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Tuesday 12<sup>th</sup> Feb 2019

DR. PANDITRAO DATTATRAYA SHIRAGAVE Ph.D CONVENER,

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#### **Editor**

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#### **INDEX**

-	INDEX		
Sr. No.	r aper Tvame	Author Name	Pag
1	Effect of Euphorbia geniculata L. (Dudhali) lead extract on Root and Shoot growth performance in Triticum aestivum L. and Trigonella foenum graceum L.		No 10-1
2	Study of Early Growth Performance in Trigonella foenum graceum L. and Triticum aestivum L. as influenced by Leaf Extract of Ipomoea palmata Forrsk.	Amate Sushant , Bhavsar Madhuri , Jadhav Dimple, Kadale Monika , Kumbhar	14-1
3	Optimization of pH for the cellulolytic activity of bacteria isolated from different soil sample collected from Mouni Vidyapeeth Campus Gargott Kolhapur M.S.	v Vhanalakar S.A	18-21
5	The Organic Farming is Way to Sustainable Development in Rural Area Development  Growth, Acreage Response And Resource Use of Chickpea Production For Sustainable Development In Maharashtra.	Kamble Vijay Vasant  f Bondar U.S. Waiwal VD.	22-25 26-32
5	Antibacterial Activity And Green Synthesis of AGNPS of Leonotis nepetifolia (L.) R. Br. Crude Extract.	Chougule Ankush, Akash 3 Minache., Vaibhav Patil., Pranav Pinjre., Sujata Patil. and Omkar Koshti.	3-36
I	Synthesis of Zinc Nanoparticles By Chemical Method and Their Microbial Activity Study	Godfroni I. I. I. I. I.	7-40
M.	Performance of Persea americana mill (Avocado) nder the eco-climatic conditions of Kolhapur, Maharashtra (India)	Colchel N. I.	-43
ac	reliminary phytochemical analysis and biological civity of leaf extract of <i>Eupatorium odoratum</i> L. gainst larvae of <i>Spodoptera litura</i> (Fabricius)	Gorawade V.B., Magdum S.P., 44-Attar U.A.,and Shiragave P.D.	-50

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Page No.4

National Conference On Sustainable Agriculture Proceeding, 2019 www.rjlbpcs.com RJLBPCS JOURNAL

tional Conference On Sustainable Agriculture Proceeding, 201	9 www.rjlbpcs.com RJLBPCS JOUR	NAL
Pesticides for Sustainable Agriculture		273
Evaluation of Sugarcane Genotypes For Resistance	Patil V. S., Ghodake N. B.,	274-
to Smut Caused By Ustilago scitaminea Syd.	Deshmukh D.P., Mahajan S. B.	277
	Karade V. M. and Khot G. G.	
Effect of Soft Drinks on Seed Germination of	Patil Vaibhav, Pinjre Pranav,	278-
Fenugreeks (Trigonella foenum-graecum L.) Seeds.	Minache Akash, Chougule	282
	Ankush, Gorawade Veerkumar	
	and Koshti Omkar	
Plants as source of pesticides	Payamallea Shivanand,	283-
	Jaganureb A. S., Vantmuri	288
	Adiveppa.	
Green synthesis of silver nanoparticles using	Pinjre Pranav, Koshti Omkar,	289-
Mesosphaerum suaveolens (L.) Kuntze (Lamiaceae)	Jadhav Snehal, Patil Vaibhav,	294
leaf extract and study of its antibacterial activity	Gorawade Veerkumar and	
	Aitawade Makarand.	
Enrichmement of Nutrient Availability in Soil by	Pore Sanjay Vishnu	295-
The Applicationof Distillery Spent Wash and its		303
Impact on the Growth of the Plants		
Water Quality of Yenechavandi Reservoir, India	Sawant Rajaram S.	304-
		307
Determination of paraquat and diquat in pulses using	Shinde Raviraj, Shiragave	308-
LC-MS/MS and qualitative analysis by AP-MALDI-	Pandit, Thorat Pooja,	315
HRMS	Dhanshetty Manisha, Lakade	
	Ankita, Banerjee Kaushik	
Phytopesticidal Potential Study of Gliricidia sepium	Shiragave P.D	316-
(Jacq.) Kunth ex. Walp. Leaf Extract Against		321
Holotrichia serrata Fab.		
Genetic Engineering in Agriculture	Sunnal Shipla S.	322-
		324
Potential Pesticidal action of cell free medium after	Swami D.S., Yedake M.B.,	325-
growth of Bacillus subtilis against larvae Spodoptera	Kaloji N.B., and Ghosh J.S.	327
litura.		
2000 (1900 1900 1900 1900 1900 1900 1900	Vhanalakar S. A., Jagtap V. A.	328-
	and Bhagat C. P.	331
	Pesticides for Sustainable Agriculture  Evaluation of Sugarcane Genotypes For Resistance to Smut Caused By Ustilago scitaminea Syd.  Effect of Soft Drinks on Seed Germination of Fenugreeks (Trigonella foenum—graecum L.) Seeds.  Plants as source of pesticides  Green synthesis of silver nanoparticles using Mesosphaerum suaveolens (L.) Kuntze (Lamiaceae) leaf extract and study of its antibacterial activity  Enrichmement of Nutrient Availability in Soil by The Applicationof Distillery Spent Wash and its Impact on the Growth of the Plants  Water Quality of Yenechavandi Reservoir, India  Determination of paraquat and diquat in pulses using LC-MS/MS and qualitative analysis by AP-MALDI-HRMS  Phytopesticidal Potential Study of Gliricidia sepium (Jacq.) Kunth ex. Walp. Leaf Extract Against Holotrichia serrata Fab.  Genetic Engineering in Agriculture  Potential Pesticidal action of cell free medium after growth of Bacillus subtilis against larvae Spodoptera litura.	Evaluation of Sugarcane Genotypes For Resistance to Smut Caused By Ustilago scitaminea Syd.  Effect of Soft Drinks on Seed Germination of Fenugreeks (Trigonella foenum—graecum L.) Seeds.  Effect of Soft Drinks on Seed Germination of Fenugreeks (Trigonella foenum—graecum L.) Seeds.  Plants as source of pesticides  Plants as source of pesticides  Plants as source of pesticides  Payamallea Shivanand, Jaganureb A. S., Vantmuri Adiveppa.  Plants as source of pesticides  Payamallea Shivanand, Jaganureb A. S., Vantmuri Adiveppa.  Pinjre Pranav, Koshti Omkar, Jadhav Snehal, Patil Vaibhav, Gorawade Veerkumar and Aitawade Makarand.  Enrichmement of Nutrient Availability in Soil by The Applicationof Distillery Spent Wash and its Impact on the Growth of the Plants  Water Quality of Yenechavandi Reservoir, India  Determination of paraquat and diquat in pulses using LC-MS/MS and qualitative analysis by AP-MALDI-HRMS  Determination of paraquat and diquat in pulses using LC-MS/MS and qualitative analysis by AP-MALDI-HRMS  Shinde Raviraj, Shiragave Pandit, Thorat Pooja, Dhanshetty Manisha, Lakade Ankita, Banerjee Kaushik  Phytopesticidal Potential Study of Gliricidia sepium (Jacq.) Kunth ex. Walp. Leaf Extract Against Holotrichia serrata Fab.  Genetic Engineering in Agriculture  Potential Pesticidal action of cell free medium after growth of Bacillus subtilis against larvae Spodoptera litura.  Physico-Chemical Characteristics of Madilage  Vhanalakar S. A., Jagtap V. A.

National Conference On Sustainable Agriculture Proceeding, 2019 <a href="https://www.rjlbpcs.com">www.rjlbpcs.com</a> RJLBPCS JOURNAL

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

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#### **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<sup>25</sup> 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)

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<sup>26</sup>. 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

© All rights reserved Peer review under responsibility of NCOSA Conference Proceeding 12-Feb 2019 Page No.295 National Conference On Sustainable Agriculture Proceeding, 2019 <a href="www.rjlbpcs.com">www.rjlbpcs.com</a> RJLBPCS JOURNAL matter<sup>15</sup>. It contains highest percent of nitrogen and plant nutrients<sup>18</sup>. 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<sup>10</sup>, Wheat<sup>14</sup>, groundnut<sup>1</sup>, and physiological response of soyabean<sup>20</sup>. Diluted spent wash increases the growth of shoot length, leaf number per plant, leaf area and chlorophyll content of Peas<sup>21</sup>.

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<sup>23</sup> 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<sup>17,19</sup> without adversely affecting soil fertility and crop productivity<sup>12,13,22</sup>. Twelve pre sowing irrigations with the diluted spentwash had no adverse effect on the germination of maize but improved the growth and yield24. The diluted spentwash irrigation improved the physical and chemical properties of the soil and further increased soil microflora9,12.13. 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<sup>16</sup>. The diluted spentwash increase the uptake of nutrients, height, growth and yield of leafy vegetables<sup>4,5,6</sup>. Nutrients of pulses<sup>7</sup>, condimaents and root vegetables<sup>5,6,7,8</sup>, top vegetables<sup>2,3</sup>, cabbage and mint<sup>5,6,7,8</sup>. 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.

# National Conference On Sustainable Agriculture Proceeding, 2019 <a href="https://www.rjlbpcs.com">www.rjlbpcs.com</a> RJLBPCS JOURNAL Table 1: Chemical Composition of distillery spentwash

Sı	Chemcial Parameters	Units				Chemical Parameters	Units		33% DSW
1	PH		7.37	7.23	14		_	1642.16	100000000000000000000000000000000000000
2	Electrical Conductivity	μS	28799	10019	15		Mg/I	74.6	22.7
3	Total Solids	Mg/I	46139	20870	16	Sodium	Mg/I	480	240
4	Total dissolved solids	Mg/I	35160	10140	17		Mg/I	5963	3164
5	Total Supended solids	Mg/I	10540	4380	18	Iron	Mg/I	9.2	5.20
6	Settleable solids	Mg/I	10069	3010	19	Manganese	Mg/l	1424	260
7	COD	Mg/l	40529	10224	20	Zinc	Mg/I	1.27	368
8	BOD	Mg/I	16199	4799	21	Copper			0.41
9 .	Carbonate	Mg/I	Nil	Nil	22	Cadmium	Mg/I	0.276	0.074
0	Bicarbonate	Mg/l	13099	4197			Mg/I	0.039	0.010
1	Total			C-12-12-12	23	Lead	Mg/l	0.16	0.06
	phosphorous	Mg/l	30.27	6.78	24	Chromium	Mg/I	0.067	0.014
2	Total Potassium	Mg/I	7199	2398	25	Nickel	36.0	n 12	
3	Calcium	Mg/l	9439	379.0	-	9	Mg/I	0.165	0.040
. 5	/ – Primary treated of	a <sup>tt</sup> enve			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-	Plot-	Sı	-1: Untreated soil, I	71ot -2: T	reated so	il
-			1	2	51	: Parameters	Unit	Plot	Plot-2
1	Coarse sand	%	9.72	10.94	10	- 17 and of	Ppm	80	65
2	Fine sand	%	40.80	12.00	-	potassium		3	
		1	40.80	42.86	11	Exchangeable calcium	ppm	140	150
3	Slit	%	25.28	26.32	12	Exchangeable			1460
1	QI.	<i>a</i> 1	j.,	4.15	N/F	Magnesium	Ppm	220	190
+	Clay	%	24.2	19.88	13	Exchangeable	Ppm	90	100
	PH (1:2 Soln)	0.1				Sodium	Pin	90	180
-	198	%	8.16	8.15	14	Available sulphur	Ppm	240	
	Eleetrical	μS	526	451	15	DTPA Iron		240	230
AI	l rights reserved Peer					DITATION	Ppm	200	240

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	Conductivity					www.tjibpes.e			
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<sup>th</sup>, 18<sup>th</sup> 25<sup>th</sup> 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 I 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 8th. 18th, 25th 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).

Thickr	1000000	reated	soil				Plot.	
	ness of							
	ess of					_		
Stem (	100001	Height	of	Thickn	essof	Height of the		
Stelli (	in mm)	The pla	nt(in cm)	stem(in	n mm)	plant	(in cm	
RW	33%	RW	33%	RW	33%	RW	33%	
	SW		SW		SW		SW	
1.2	2.0	1.9	3.0	1.28	2.4	2.0	3.3	
2.4	3.62	22.0	30.0	2.8	3.84	26.0	32.0	
3.1	4.24	28.0	37.0	3.4	4.64	36.0	42.0	
4.10	5.62	34.0	42.0	4.6	5.82	41.0	58.0	
145 g	360 g	-	-	350 g	410	-	-	
	7				g			
75 g	180 g	-	-	170 g	210	_	-	
					g			
tht and v	weight of sl	hepu (Peu	cedanum	graveole				
							Plot. 1	
Thickn	ess of	Height	of the	Thickn	ess of	Heig	nt of the	
stem				52		plant (in cm		
RW	33%	RW	33%	RW			33%	
	SW	_	sw			1011	SW	
0.6	1.24	1.5	2.2	0.7		2 15	3.4	
1.5	3.02	10.0		100000			23.45	
2.0								
2.72							35.0	
						37.0	44.0	
	1.08			100 g		-	-	
35 g	140 σ	_		120 ~				
	1.06		-	130 g		-	<b>4</b> 7	
and wei	ight of co	riander lo	avec (Ca	ion d	g			
				iandum S	satıvun	1)		
	Onnea	iou	SOII				Plot.1	
-								
	2.4 3.1 4.10 145 g 75 g Thickn stem RW 0.6 1.5 2.0 2.72 50 g	1.2 2.0 2.4 3.62 3.1 4.24 4.10 5.62 145 g 360 g  75 g 180 g  Thickness of stem  RW 33% SW  0.6 1.24 1.5 3.02 2.0 3.82 2.72 3.92 50 g 170 g  and weight of co	1.2       2.0       1.9         2.4       3.62       22.0         3.1       4.24       28.0         4.10       5.62       34.0         145 g       360 g       -         75 g       180 g       -         Thickness of least and weight of shepu (Peus)         Thickness of stem       Plant (in RW SW)         0.6       1.24       1.5         1.5       3.02       10.0         2.0       3.82       16.0         2.72       3.92       23.0         50 g       170 g       -         35 g       140 g       -	1.2       2.0       1.9       3.0         2.4       3.62       22.0       30.0         3.1       4.24       28.0       37.0         4.10       5.62       34.0       42.0         145 g       360 g       -       -         75 g       180 g       -       -         Thickness of stem       Height of the plant (in cm)         RW       33%       RW       33%         SW       SW       SW         0.6       1.24       1.5       2.2         1.5       3.02       10.0       19.5         2.0       3.82       16.0       30.0         2.72       3.92       23.0       37.8         50 g       170 g       -       -         and weight of       coriander leaves (Coriander leaves (Coriander leaves)	1.2       2.0       1.9       3.0       1.28         2.4       3.62       22.0       30.0       2.8         3.1       4.24       28.0       37.0       3.4         4.10       5.62       34.0       42.0       4.6         145 g       360 g       -       -       350 g         Thickness of stem       180 g       -       -       170 g         Thickness of plant (in cm)       Thickness stem       of the plant (in cm)       Thickness stem (in cm)         RW       33%       RW       33%       RW         SW       0.6       1.24       1.5       2.2       0.7         1.5       3.02       10.0       19.5       1.8         2.0       3.82       16.0       30.0       2.4         2.72       3.92       23.0       37.8       2.8         50 g       170 g       -       -       160 g         35 g       140 g       -       -       130 g         and weight of coriander leaves (Coriandum S	1.2       2.0       1.9       3.0       1.28       2.4         2.4       3.62       22.0       30.0       2.8       3.84         3.1       4.24       28.0       37.0       3.4       4.64         4.10       5.62       34.0       42.0       4.6       5.82         145 g       360 g       -       -       350 g       410 g         g         Thickness of stem use weight of shepu (Peucedanum graveolens)         Untreated soil         Thickness of plant (in cm)       Thickness of stem (in mm)         RW       33%       RW       33% gW       SW         0.6       1.24       1.5       2.2       0.7       1.52         1.5       3.02       10.0       19.5       1.8       3.24         2.0       3.82       16.0       30.0       2.4       3.92         2.72       3.92       23.0       37.8       2.8       4.23         50 g       170 g       -       160 g       240 g         and weight of coriander leaves (Coriandum Sativum	1.2       2.0       1.9       3.0       1.28       2.4       2.0         2.4       3.62       22.0       30.0       2.8       3.84       26.0         3.1       4.24       28.0       37.0       3.4       4.64       36.0         4.10       5.62       34.0       42.0       4.6       5.82       41.0         145 g       360 g       -       -       350 g       410       -         g         Thickness of gland weight of shepu (Peucedanum graveolens)         Untreated soil         Thickness of plant (in cm)       Thickness of plant (in cm)       RW       33%       RW       33%       RW       33%       RW       33%       RW       33%       RW       33%       RW       SW       SW </td	

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	stem (in mm)		plant (in cm		stem (in mm)		plant (in cm)	
Observations	RW	33%	RW	33%	RW	33%	RW	33%
		SW		SW		SW		SW
8 <sup>th</sup> 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
25 <sup>th</sup> 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	45 g	150 g	-	-	135 g	180 g	-	-
(bundle of 50 nos				9				
Weight of edible portion of	40 g	110 g	-	-	100 g	140 g	-	-
plants (bundle of 50 nos)								

RW - Raw water 33% distillery spentwash

RW – Raw water 33% distillery spe	entwash								
Table 6: Thieckness of stem height	fenugreek ( Trigonella foenum graceum)								
			U	ntreated	d so	1		Plot.1	
Treated soil Plot.2									
	Thickne	ess of	Height of	of the	Thickne	ess of	Height of the		
	stem (ii	n mm)	plant (in	cm	stem (in	n mm)	plant (in cm)		
Observations	RW	33%	RW	33%	RW	33%	RW	33%	
0000174410110		SW		SW		sw		SW	
8 <sup>th</sup> day from plantation	0.2	0.35	2.5	5.0	0.26	0.45	3.0	5.4	
18 <sup>th</sup> day from plantation	0.7	1.0	20.0	29.0	0.82	1.26	24.0	31.0	
25 <sup>th</sup> 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	80 g	125	-	-	110 g	240	-		
(bundle of 50 nos)		g				g			
Weight of edible portion of	45 g	85 g	-	-	70 g	120	-	-	
plants (bundle of 50 nos)						g			
Table 6: Thieckness of stem height	and we	ight of	spinach	(Spina	cia olera	cea)			
			Ur	treated	soi	l		Plot.1	
Treated soil Plot.2									
	Thick	ness of	Height	of the	Thickn	ess of	Heigh	nt of the	
50K	stem (	in mm)	plant (in	n cm	stem (i	n mm)	plant	(in cm)	
Observations	RW	33%	RW	33%	RW	33%	RW	33%	
30001.4410115		sw		sw		SW		SW	
8 <sup>th</sup> day from plantation	0.08	0.14	4.0	6.3	0.09	0.16	4.6	6.6	

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National Conference On Sustainable Agriculture Proceeding, 2019 <a href="https://www.rjlbpcs.com">www.rjlbpcs.com</a> RJLBPCS JOURNAL 18<sup>th</sup> day from plantation 0.31 0.39 14.0 17.0 0.36 0.42 16.0 19.0

18 <sup>th</sup> day from plantation	0.31	0.39	14.0	17.0	0.36	0.42	16.0	19.0
25 <sup>th</sup> 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	170	330g	-	-	300 g	420 g	-	-
of 50 nos	g							
Weight of edible portion of	120	275 g	Two is		260 g	350 g	-	_
plants (bundle of 50 nos)	g					1		

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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    Page No.301

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