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Impact of Distillery Spentwash Irrigation on the Yields of Top Vegetables (Creepers)

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Abstract: Cultivation of some top vegetables (Creepers) was made by irrigation with distillery spent wash of different proportions. The primary treated spent wash (PTSW), 50% and 33% spent wash were analyzed for additive plant nutrients such as nitrogen, phosphorous, potassium and other physical and chemical parameters. Experimental soil was tested for its chemical and physical parameters. The vegetables seeds (Namadhari and Mayhco) were sowed in the prepared land and irrigated with raw water (RW), 50% and 33% spent wash. It was found that the yields of all top vegetables were high in 33% spentwash than 50% spentwash and raw water irrigation.

Key words: Top vegetables · Distillery spent wash · Yields · Nutrients · Soil · Parameters

INTRODUCTION

Molasses (one of the important byproducts of sugar industry) is the chief source for the production of alcohol in distilleries by fermentation method. About 40 billion liters of waste water annually discharged in distilleries, known as raw spent wash (RSW), which is characterized by high biological oxygen demand (BOD: 5000-8000mg/l), chemical oxygen demand (COD: 25000-30000mg/l) [1], undesirable color and foul smell. Discharge of raw spent wash into open land or near by water bodies resulting in a number of environmental, water and soil pollution including threat to plant and animal lives. Hence discharge of spent wash is a serious problem. The RSW is highly acidic and contains easily oxidisable organic matter with very high BOD and COD (Patil, 1987). Also, spent wash contains highest content of organic nitrogen and nutrients [2]. By installing biomethenation plant in distilleries, reduces the oxygen demand of RSW, the resulting spent wash is called primary treated spent wash (PTSW) and primary treatment to RSW increases the nitrogen (N), potassium (K) and phosphorous (P) contents and decreases the calcium (Ca), magnesium (Mg), sodium (Na), chloride (Cl^-) and sulphate (SO_4^{2-}) (Mahamod Haron and Subhash Chandra Bose, 2004). The PTSW is rich in potassium (K), sulphur (S), nitrogen (N), phosphorous (P) as well as easily biodegradable organic matter and its application to soil has been reported to be beneficial to increase sugar cane [3], rice [4], wheat and rice yield [5], quality of groundnut [6] and physiological response of soybean [7]. Diluted spent wash could be used for irrigation purpose without adversely affecting soil fertility [8, 9], seed germination and crop productivity [10]. The diluted spent wash irrigation improved the physical and chemical properties of the soil and further increased soil micro flora [11,12,8]. Twelve pre sowing irrigations with the diluted spent wash had no adverse effect on the germination of maize but improved the growth and yield [13]. Diluted spent wash increases the growth of shoot length, leaf number per plant, leaf area and chlorophyll content of peas [14]. Increased concentration of spent wash causes decreased seed germination, seedling growth and chlorophyll content in sunflowers (Helianthus annuus) and the spent wash could safely used for irrigation purpose at lower concentration [15,10]. The spent wash contained an excess of various forms of cations and anions, which are injurious to plant growth and these constituents should be reduced to beneficial level by diluting the spent wash, which can be used as a substitute for chemical fertilizer [16]. The spent wash could be used as a complement to mineral fertilizer to sugarcane [17]. The spent wash contained N, P, K, Ca, Mg and S and thus valued as a fertilizer when

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applied to soil through irrigation with water [18]. The application of diluted spent wash increased the uptake of Zinc (Zn), Copper (Cu), Iron (Fe) and Manganese (Mn) in maize and wheat as compared to control and the highest total uptake of these were found at lower dilution levels than at higher dilution levels [19]. Mineralization of organic material as well as nutrients present in the spent wash was responsible for increased availability of plant nutrients. Diluted spent wash increase the uptake of nutrients, height, growth and yield of leaves vegetables [20, 21], nutrients of cabbage and mint leaf [22], nutrients of top vegetable [23], pulses, condiments and root vegetables [24, 25]. However, not much information is available on the impact of distillery spent wash on the yields of top vegetables. Therefore the present investigation was carried out to investigate the impact of different proportions of spent wash on the yields of some top vegetables (creepers).

MATERIALS AND METHODS

Physico-chemical parameters and amount of nitrogen (N), potassium (K), phosphorous (P) and sulphur (S) present in the primary treated spent wash 50% and 33% spent wash were analyzed by standard methods (Table 1, 2). The PTSW was used for irrigation with a dilution of 33% and 50%. Before initiation, the A composite soil sample was collected at 25 cm depth, air-dried, powdered and analyzed for physico-chemical properties (Table 3).

Top vegetables selected for the present investigation were, Bottle Gourd (Lagearia Vulgaris), Ash Gourd (Benincasa hispida), Pumpkin (Cucrbita mzxima), Snake Gourd (Trichosanthes anguina), Ridge Gourd (Luffa acutangula) and Bitter Gourd (Momordica Charavatia0).The seeds were sowed and irrigated with raw water (RW), 50% and 33% spent wash at the dosage of twice a week and rest of the period with raw water as

Table 1: Chemical composition of spent wash

Chemical parameters	PTSW	50% SW	33% SW
pH	7.65	7.73	7.75
Electrical conductivity[a]	28800	19660	10020
Total solids[b]	46140	26170	20870
Total dissolved solids[b]	35160	16060	10140
Total suspended solids[b]	10540	5680	4380
Settleable solids[b]	10070	4340	3010
COD[b]	40530	18316	10228
BOD[b]	16200	7818	4800
Carbonate[b]	Nil	Nil	Nil.
Bicarbonate[b]	13100	7400	4200
Total Phosphorous[b]	30.26	12.20	6.79
Total Potassium[b]	7200	3700	2400
Calcium[b]	940	600.0	380.0
Magnesium[b]	1652.16	884.16	542.22
Sulphur[b]	74.8	35.0	22.6
Sodium[b]	480	260	240
Chlorides[b]	5964	3272	3164
Iron[b]	9.2	6.40	5.20
Manganese[b]	1424	724	368
Zinc[b]	1.28	0.72	0.41
Copper[b]	0.276	0.134	0.074
Cadmium[b]	0.039	0.021	0.010
Lead[b]	0.16	0.09	0.06
Chromium[b]	0.066	0.032	0.014
Nickel[b]	0.165	0.084	0.040
Ammonical Nitrogen[b]	743.68	345.24	276.64

PTSW - Primary treated spent wash
SW - Spent wash; Units: a- µS; b- mg/l

Table 2: Amount of N, P, K and S (Nutrients) in Spent wash (mg/l)

Chemical parameters	PTSW	50% SW	33% SW
Ammonical Nitrogen	743.68	345.24	276.64
Total Phosphorous	30.26	12.20	6.79
Total Potassium	7200.00	3700.00	2400.00
Sulphur	74.80	35.00	22.60

PTSW - Primary treated spentwash
SW - Spentwash

Table 3: Characteristics of experimental soil

Parameters	
pH (1:2 soln)	0.61
Fine sand[a]	40.80
Slit[a]	25.28
Clay[a]	24.20
Course sand[a]	8.16
Organic carbon[a]	9.72
Electrical conductivity[b]	526.00
Available Nitrogen[c]	340.00
Available Phosphorous[c]	130.00
Available Potassium[c]	80.00
Exchangeable Calcium[c]	140.00
Exchangeable Magnesium[c]	220.00
Exchangeable Sodium[c]	90.00
Available Sulphur[c]	240.00
DTPA Iron[c]	200.00
DTPA Manganese[c]	220.00
DTPA Copper[c]	5.00
DTPA Zinc[c]	50.00

Units: a- %; b- µS; c- ppm

Table 4: Average weight of vegetables at different irrigation

	Average weight of vegetable (kg)		
Name of vegetables	RW	50% SW	33% SW
Bottle gourd [a]	3.840	4.270	5.480
Ash gourd [a]	20.840	26.420	30.850
Snake Gourd [a]	1.950	3.250	3.640
Pumpkin [a]	14.870	18.640	22.650
Ridge Gourd [a]	0.640	1.150	1.540
Bitter Gourd [b]	0.180	0.210	0.280

a- Average weight of five numbers
b- Average weight of ten numbers
RW - Raw water; SW- Spent wash

required. At the maturity time, vegetables were harvested at their respective maturity and the yields were recorded by taking the average weight (Table 4).

RESULTS AND DISCUSSION

Chemical composition of PTSW, 50% and 33% spent wash such as pH, electrical conductivity, total solids (TS), total dissolved solids (TDS), total suspended solids (TSS), settelable solids (SS), chemical oxygen demand (COD), biological oxygen demand (BOD), carbonates, bicarbonates, total phosphorous (P), total potassium (K), ammonical nitrogen (N), calcium (Ca), magnesium (Mg), sulphur (S), sodium (Na), chlorides (Cl), iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), cadmium (Cd), lead (Pb), chromium (Cr) and nickel (Ni) were analyzed and tabulated (Table 1). Amount of N, P, K and S contents are presented in Table 2.

Characteristics of experimental soils such as pH, electrical conductivity, the amount of organic carbon, available nitrogen (N), phosphorous (P), potassium (K), sulphur (S) exchangeable calcium (Ca), magnesium (Mg), sodium (Na), DTPA iron (Fe), manganese (Mn), copper (Cu) and zinc (Zn) were analyzed and tabulated (Table 3).

The yields were very high in the case of 33% spent wash irrigation for all types of vegetables and moderate in 50%, while very poor in raw water (Table 4). However, the percentage yield is maximum in the case of Ridge Gourd (140.7%) and minimum in the case of Bottle Gourd (42.8%), [Snake Gourd (86.7), Bitter Gourd (55.6%), Pumpkin (52.3%) and Ash Gourd (48.0%)]. The soil was tested after the harvest of vegetables, shows there is enrich in the plant nutrients (N.P.K) in the soil and no adverse effect on other parameters.

It was noticed that the yields of all vegetables were high in the case of 33% and moderate in 50% spent wash and low in raw water irrigation. In 33% spent wash irrigation, the plants are able to absorb maximum amounts of nutrients both from the soil and the spent wash resulting good yields. This concludes that, the spent wash can be conveniently used for the cultivation of top vegetables (Creepers) without external (either organic or inorganic) fertilizers. This minimizes the cost of cultivation and hence elevates the economy of the farmers.

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REFERENCES

1. Joshi, H.C., N. Kalra, A. Chaudhary and D.L. Deb, 1994. Environmental issues related with distillery effluent utilization in agriculture in India, Asia Pac. J. Environ. Develop., 1: 92-103.
2. Ramadurai, R. and E.J. Gearard, 1994. Distillery effluent and downstream products, SISSTA, Sugar J., 20: 129-131.
3. Zalawadia, N.M., S. Raman and R.G. Patil, 1997. Influence of diluted spent wash of sugar Industries application on yield and nutrient uptake by sugarcane and changes in soil Properties. J. Indian Soc. Soil. Sci., 45: 767-769.
4. Deverajan, L. and G. Oblisami, 1995. Effect of distillery effluent on soil fertility status, yield and quality of rice. Madras Agri. J., 82. 664-665.
5. Pathak, H., H.C. Joshi, A. Chaudhary, R. Chaudhary, N. Kalra and M.K. Dwivedi, 1998. Distillery effluent as soil amendment for wheat and rice. J. Indian Soc. Soil Sci., 46: 155-157.
6. Amar B.S., K.B. Ashish and Sivakoti Ramana, 2003. Effect of distillery effluent on Plant and Soil enzymatic activities and ground nut quality. J. Plant Nutri. Soil Sci., 166: 345-347.
7. Ramana, S., A.K. Biswas, S. Kundu, J.K. Saha and R.B.R. Yadava, 2000. Physiological response of Soybean (Glycine max L.) to foliar application of distillery effluent. Ann. Plant Soil Res., 2: 1-6.
8. Kuntal, M.H., A.K. Biswas, K. Bandypadhyay and K. Misra, 2004. Effect of Post-methanation effluent on soil physical properties under a soybean-wheat system in a vertisol. J. Plant Nutri. Soil Sci., 167, 5: 584-590.
9. Raverkar, K.P., S. Ramana, A.B. Singh, A.K. Biswas and S. Kundu, 2000. Impact of post Methanated spent wash (PMS) on the nursery raising, biological parameters of Glyricidia sepum and biological activity of soil. Ann. Plant Res., 2(2): 161-168.
10. Ramana, S., A.K. Biswas, S. Kundu, J.K. Saha, R.B.R. Yadava, 2001. Effect of distillery Effluent on seed germination in some vegetable crops. Bio-resource Technol., 82, 3: 273-275.
11. Devarajan, L., G. Rajanan, G. Ramanathan and G. Oblisami, 1994. Performance of field crops under distillery effluent irrigations, Kisan world, 21: 48-50.
12. Kaushik, K., R. Nisha, K. Jagjeeta, C.P. Kaushik, 2005. Impact of long and short term irrigation of a sodic soil with distillery effluent in combination with bio-amendments. Bioresource Technol., 96, 17: 1860-1866.

13. Singh, Y. and Raj Bahadur, 1998. Effect of application of distillery effluent on maize crop and soil properties. Indian. J. Agri. Sci., 68: 70-74.
14. Rani, R. and M.M. Sri Vastava, 1990. Eco-physiological response of Pisum sativum and citrus Maxima to distillery effluents. Intl. J. Eco. Environ. Sci., 16-23.
15. Rajendran, K., 1990. Effect of distillery effluent on the seed germination, seedling growth, Chlorophyll content and mitosis in Helianthus Annuus-Indian Botanical Contactor, 7: 139-144.
16. Sahai, R., S. Jabeen and P.K. Saxena, 1983. Effect of distillery waste on seed germination, Seedling growth and pigment content of rice. Indian J. Eco., 10: 7-10.
17. Chares, S., 1985. Vinasse in the fertilization of sugarcane. Sugarcane, 1: 20.
18. Samuel, G., 1986. The use of alcohol distillery waste as a fertilizer, Proceedings of International American Sugarcane Seminar, pp: 245-252.
19. Pujar, S.S., 1995. Effect of distillery effluent irrigation on growth, yield and quality of crops. M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad.
20. Chandraju, S. and H.C. Basavaraju, 2007. Impact of distillery spent wash on seed germination and growth of leaves Vegetables: An investigation. Sugar J., (SISSTA), 38: 20-50.
21. Chandraju, S.,H.C. Basavaraju and C.S. Chidankumar, 2008. Investigation of impact of Irrigation of distillery spent wash on the growth, yield and nutrients of leafy vegetable. Chem. Env. Res., 17. (1and2):(In press).
22. Chandraju, S., H.C. Basavaraju andC.S. Chidankumar, 2008. Investigation of impact of Irrigation of distillery spent wash on the nutrients of cabbage and mint leaf. Indian Sugar, 39: 19-28.
23. Basavaraju, H.C. and S. Chandraju, 2008. Impact of distillery spent wash on the nutrients of Leaves vegetables: An Investigation. Asian J. Chem., 20(7): 5301-5310.
24. Basavaraju, H.C. and S. Chandraju, 2008. An Investigation of Impact of distillery spent wash On the nutrients of Top Vegetables. Int. J. Agri. Sci. 4(2): 691-696.
24. Chandraju, S.,H.C. Basavaraju and C.S. Chidankumar, 2008. Investigation of impact of Irrigation of distillery spent wash on the nutrients of pulses. Asian J. Chem., 20(8): 6342- 6348.
25. Chandraju, S.,H.C. Basavaraju and C.S. Chidankumar, C.S., 2008. Investigation of impact of Irrigation of distillery spent wash on the nutrients of some condiments and Root Vegetables. Chem. Env. Res., (Communica).