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Effect of Spent Wash Application on Nutrient Concentration and Uptake by Bajra and Blackgram

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ABSTRACT

A pot culture experiment was conducted with six treatments and three replications in factorial CRD concept by taking two crops *i.e* legume (blackgram) and a cereal (bajra) to know the effect of different dilutions of spent wash application on nutrient concentration ,uptake, drymatter production and yield of bajra and blackgram. Maximum drymatter production and yield was recorded (78.40 g pot^{-1} and 14.95 g pot^{-1}) with the application of 10 times diluted spent wash in bajra while it was noticed with 20 times diluted spent wash with irrigation water in blackgram (41.80 g pot^{-1} and 12.4 g pot^{-1}) ,respectively. Uptake of various nutrients was highest with 10 and 20 times diluted spent wash application in bajra and blackgram ,respectively when compared to control.

Key words : Bajra, Blackgram, Nutrient content , Nutrient uptake, Spent wash.

In India there are about 285 distilleries with an installed capacity to produce 2.7 billion litres of alcohol per annum and generating nearly 40 billion litres of spent wash annually. In Andhra Pradesh, there are about 24 distilleries with total installed capacity 1.24 lakh kilolitres of alcohol per annum. The waste water of distillery , generally known as spent wash is being discharged for disposal from these distilleries. The farmers in the vicinity of distilleries are using spent wash as a source of manure with out knowing the adverse or beneficial effects on crop as well as on soil. Devarajan and Oblisami (1995) reported that the distillery effluent could be considered as a liquid manure and controlled application of treated effluent can increase the productivity of soils and crops. Keeping this in view, present study is carried out to explore the feasibility of spent wash as a source of irrigation and nutrient supply to bajra and blackgram crops.

MATERIAL AND METHODS

Spent wash samples were collected in 25 liters capacity polythene cans from Srinivasa distilleries of Chittoor, Andhra Pradesh for soil application. A pot culture experiment was conducted to study the effect of spent wash on nutrient concentration, uptake, drymatter production and yield of bajra and black gram during *rabi*, 2002 in green house at S.V. Agricultural college, ANGRAU, Tirupathi, A.P. with four replications and six treatments viz; T_0=Control(Normal irrigation)T1=Application of 5 times diluted spent wash with irrigation water,T2= Application of 10 times diluted spent wash with irrigation water,T3= Application of 20 times diluted spent wash with irrigation water, T4= Application of 40 times diluted spent wash with irrigation water and T5= Application of 60 times diluted spent wash with irrigation water under factorial CRD design. Pots were filled with 10 kg of 2 mm sieved red soil . The soil is sandy clay loam, neutral in reaction, medium in soluble salt concentration, low in organic carbon, nitrogen and phosphorus, medium in available potassium and high in micronutrients. Calculated amount of nitrogen through urea, phosphorus in the form of SSP and potassium in the form of murate of potash was applied as basal dose. No potassic fertilizer was applied to blackgram since it is considered adequate in the soil to support blackgram.

A pre-sowing water was given and sowing was taken up at optimum moisture content, two days after fertilizer application. The pots were initially watered with normal irrigation water for establishment of crop. Subsequently (after 7 days) , treatments were imposed and crops were regularly irrigated with these waters through out the crop growth period. Leaf samples were collected from both the crops *viz;* bajra and blackgram at 30 days ,60 days and at harvest for determination of nutrient concentration. The plants were uprooted carefully from the sampling area for dry matter content. The dry weight of plants were recorded after drying in an hot air oven at 60^0C to a constant weight and expressed as $gpot^{-1}$. Yield also recorded at the stage of harvest and expressed as $gpot^{-1}$. Plant samples were washed with distilled water and were

dried under shade and finally in a hot air oven at 60^0C. The samples were ground to pass through 40 mesh sieve and these samples were estimated for various nutrients as per the standard procedures. Uptake of nutrients at harvest was calculated using the dry weights of whole plants excluding the root portion.

RESULTS AND DISCUSSION

Drymatter production and Yield

Drymatter production and yield increased significantly with spent wash application (Table 1) . Maximum drymatter production and yield was recorded with application of 10 times and 20 times diluted spent wash with irrigation water in bajra, (78.40 g pot^{-1}and19.6 g pot^{-1}) and blackgram (41.80 g pot^{-1} and 12.4 g pot^{-1}) respectively. Blackgram showed lowest drymatter production with application of 5 times diluted spent wash with irrigation water when compared to control. It indicated that legumes were found to be sensitive to higher concentration of spent wash application when compared to cereals due to presence of higher salts. At higher concentration of spent wash application, the drymatter production was lowest, it might be due to presence of more soluble salts and also toxic amounts of nutrients present in soil which were added through spent wash causing the nutritional imbalance in plant. However, the positive influence of diluted spent wash application on crops was noticed with improvement of drymatter production to 61.89% with application of 10 times diluted spent wash with irrigation water over control. Improvement in drymatter production, was also reported by Zalawadia and Raman(1994). Significantly higher yield was recorded with spent wash application when compared to control. Mean yield of crops increased by 81.19% with application of 10 times diluted spent wash with irrigation water over control. This is in confirmation with the findings of Devarajan and Oblisami (1994) who observed that yield increased with decreasing spent wash concentration.

Concentration of N,P and K

The nitrogen concentration(Table 2,3,4&5)increased with increased concentration of spent wash application at different stages of crop growth. Significantly high nitrogen concentration was observed with application of 5 times diluted spent wash with irrigation water at three stages of crop growth. This might be due to addition of nitrogen through spent wash may increased its availability and consequently concentration in plants. At 30 days, crops did not show any significant difference in nitrogen concentration ,while at 60 days and harvest the concentration of nitrogen differed significantly between the crops. Blackgram recorded significantly higher nitrogen concentration than bajra at 60 days and harvest of crop growth. These results were in conformity with the results obtained by Bhat and Doddamani (1998). High phosphorus concentration was maintained in crops in early stages of crop growth and gradually decreased at harvest. At three stages, higher potassium concentration was observed with application of 5 times diluted spent wash with irrigation water, over the other treatments. Potassium is one of the major nutrients which was supplied in higher amounts through spent wash, might be responsible for the high concentration of potassium in plants which received higher concentration of spent wash application .Similar results were reported by Bhat and Doddamani (1998). N,P and K concentration was highest at early stages of crop growth and decreased gradually with advancement of crop growth period. This might be due to utilization of these nutrients for various metabolic processes of the plant causing the dilution effect on these nutrients.

Concentration of Fe, Mn, Zn and Cu

The Zn, Fe, Mn and Cu concentration increased with increase in application of spent wash in both the crops at three stages of crop growth. Significantly high Zn, Fe, Mn and Cu concentration was noticed with application of 5 times diluted spent wash with irrigation water at three stages of crop growth. Similar results were obtained by Bhat and Doddamani (1998) and Zalawadia *et al.,* (1997). The concentration of micronutrients *viz;* Zn, Fe, Mn and Cu was maximum with application of 5 times diluted spent wash with irrigation water irrespective of crops might be due to availability of more micronutrients from concentrated spent wash application.

Uptake of N, P, K, Zn, Fe, Mn and Cu

Significant increase in uptake of N,P and K was observed with spent wash application over control (Table 4). Crops differed significantly in nutrients uptake, Bajra showed significantly higher N, P and K uptake than blackgram. This might be due to high production of drymatter by bajra when compared to blackgram . The maximum N,P and K uptake was recorded with application of 10 times diluted spent wash with irrigation water in case of bajra, while it was noticed with application of 20 times diluted spent wash with irrigation water in blackgram. The above results in confirmation with

Table 1. Effect of spent wash application on drymatter (g pot^{-1}) production and seed yield (g pot^{-1}) of crops.

Treatments	Drymatter production of crops (g pot^{-1})			Seed yield of crops (g pot^{-1})		
	Bajra	Blackgram	Mean	Bajra	Blackgram	Mean
T0	44.50	26.20	35.35	10.5	6.20	8.35
T1	60.20	20.12	40.16	15.4	4.30	9.85
T2	78.40	36.06	57.23	19.6	10.6	15.13
T3	68.20	41.80	55.00	17.5	12.40	14.95
T4	55.20	33.68	44.44	14.7	10.20	12.45
T5	49.40	28.67	39.03	12.0	9.20	10.60
Mean	59.31	31.08		14.95	8.81	
CD(P=0.05)	C=9.45;T=9.94;CxT=14.05			C=4.70;T=4.95;CxT=7.00		

Note: C =crops, T =Treatments, CxT= Crops x Treatments

Table 2. Effect of spent wash application on concentration of N,P and K at different stages of crop growth.

Treatments	Growth stages								
	30days			60days			Harvest		
	Bajra	Blackgram	Mean	Bajra	Blackgram	Mean	Bajra	Blackgram	Mean
				Nitrogen concentration (%)					
T0	1.92	3.66	2.79	1.12	3.12	2.12	0.92	2.89	1.90
T1	4.42	5.86	5.14	3.20	4.36	3.78	2.32	4.02	3.17
T2	3.90	5.22	4.56	2.56	4.82	3.69	1.84	4.22	3.03
T3	3.73	4.91	4.32	2.48	4.72	3.60	1.58	4.09	2.83
T4	3.69	4.76	4.22	2.41	4.68	3.54	1.54	3.96	2.75
T5	3.41	4.60	4.00	2.08	4.52	3.30	1.52	3.82	2.67
Mean	3.51	4.80		2.30	4.37		1.62	3.83	
Cd(p=0.050)	C=NS;T=1.83;Cx T=NS			C=1.105;T=1.162;CxT=1.644			C=0.877;T=0.923;CxT=1.306		
				Phosphorus concentration (%)					
T0	0.19	0.22	0.20	0.16	0.18	0.17	0.11	0.12	0.11
T1	0.43	0.78	0.60	0.33	0.54	0.43	0.25	0.38	0.26
T2	0.34	0.68	0.51	0.28	0.44	0.36	0.24	0.22	0.23
T3	0.28	0.56	0.42	0.22	0.36	0.29	0.18	0.24	0.21
T4	0.24	0.43	0.33	0.20	0.32	0.26	0.13	0.20	0.16
T5	0.21	0.28	0.24	0.19	0.20	0.19	0.11	0.10	0.10
Mean	0.28	0.49		0.22	0.34		0.17	0.21	
Cd(p=0.050)	C=0.144 ;T=0.151;Cx T=0.214			C=NS;T=0.149;CxT=NS			C=NS;T=0.128;CxT=NS		
				Potassium concentration (%)					
T0	1.45	2.12	1.78	0.94	1.42	1.18	0.72	1.04	0.88
T1	3.95	3.82	3.88	4.32	4.15	4.23	3.74	2.62	3.18
T2	3.45	2.55	3.00	3.86	3.04	3.45	3.05	1.80	2.42
T3	3.25	2.25	2.75	2.78	2.07	2.42	2.15	0.95	1.55
T4	2.45	2.15	2.30	1.77	1.05	1.41	1.15	0.84	0.99
T5	2.25	2.05	2.15	1.55	0.95	1.25	1.07	0.72	0.89
Mean	2.80	2.49		2.53	2.11		1.98	1.32	
Cd(p=0.050)	C=NS;T=1.033;Cx T=NS			C=NS;T=0.880;CxT=NS			C=NS;T=0.851;CxT=NS		

Note: C =crops, T =Treatments, CxT= Crops x Treatments

Table 3. Effect of spent wash application on tissue concentration of Zn, Fe, Mn and Cu at different stages of crop growth.

Treatments	Growth stages								
	30days			60days			Harvest		
	Bajra	Blackgram	Mean	Bajra	Blackgram	Mean	Bajra	Blackgram	Mean
				Zinc concentration (mgkg^{-1})					
T0	38	52	45	34	50	42	32	46	39
T1	64	88	76	60	82	71	59	78	68
T2	58	76	67	55	70	62	50	68	59
T3	52	68	60	48	61	54	44	66	55
T4	48	62	55	42	56	49	38	52	45
T5	40	56	48	36	52	44	34	48	41
Mean	50	67		45.83	61.83		42.83	59.66	
Cd(p=0.050)	C=6.098;T=6.415;Cx T=9.073			C=8.110;T=8.532;CxT=12.067			C=11.993;T=12.618;CxT=17.84		
				Iron concentration (mgkg^{-1})					
T0	86	68	77	90	70	80	83	65	74
T1	128	164	146	130	168	149	122	158	140
T2	118	156	137	122	160	141	114	150	132
T3	110	142	126	114	143	128	104	136	120
T4	102	126	114	106	128	117	97	123	110
T5	92	110	101	95	112	103	87	105	96
Mean	106.00	127.60		109.50	130.33		101.16	122.83	
Cd(p=0.050)	C=14.15;T=14.89;Cx T=21.06			C=13.86;T=14.58;CxT=20.62			C=14.98;T=15.78;CxT=22.28		
				Manganese concentration(mgkg^{-1})					
T0	58	76	67	50	62	56	42	54	48
T1	198	208	203	189	180	184.5	160	162	161
T2	188	192	190	167	168	167.5	132	145	138
T3	166	168	167	128	134	131	104	114	109
T4	128	126	127	93	118	105.5	87	93	90
T5	96	102	99	72	98	85	64	82	73
Mean	139.00	145.30		116.50	126.60		98.16	108.33	
Cd (p=0.050)	C= NS;T=22.88;Cx T=NS			C=NS;T22.52=;CxT=NS			C=NS;T=21.99;CxT=NS		
				Copper concentration (mgkg^{-1})					
T0	4.5	5.4	4.95	3.2	3.9	3.55	2.0	3.9	2.95
T1	10.2	9.8	10.0	9.4	8.2	8.80	7.8	7.0	7.40
T2	8.9	8.6	8.75	7.8	7.0	7.40	6.0	5.8	5.90
T3	7.3	7.7	7.50	6.3	6.2	6.25	5.7	4.2	4.95
T4	6.8	6.9	6.85	5.6	5.9	5.75	4.8	4.4	4.60
T5	6.1	6.2	6.15	5.5	5.3	5.40	4.7	4.0	4.35
Mean	7.30	7.43		6.30	6.08		5.16	4.88	
Cd (p=0.050)	C=NS;T=0.93;Cx T=NS			C=NS;T=1.073;CxT=NS			C=NS;T=1.295;CxT=NS		

Note: C =crops, T =Treatments, CxT= Crops x Treatments

Table 4. Effect of spent wash application on uptake (mg pot^{-1}) of N, P and K by crops at the stage of harvest.

Treatments	Uptake								
	N			P			K		
	Bajra	Blackgram	Mean	Bajra	Blackgram	Mean	Bajra	Blackgram	Mean
T0	231.04	482.08	356.56	26.70	15.72	21.21	671.95	314.40	93.10
T1	1216.04	581.46	898.75	125.44	48.28	86.86	2299.64	527.14	1413.30
T2	1317.12	970.01	1143.50	16.42	72.12	99.27	2304.96	807.36	1556.30
T3	668.36	886.16	777.20	81.84	75.24	78.54	1241.24	844.74	1042.80
T4	430.56	666.86	548.71	49.68	47.15	48.41	894.24	545.61	719.90
T5	335.92	544.73	440.30	39.52	28.67	34.09	711.36	384.17	547.70
Mean	699.84	688.55		74.93	47.86		1235.33	570.57	
CD (p=0.05)	C=NS;T=117.75;CxT=166.53			C=17.17;T=18.07;CxT=25.55			C=243.56;T=256.24;CxT=362.39		

Note: C =crops, T =Treatments, CxT= Crops x Treatments

Bhat and Doddamani (1998) who reported that the uptake of nutrients such as N, P and K was high in sugarcane which was applied with diluted spent wash. The uptake of Zn, Fe , Mn and Cu (Table 5) also followed the same trend as that of N,P and K. Similar results were reported by Zalawadia *et al.,* (1997) .

The present study indicated that spent wash may be applied after making proper dilution with irrigation water. Legumes requires 20 times diluted spent wash, where as graminae crops with stand even at 10 times diluted spent wash application. In the areas where effluent is available it should be diluted 10 times and 20 times with irrigation water in case of cereals and legumes respectively to increase the crop yields.

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