Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; SP2: 277-279

SD Zodge
Department of Soil Science and Agril. Chemistry, Collage of Agriculture Dr. B.S.K.K.V Dapoli, Ratnagiri, Maharashtra, India

SB Dodake
Department of Soil Science and Agril. Chemistry, Collage of Agriculture Dr. B.S.K.K.V Dapoli, Ratnagiri, Maharashtra, India

UY Puranik
Department of Soil Science and Agril. Chemistry, Collage of Agriculture Dr. B.S.K.K.V Dapoli, Ratnagiri, Maharashtra, India

PB Sanap
Department of Soil Science and Agril. Chemistry, Collage of Agriculture Dr. B.S.K.K.V Dapoli, Ratnagiri, Maharashtra, India

MK Dev
Department of Soil Science and Agril. Chemistry, Collage of Agriculture Dr. B.S.K.K.V Dapoli, Ratnagiri, Maharashtra, India

SM Bhoyar
Department of Soil Science and Agril. Chemistry, Dr. PDKV, Akola, Maharashtra, India

PR Kadu
Department of Soil Science and Agril. Chemistry, Dr. PDKV, Akola, Maharashtra, India

PN Patle
Department of Soil Science and Agril. Chemistry, Dr. PDKV, Akola, Maharashtra, India

Correspondence
SD Zodge
Department of Soil Science and Agril. Chemistry, Collage of Agriculture Dr. B.S.K.K.V Dapoli, Ratnagiri, Maharashtra, India

Effect on microbial count and micronutrients in soil by application of factory effluent in lateritic soil of Konkan

SD Zodge, SB Dodake, UY Puranik, PB Sanap, MK Dev, SM Bhoyar, PR Kadu and PN Patle

Abstract
A field experiment was conducted an “effect on microbial population and DTPA extractable micronutrient in soil by application of factory effluent in lateritic soil of Konkan” with Randomized Block Design having nine treatments and three replication at Central Experiment Station, Pangari Block, Wakawali, Dr. B. S. K. K. V., Dapoli, Dist. Ratnagiri during *Rabi* 2013-14. Effluent (composite sample of digester over flow) from the Saf Yeast company private limited, Gane- Khadpoli, Chiplun District-Ratnagiri was collected and applied to the field. According to the irrigation requirement of spinach, effluent was applied before sowing and after first cutting @ 600 liter/treatment with NPK dose @ 100, 50 and 25per cent with and without fertilizers.

Application of effluent at different times with inorganic fertilizers in spinach crop having three numbers of cutting significantly increased microbial population and micronutrients like Fe, Mn, Zn and Cu in soil as compare to only RDF fertilizers. The highest Fe content in soil was observed in treatment T_3 at 1^{st} cutting where (application of effluent with 100 % RDF) was applied, treatment T_7 at 2^{nd} and 3^{rd} cutting where (application of effluent before sowing and after first cutting + 100 % RDF) was applied. Mn content in soil was observed in T_7 at 1^{st} and 2^{nd} cutting, while treatment T_6 at 3^{rd} cutting where (application of effluent before sowing and after 1^{st} cutting) was applied. The highest Zn contain in soil was observed in treatment T_9 from 1^{st} to 3^{rd} cuttings where (application of effluent before sowing and after 1^{st} cutting + 25% RDF) was applied. Whereas highest Cu in soil was found in treatment T_9 at 1^{st} cutting, treatment T_3 at 2^{nd} cutting and treatment T_5 at 3^{rd} cutting where (application of effluent before sowing + 25% RDF) was applied.

Keywords: Microbial population, micronutrients, factory effluent, Konkan

Introduction
In recent years considerable attention has been paid to industrial waste which are usually discharge on land or into sources of water, It’s anticipated that the industrial activities will accelerate with the pace of development. This would have adverse impact on agriculture rind would cause environmental degradation. On the other hand, a huge amount rind would cause environmental degradation. Have adverse impact on the other hand, huge amount of factory effluent like sugarcane industries vide a solution to the disposal problems. From the crop production point of view a healthy soil may be defined as one that produces good crop’s suitable for human and animal consumption and has the ability to recuperate to sustain production. Therefore on the point of nutrient supplying capacity of soil factory effluent is cheap and easy way as compare to use costly fertilizer at some extent. Also microbial activity required for available nutrient is also affected due to factory effluent of sugar factory which is also known as molasses.

Material and Methods
The field experiment was laid out in randomized block design with nine treatments and three replications of Spinach crop, verity All green during 2013-14 at Central Experiment Station, Pangari Block, Wakawali, Dr. B. S. K. K. V., Dapoli, Dist. Ratnagiri. After preparation of the layout, treatment wise effluent was applied to the experimental plots. The treatments were T_1 RDF (100:50:50 kg ha^{-1}), T_2 Application of effluent before sowing, T_3 (T_2 + 100% RDF), T_4 - (T_2 + 50% RDF), T_5 (T_2 + 25% RDF), T_6 (Application of effluent before sowing and after 1^{st} cutting), T_7 (T_6 + 100% RDF), T_8 (T_6 + 50% RDF), T_9 (T_6 + 25% RDF).

The quantity of the effluent per plot was calculated by considering the irrigation water requirement of the crop. The 600 liters of irrigation effluent was applied to each plot as per the treatment before sowing.

After 5 days, the soil of the treated plots was thoroughly mixed by cultivator to facilitate aeration and oxidation. Again after first cutting of crop nearly about 35 days 2nd application of effluent 600 liter per plot was done as per the treatments. For determination of DTPA extractable Zn, Cu, Fe and Mn 0.005 M DTPA (Diethylene triamine penta acetic acid), 0.01 M $CaCl_2$ and 0.1 M TEA (Tri Ethanol Amine) buffered at pH 7.3 (Lindsay and Norwell 1978) [12]. The concentration of these nutrients was read in atomic absorption spectrophotometer. Whereas, soil biological properties of bacteria, fungi and actinomycetes, serial dilutions were prepared and 10^6 dilutions were taken for inoculation. For bacterial count nutrient agar medium, for fungi, potato dextrose agar medium and for actinomycetes ken knight's medium was used (Pramer and Schmidt 1964 and Subba Rao 1988) [14, 13].

Result and Discussion

Microbial population in soil

Application of effluent and inorganic fertilizers significantly affect the microbial population of bacteria in soil (Table 1), which varied from 9.90 to 23.29 × 10^6 cfu g^{-1} at 1st cutting, 7.45 to 28.42 × 10^6 cfu g^{-1} at 2nd cutting and 6.78 to 26.26 × 10^6 cfu g^{-1} at 3rd cutting, respectively. Similarly fungi in soil was varied from 1.58 to 7.06 × 10^6 cfu g^{-1} at 1st cutting, 1.40 to 7.18 × 10^6 cfu g^{-1} at 2nd cutting and 1.14 to 6.51 × 10^6 cfu g^{-1} at 3rd cutting, respectively. Whereas in case of actinomcetes was varied from 2.15 to 6.25 × 10^6 cfu g^{-1} at 1st cutting, 1.36 to 6.65 ×10^6 cfu g^{-1} at 2nd cutting and 1.16 to 5.15 × 10^6 cfu g^{-1} at 3rd cutting, which was decreased as time interval from 1st to 3rd cutting.

A field experiment was conducted to study the effect of different levels and method of biomethanted spentwash by (Selvamurugan *et al.* 2011) [1]. They found that by using distillery spentwash and pressmud boicompost on soil microbial bacteria was mostly appeared to have increased at initial stages and thereafter, progressively decreased with crop growth stages. The degradation of organic matter and depletion of plant nutrients might be the reason for the reduction of microbial population.

DTPA extractable micronutrients (Fe, Mn, Zn and Cu) in soil

Iron (mg kg^{-1})

DTPA extractable Fe content of soil as influenced by application of effluent and inorganic fertilizers at different times in acid lateritic soil ranged from 39.17 to 53.90 mg kg^{-1}, 47.67 to 59.25 mg kg^{-1} and 44.54 to 61.33 mg kg^{-1} at 1st, 2nd and 3rd cutting of spinach, respectively (Table 2). From the data it was observed that with application of effluent before sowing and after first cutting, there was increase in Fe content in soil from 1st to 2nd cutting, which was further decreased from the treatment T_1 to T_5 and increased from the treatment T_6 to T_9 at 3rd cutting. Regarding high availability of Fe in acid lateritic soils, Katyal *et al.* (1982) [2] cleared that the high content of available Fe may be due to accumulation of sesquioxides and also higher organic matter content, which keeps iron in complexes and available form. In addition to this, Tisdale *et al*. (1995) [11] explained that when a strong acid anion (NO_3^-) is absorbed and replaced with a weak acid (HCO_3^-), the pH of root zone increases Fe availability.

Manganese (mg kg^{-1})

The variations in Mn observed from 118.08 to 260.59, 133.23 to 464.80 and 130.02 to 341.81 mg kg^{-1} at 1st, 2nd and 3rd cuttings of spinach, respectively (Table 2). The application of effluent before sowing and after first cutting, there was increase Mn in soil. These results are in agreement with those reported by Devrajan and Oblisami (1995b) [3] and Baskar *et al*. (2003) [4, 10]. Increased availability of Mn might be due to direct contribution from the effluent as well as solubilisation and chelation effect of organic matter supplied by the effluent (Baskar *et al*. 2003) [4, 10]. An experiment was conducted by Jena *et al.* (2010) [5] regarding high availability of Mn in acid lateritic soils, Mehta and Patel (1967) [6] stated that the high concentration of available Mn might be due to warm and humid climate of the region.

Zinc (mg kg^{-1})

The DTPA extractable Zn at various cuttings stages ranged from 0.62 to 0.93 mg kg^{-1} at 1st cutting, 0.21 to 1.70 mg kg^{-1} at 2nd cutting, while 0.37 to 1.93 mg kg^{-1} at 3rd cutting, respectively (Table 2). A perusal of data indicated that there was decreased the content of Zn in soil at 2nd cutting in case of T_1 to T_5, but it was increased in treatment from T_6 to T_9 it may be due to 2nd time application of effluent after first cutting whereas it was increased in all treatment at 3rd cutting. Baskar *et al*. (2001) [7] stated that increased availability of Zn might be due to direct contribution from the effluent as well as solubilization and chelation effect of organic matter supplied by the effluent. Patil (2012) [8] found that there was increase in Zn content due to application of distillery effluent in different doses in lateritic soils of Konkan.

Copper (mg kg^{-1})

The data representing that to Cu content in (Table 2) as a whole revealed that there were significant changes in Cu values from 1st to 3rd cutting ranged from 5.08 to 6.38 mg kg^{-1}, 5.01 to 6.04 mg kg^{-1} and 5.13 to 6.19 mg kg^{-1} at 1st, 2nd and 3rd cutting, respectively. It is obvious that as the application of effluent increased the Cu content of soil. The data indicated that Cu content of soil decreased at 2nd cutting as compared to 1st cutting. Bose *et al*. (2002) [9] also reported an increase in Cu due to application of effluent on soils with neutral pH (7.08) with sugarcane crop. Baskar *et al.* (2003) [4, 10] have explained that increased Cu availability might be due to direct contribution from the effluent as well as solubilization and chelation effect of organic matter supplied by the effluent.

Table 1: Effect of factory effluent and inorganic fertilizers on microbial population of soil

Tr. No.	Treatments	Bacteria (× 10^6 cfu g^{-1})			Fungi (× 10^6 cfu g^{-1})			Actinomycetes (× 10^6 cfu g^{-1})		
		1st cutting	2nd cutting	3rd cutting	1st cutting	2nd cutting	3rd cutting	1st cutting	2nd cutting	3rd cutting
T_1	RDF (100:50:50 kg ha^{-1})	9.90	7.45	6.78	1.58	1.40	1.14	2.15	1.36	1.16
T_2	Application of effluent before sowing	14.27	12.42	9.33	3.87	2.92	3.17	4.27	2.90	1.73
T_3	T_2 + 100% RDF	23.05	21.39	15.91	7.06	5.46	4.31	5.49	4.08	2.53
T_4	T_2 + 50% RDF	20.26	20.20	11.54	6.56	4.33	2.70	5.95	3.45	3.87
T_5	T_2 + 25% RDF	19.84	19.56	14.97	4.60	3.00	2.62	5.21	3.19	2.23

T_6	Application of effluent before sowing and after 1st cutting	15.50	17.25	26.26	5.15	5.89	4.95	4.30	5.23	3.79
T_7	T_6 + 100% RDF	23.29	28.42	22.64	6.17	7.18	6.51	6.16	6.53	4.93
T_8	T_6 + 50% RDF	22.67	22.92	20.64	5.99	6.24	4.97	6.25	6.65	3.05
T_9	T_6 + 25% RDF	16.17	19.24	16.45	4.49	4.58	3.35	5.26	5.33	5.15
S.E.±		0.65	1.29	0.73	0.50	0.29	0.56	0.25	0.30	0.53
C.D. (P=0.05)		1.96	3.87	2.18	1.50	0.88	1.68	0.65	0.91	1.60

Table 2: Effect of factory effluent and inorganic fertilizers on Fe and Mn micronutrient in soil at various cuttings of spinach

Tr. No.	Treatments	Fe			Mn			Zn			Cu		
		1st cutting	2nd cutting	3rd cutting	1st cutting	2nd cutting	3rd cutting	1st cutting	2nd cutting	3rd cutting	1st cutting	2nd cutting	3rd cutting
T_1	RDF (100:50:50 kg ha^{-1})	39.17	47.67	44.54	118.08	133.23	130.02	0.62	0.21	0.37	5.08	5.01	5.13
T_2	Application of effluent before sowing	45.29	52.47	46.83	249.49	294.49	222.80	0.85	0.63	0.79	5.36	5.30	6.04
T_3	T_2 + 100% RDF	53.90	55.64	45.97	251.92	301.01	235.68	0.78	0.56	0.81	6.06	6.04	6.16
T_4	T_2 + 50% RDF	46.35	49.49	45.23	248.80	286.83	255.52	0.91	0.66	0.88	6.22	5.89	6.08
T_5	T_2 + 25% RDF	45.92	54.08	46.88	227.84	294.72	254.99	0.88	0.52	0.83	6.06	5.97	6.19
T_6	Application of effluent before sowing and after 1st cutting	47.25	54.91	58.77	260.05	423.36	341.81	0.85	1.67	1.90	5.93	5.17	5.40
sT_7	T_6 + 100% RDF	53.76	59.25	61.33	260.59	464.80	330.13	0.91	1.53	1.78	6.26	4.91	5.30
T_8	T_6 + 50% RDF	49.28	50.77	59.45	241.76	438.51	250.13	0.89	1.66	1.70	6.18	5.12	5.56
T_9	T_6 + 25% RDF	51.68	55.52	55.59	255.79	452.75	299.73	0.93	1.70	1.93	6.38	5.28	5.98
S.E.±		2.74	2.05	1.81	14.808	13.001	22.686	0.04	0.18	0.04	0.27	0.20	0.19
C.D. (P=0.05)		8.21	6.15	6.06	44.394	38.977	68.012	0.11	0.55	0.13	0.81	0.58	0.57

Conclusion

The application of effluent with inorganic fertilizers resulted in a significant increase in micronutrients content and microbial population in the soils which was very necessary for availability of nutrients for crop production and build-up of soil fertility.

References

1. Selvamurugan M, Doraisamy P, Maheswari M. Effect of biomethanated distillery spentwash and pressed mud bio compost on microbial and enzyme dynamics in sugarcane grown soil. J of Biological Sciences. 2011; 11(6):471-422.
2. Katyal JC, Sharma BD, Mehta SK. 14th annual report of the ICAR's all India coordinated scheme of micronutrients in soils and plants for the year 1980-81, 1982, 63.
3. Devrajan L, Oblisami G. Effect of distillery effluent on soil fertility status yield and quality of Rice. Madras. Agric. J. 1995b; 82(12):664-665.
4. Baskar M, Kayalvizhi C, Subash Chandra BM. Eco-friendly utilization of distillery effluent in agriculture. - A review. Agric. Rev. 2003; 24(1):16-30.
5. Jena D, Dash AK, Yerra R, Mohanty B, Jena B, Mukhi SK. Effect of continues use of sewage water on soil properties and plants. An Asian Journal of soil Science. 2010; 4(2):158-164.
6. Mehta BV, Patel NK. Forms of manganese and their distribution in soil profiles of Kaira district in Gujrat. Journal of the Indian Society of Soil Science. 1967; 35:322-324.
7. Baskar M, Kayalvizhi C, Subash Chandra, Bose M. In Proceeding of National Seminar on use of poor quality water and sugar industrial effluents in agriculture. Feb 5th 2001. AC and RI, Trichy, 2001, 76.
8. Patil PV. Effect of factory effluent (Saf yeast) on growth, yield, nutrient uptake by rice and changes in soil properties. M.Sc. (Ag.) Thesis submitted to Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, 2012.
9. Bose SM, Gopal H, Baskar M, Kayalvizhi C, Sivanandham M. Utilization of distillery effluent in cost sandy soil to improve soil fertility and yield of sugarcane. Symposium no. 30, 17th World Congress of Soil Science, 14-21th August 2002, Thailand. 2002, 980-1988.
10. Baskar M, Kayalvizhi C, Subash Chandra BM. Eco-friendly utilization of distillery effluent in agriculture. - A review. Agric. Rev. 2003; 24(1):16-30.
11. Tisdale L, Samuel, Werner Nelson L, James Beaton D, John L. Havlin. Soil fertility and fertilizers published by Prentice, Hall of India Private Limited, New Delhi. 1995, 316, 321, 325, 335, 336.
12. Lindsay WL, Norvell WL. Development of DTPA soil test for zinc, iron, manganese and copper. Processing Soil Science Society America. 1978; 42(3):421-428.
13. Subba Rao NS. Soil microorganisms and plant growth. Oxford and IBH Pub. Co., New Delhi, 1988
14. Pramer D, Schmidit EL. Experrimental soil microbiology. Burgess publishing company, Minnesota, 1964, 35.