.5	42.5

mg 100 g^{-1}							
T.S.S. %	12.00	6.2	8.0	7.0	6.3	7.7	7.1
Reducing sugar %	17.05	19.5	18.00	15.50	13.50	22.25	23.25

II. OBSERVATIONS :

1. The nitrogen concentration in Amaranthus grown on sewage irrigated soils ranged from 3.3 to 4.7 percent (Table 1). The nitrogen concentration in Amaranthus grown on sewage free soils ranged from 1.2 to 1.82 percent.
2. The Phosphorus content of Amaranthus grown on sewage irrigated soils ranged from 0.24 to 0.47 percent (Table 1). The potassium content of Amaranthus grown on sewage free soils ranged from0.123.1to 0.210 percent
3. The potassium content of Amaranthus grown on sewage irrigated soils ranged from 1.3 to 2.3 percent (Table 1). The potassium content of Amaranthus of grown on sewage free soils ranged from 2.1to 2.2 percent.
4. The concentration of calcium in Amaranthus grown on sewage irrigated soils ranged from 2.0 to 2.4 percent while in Amaranthus grown on sewage from 2.0 to 2.1 percent
5. The concentration of Fe, Mn, Zn, Cu, B in Amaranthus grown on sewage fed soils ranged form 525 to 1365 mg kg^{-1} , 101.25 to 137 mg kg^{-1} , 119.00 to 138.00 mg kg^{-1} , 118.25 to 137 mg kg^{-1} , 6.80 to 7.662 mg kg^{-1} respectively.and sewage free soil are774.75 to776.75, 27.50 to31.25, 15.75 to17.55,6.700 to6.995.respectively.
6. The concentration of Cd, Cr, Ni, As ranged from 2.25 to 3.25 mg kg^{-1} , 1.625 to 2.475 mg kg^{-1} , 123.75 to 142.75 mg kg^{-1} , 7.5 to 8.0 respectively sewage free soil are 0.60 to0.75, 65 to 760 , 72.00 to78.00,0.50 to 0.50 respectively.
7. The ascorbic acid content in Amaranthus leaf grown on sewage irrigated soils ranged from 16.2to 32.5 mg 100 g^{-1} (Table No. 2)
8. The total soluble solids of sewage irrigated Amranthus ranged from 6.2 to 12.0 percent. The total soluble solids of sewage unirrigated Amranthus ranged from 7.1 to 7.7 percent(Table No2.)
9. The reducing sugars in the Amaranthus grown in sewage water ranged from 13.50 to 19.00 percent. The reducing sugars of sewage unirrigated Amaranthus ranged from 22.25 to 23.5 percent (Table No.2)
10. Thus, it was observed that the ascorbic acid and reducing sugar was lowered in the Amaranthus grown on sewage irrigate soils Amaranthus grown on sewage free areas.
11. 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.
12. Thus, it was observed that the concentration of Fe, Mn and Cu was considerably higher in Amaranthus 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 Amaranthus 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.

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