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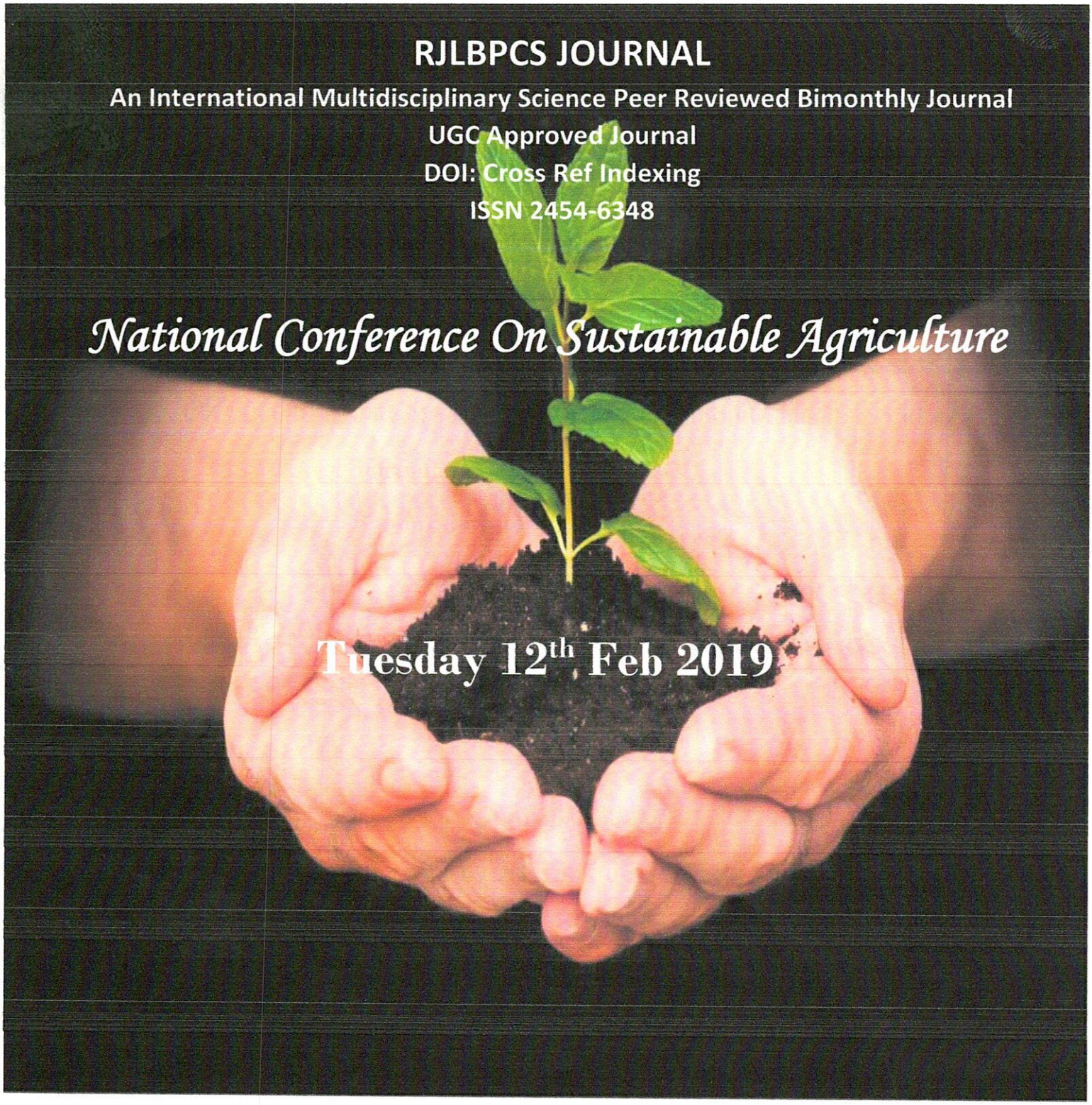

National Conference On Sustainable Agriculture

Tuesday 12th Feb 2019

DR. PANDITRAO DATTATRAYA SHIRAGAVE Ph.D
CONVENER,
CO-ORDINATOR, DEPARTMENT OF AGROCHEMICALS AND PEST MANAGEMNET(AGPM), DEVCHAND COLLEGE, ARJUNNAGAR
TAL – KAGAL, DIST – KOLHAPUR, PIN. 591 237, MAHARASHTRA, INDIA.

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INDEX

ENRICHMEMENT OF NUTRIENT AVAILABILITY IN SOIL BY THE APPLICATIONOF DISTILLERY SPENT WASH AND IT'S IMPACT ON THE GROWTH OF THE PLANTS

Dr. Pore Sanjay Vishnu

Department of Chemistry

, Bharati Vidyapeeth's Matoshri Bayabai Shripatrao Kadam Kanya Mahavidyalaya Kadegaon,

Email-poresanjay67@gmail.com.Mob-9881442429

ABSTRACTS

A Comparative field study of impact of distillery spentwash on the fertility of Soil as well as the growth of the plant under cultivation is done. The primary treated distillery spent wash and 33% distillery spent wash were analyzed for their physical and chemical parameters. The experimental fields of untreated and treated soil called plot 1 and plot 2 respectively were tested for their Physico-Chemical parameters. The seeds of the selected plants were sowed in the prepared land dimension of 4'x 4' blocks in both plots. Seeds were irrigated with raw water and various % of spentwash. The nature of the growth of plants were studied and compared. Among the irrigation with various % of spent wash and raw water in both untreated and treated soil, it concluded that the growth of the plants are highly potential and yield is more in the case of 33% spentwash as compared to raw water. Also in treated soil (Plot 2) growth and yield are much greater than the untreated soil (plot 1). It concludes that, the spentwash treated soil (plot 2) is enriched with the plant nutrients. It further concludes that, the subsequent use of sentwash for irrigation enriches the soil fertility and hence, the diluted distillery spentwash (33%) can be conveniently used for the cultivation of the plants.

KEYWORDS: Distillary, spentwash, untreated soil, treated soil, germination, sugar industry

1.INTRODUCTION

A wide variety of pollutants have been reported to cause deterioration of properties of water, due to rapidly increasing pollution,urbanization, industrialization and new technological developments[25] Molasses is the dark brown colored viscous liquid left over as a residue after the crystallization of cane sugar in sugar industry. It is one of the important byproducts of sugar industry which is the chief raw material for the production of alcohol in distilleries. Every distillery produce about 40 billion liters of wastewater known as raw spent wash, which is characterized by high biological oxygen demand (BOD: 5000-8000 mg/I) and chemical oxygen demand (COD: 25000-30000 mg/I[11]

Distillary industry has been playing an important role in our economy but its effluent are quite unstable and creating a serious problems of water pollution and sanitation in respect to health and hygiene and growth and productivity of vegetation[26].In most of the distilleries it is discharged into open land or nearby water bodies results number of environmental hazards including threat to plant and animal lives. The raw spentwash is highly acidic and containing easily oxidisable organic

matter[15]. It contains highest percent of nitrogen and plant nutrients[18]. By adopting biomethenation plant in distilleries, reduces the oxygen demand of raw spentwash called primary treated spentwash which is rich in nitrogen, potassium, and phosphorous and deficient in calcium, magenesium, sodium, chloride and sulphate .It also contains easily biodegradable organic matter and its application to soil has been reported to be beneficial to increase the yield of sugar cane, rice[10], Wheat[14], groundnut[1], and physiological response of soyabean[20]. Diluted spent wash increases the growth of shoot length, leaf number per plant, leaf area and chlorophyll content of Peas[21].

The spentwash consists excess of various forms of cations and anions, which are harmful to plant growth. The concentration of these constituents should be reduced to beneficial level by diluting the spenstwash, which can be used as a substitute for chemical fertilizer[23] The spentwash could be used as a complement to mineral fertilizer to sugarcane and thus valued as fertilizer when applied to soil through irrigation water. Higher percentage of spentwash irrigation causes decrease in seed germination, seediling growth and chlorophyll content in sunflowers and the spentwash could be safely used for irrigation purpose at lower concentration[17,19] without adversely affecting soil fertility and crop productivity[12,13,22]. Twelve pre sowing irrigations with the diluted spentwash had no adverse effect on the germination of maize but improved the growth and yield[24]. The diluted spentwash irrigation improved the physical and chemical properties of the soil and further increased soil microflora[9,12,13]. Application of diluted spentwash increased the uptake of Zinc, Copper, Iron and Manganese in maize and wheat, the highest total uptake of these were found at lower dilution than at higher dilution levels[16]. The diluted spentwash increase the uptake of nutrients, height, growth and yield of leafy vegetables[4,5,6]. Nutrients of pulses[7], condimaents and root vegetables[5,6,7,8], top vegetables[2,3], cabbage and mint[5,6,7,8]. Therefore the present investigation was carried out to investigate the impact of various % of Spentwash on the growth and yield of different kinds of leafy vegetables in untreated and treated soils.

2.MATERIALS AND METHODS

The distillery spent wash used in the present investigation was collected from Sonhira Co-Operative Sugar factory. Ltd. Wangi.Dist. Sangli.(M.S.) India. Physico-Chemical parameters and amount of nitrogen, potassium, phosphorous and sulphur present in the primary treated distillery spentwash (PTSW) and 33% spentwash were analyzed by standard methods (Table 1). The primary treated spentwash was used for irrigation with a dilution of 33% in the plot 1 (untreated soil) and plot.2(treatedsoil). The experiments were conducted at the field of distillery at Sonhira Co-Operative Sugar factory. Ltd. Wangi.Dist. Sangli.(M.S.) India.

Table 1: Chemical Composition of distillery spentwash

Sr.	Chemcial Parameters	Units	PTSW	33% DSW		Chemical Parameters	Units	PTSW	33% DSW
1	P^H	--	7.37	7.23	14	Magnesium	Mg/l	1642.16	532.22
2	Electrical Conductivity	µS	28799	10019	15	Sulphur	Mg/l	74.6	22.7
3	Total Solids	Mg/l	46139	20870	16	Sodium	Mg/l	480	240
4	Total dissolved solids	Mg/l	35160	10140	17	Chlorides	Mg/l	5963	3164
5	Total Supended solids	Mg/l	10540	4380	18	Iron	Mg/l	9.2	5.20
6	Settleable solids	Mg/l	10069	3010	19	Manganese	Mg/l	1424	368
7	COD	Mg/l	40529	10224	20	Zinc	Mg/l	1.27	0.41
8	BOD	Mg/l	16199	4799	21	Copper	Mg/l	0.276	0.074
9	Carbonate	Mg/l	Nil	Nil	22	Cadmium	Mg/l	0.039	0.010
10	Bicarbonate	Mg/l	13099	4197	23	Lead	Mg/l	0.16	0.06
11	Total phosphorous	Mg/l	30.27	6.78	24	Chromium	Mg/l	0.067	0.014
12	Total Potassium	Mg/l	7199	2398	25	Nickel	Mg/l	0.165	0.040
13	Calcium	Mg/l	9439	379.0	26	Ammonical nitrogen	Mg/l	742.68	275.63

PTSW – Primary treated distillery Spentwash, 33% SW – 33% distillery spentwash

Table 2: Characteristics of experimental Soils: Plot-1 : Untreated soil, Plot -2: Treated soil

Sr.	Parameters	Units	Plot-1	Plot-2	Sr.	Parameters	Unit	Plot-1	Plot-2
1	Coarse sand	%	9.72	10.94	10	Available potassium	Ppm	80	65
2	Fine sand	%	40.80	42.86	11	Exchangeable calcium	ppm	140	150
3	Slit	%	25.28	26.32	12	Exchangeable Magnesium	Ppm	220	190
4	Clay	%	24.2	19.88	13	Exchangeable Sodium	Ppm	90	180
5	PH (1:2 Soln)	%	8.16	8.15	14	Available sulphur	Ppm	240	230
6	Eleetrical	µS	526	451	15	DTPA Iron	Ppm	200	240

	Conductivity								
7	Organic Carbon	%	0.61	0.93	16	DTPA Manganese	Ppm	220	260
8	Available nitrogen	Ppm	340	460	17	DTPA Copper	Ppm	5	8
9	Available Phosphorous	Ppm	130	180	18	DTPA Zinc	ppm	50	65

Before initiation Plot.2 soil was treated with 33% spentwash for four times at an intervals of one week, each time land was ploughed and exposed to sunlight. A composite soil samples from both plots were collected from the experimental site at 25 cm depth, air-dried, powdered and analyzed for physico-chemical properties by standard methods (Table 2). The leafy vegetables selected were amaranth (Amaranthus gangeticus), Coriander leaves (Coriandum Sativum), Fenugreek (Trigonella Foenum graceum), Shepu (Peucedanum graveloens) and Spinach (Spinacia oleracea). The seeds were sowed in the prepared fields and irrigated with raw water and 33% spentwash at the dosage of twice a week and rest of the period with raw water. The natures of the growth of all plants were recorded at 8^{th}, 18^{th} 25^{th} days from plantation and also at the time of harvest.

3.RESULTS AND DISCUSSION

Irrigation was done as per the requirement with raw water and 33% spentwash for all varieties in different blocks. In previous invstigations, it was found that germination of seeds and growth were not favorable with 50% spentwash irrigation and that could be due to higher concentration of spentwash. In the case of amaranth (Amaranthus gangeticus) and shepu (Peucedanu gangeticus) noticed that seeds germination was unaffected in 33% spentwash and raw water irrigation (100% germination). But the growth was very good in 33% spentwash and poor in the case of raw water in both plots. However, the growth of plants was highly potential (dark greenish) in plot 2 as compared to plot l with raw water and 33% spentwash irrigation. This indicates that the presence of nutrients (Nitrogen, Phosphorous and Potassium) in 33% spentwash favoured the potential growth of plants. The growth rate i.e. thickness of the stem, height of the plants at 8^{th}. 18^{th}, 25^{th} days, at the time of harvest and yield were recorded (Table 3 and 4). The thickness of stem and height of the plants increased at different intervals of time in plot 2 as compared to plot 1. It was observed that the potential growth of plants (stem thickness, height and yield are in the order 33% spentwash (plot 2) > 33% spentwash (Plot 1) > raw water (plot 2) > raw water (plot 1).

Table 3: Thieckness of stem height and weight of amaranth (Amaranth gangeticus)

Untreated soil Plot.1

Treated soil Plot.2

	Thickness of Stem (in mm)		Height of The plant(in cm)		Thicknessof stem(in mm)		Height of the plant (in cm)	
Observations	RW	33% SW	RW	33% SW	RW	33% SW	RW	33% SW
8th day from plantation	1.2	2.0	1.9	3.0	1.28	2.4	2.0	3.3
18th day from plantation	2.4	3.62	22.0	30.0	2.8	3.84	26.0	32.0
25th day from plantation	3.1	4.24	28.0	37.0	3.4	4.64	36.0	42.0
At the time of harvesting	4.10	5.62	34.0	42.0	4.6	5.82	41.0	58.0
Weight of plants with root (bundle of 50 nos)	145 g	360 g	-	-	350 g	410 g	-	-
Weight of edible portion of plants (bundle of 50 nos)	75 g	180 g	-	-	170 g	210 g	-	-

Table 4: Thieckness of stem height and weight of shepu (Peucedanum graveolens)

Untreated soil Plot.1

Treated soil Plot.2

	Thickness of stem		Height of the plant (in cm)		Thickness of stem (in mm)		Height of the plant (in cm)	
Observations	RW	33% SW	RW	33% SW	RW	33% SW	RW	33% SW
8th day from plantation	0.6	1.24	1.5	2.2	0.7	1.52	2.15	3.4
18th day from plantation	1.5	3.02	10.0	19.5	1.8	3.24	19.0	23.45
25th day from plantation	2.0	3.82	16.0	30.0	2.4	3.92	28.0	35.0
At the time of harvesting	2.72	3.92	23.0	37.8	2.8	4.23	37.0	44.0
Weight of plants with root (bundle of 50 nos	50 g	170 g	-	-	160 g	240 g	-	-
Weight of edible portion of plants (bundle of 50 nos)	35 g	140 g	-	-	130 g	210 g	-	-

Table 5: Thickness of stem height and weight of coriander leaves (Coriandum Sativum)

Untreated soil Plot.1

Treated soil Plot.2

	Thickness of	Height of the	Thickness of	Height of the

	stem (in mm)		plant (in cm		stem (in mm)		plant (in cm)	
Observations	RW	33% SW	RW	33% SW	RW	33% SW	RW	33% SW
8th day from plantation	0.01	0.03	2.0	3.0	0.01	0.03	2.5	3.7
18th day from plantation	0.03	0.08	8.0	10.0	0.04	0.09	9.85	13.2
25th day from plantation	0.04	0.09	11.0	19.0	0.05	0.10	18.0	24.0
At the time of harvesting	0.06	0.12	13.0	25.0	0.07	0.14	24.5	35.0
Weight of plants with root (bundle of 50 nos	45 g	150 g	-	-	135 g	180 g	-	-
Weight of edible portion of plants (bundle of 50 nos)	40 g	110 g	-	-	100 g	140 g	-	-

RW – Raw water 33% distillery spentwash

Table 6: Thieckness of stem height and weight of fenugreek (Trigonella foenum graceum)

Untreated soil Plot.1

Treated soil Plot.2

	Thickness of stem (in mm)		Height of the plant (in cm		Thickness of stem (in mm)		Height of the plant (in cm)	
Observations	RW	33% SW	RW	33% SW	RW	33% SW	RW	33% SW
8th day from plantation	0.2	0.35	2.5	5.0	0.26	0.45	3.0	5.4
18th day from plantation	0.7	1.0	20.0	29.0	0.82	1.26	24.0	31.0
25th day from plantation	1.0	1.2	26.0	37.0	1.08	1.59	35.0	40.0
At the time of harvesting	1.28	1.65	31.0	41.5	1.32	1.72	40.0	49.0
Weight of plants with root (bundle of 50 nos)	80 g	125 g	-	-	110 g	240 g	-	-
Weight of edible portion of plants (bundle of 50 nos)	45 g	85 g	-	-	70 g	120 g	-	-

Table 6: Thieckness of stem height and weight of spinach (Spinacia oleracea)

Untreated soil Plot.1

Treated soil Plot.2

	Thickness of stem (in mm)		Height of the plant (in cm		Thickness of stem (in mm)		Height of the plant (in cm)	
Observations	RW	33% SW	RW	33% SW	RW	33% SW	RW	33% SW
8th day from plantation	0.08	0.14	4.0	6.3	0.09	0.16	4.6	6.6

18th day from plantation	0.31	0.39	14.0	17.0	0.36	0.42	16.0	19.0
25th day from plantation	0.52	0.60	23.0	27.0	0.58	0.66	24.0	29.0
At the time of harvesting	0.60	0.68	24.0	30.0	0.67	0.80	26.0	34.0
Weight of plants with root (bundle of 50 nos	170 g	330g	-	-	300 g	420 g	-	-
Weight of edible portion of plants (bundle of 50 nos)	120 g	275 g	-	-	260 g	350 g	-	-

RW – Raw water 33% SW 33%distillery spentwash Plot -1- Untreated soil Plot -2- Treated soil

It the case of coriander leaves (Coriandum sativum). Fenugreek (Trigonella foenum graceum) and Spinach (Spinacia oleracea) germination of seeds were almost similar in raw water and 33% spentwash in both plots 1 and 2. The plants were highly potential (dark greenish) in 33% spentwash in plot 2 and plot 1 than raw water. However, the growth of all plants was highly potential (dark greenish) in plot 2 than plot 1 with raw water and 33 per cent spentwash irrigation. Rate of growth of thickness of the leaf, height of the plants at 8th, 18th, 25th days, at the time of Harvest and yield were recorded (Table 5, 6, and 7). The thickness of the leaf and height of the plants increased at different intervals in plot.2 as compared to plot.1. It was observed that growth and yield are in the order, 33% spentwash (plot 2) > 33% spentwash (Plot 1) > raw water (plot 2) > raw water (plot 1).

4.CONCLUSION

Among the irrigation with 33% spentwash and raw water in both untreated and treated soil, it is observed that, the growth of all leafy vegetable plants are highly potential and yield is more in the case of 33% spentwash as compared to raw water. Also in treated soil (Plot 2) growth and yield are much more greater than the untreated soil (plot 1). This shows that, the spentwash treated soil (plot 2) is enriched with the plant nutrients. It further concludes that, the subsequent use of spentwash for irrigation enriches the soil fertility and hence, the diluted distillery spentwash (33%) can be conveniently used for the cultivation of leafy vegetable.

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