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Effect of Postmethanated Distillery Spentwash on the Growth, Yield and Quality of Cluster Bean

M.P. Sugumaran* and R. Suganthi

Department of Environmental Sciences, AC&RI, Coimbatore, 641 003, India

**Corresponding author*

Abstract

A field experiment was conducted at Amaravathy sugars, Udumelpet to study the effect of spentwash on cluster bean crop. Results revealed that the treatment applied with spentwash (100 % N through post methanated distillery spentwash) increased the yield of clusterbean. Application of PMDSW favoured the yield attributes of clusterbean by enhancing the availability of nutrients. Basal application of PMDSW @20.83 kL ha^{-1} (T_5) recorded the highest plant height, number of internodes per plant and number of leaves per plant than the control. Among the treatments, the maximum crude fibre was recorded in T5 (2.63%) and minimum in T1; the crude protein was maximum in T5 and minimum in T1(control). Thus it indicates that PMDSW application increased the quality when compared to control. The enormous quantities of plant nutrients present in spentwash offers an excellent opportunity to use it as a liquid fertilizer along with irrigation water, thus enabling the farmers to save cost incurred on fertilizers and at the same time achieve higher yields of crops.

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Keywords

Distillery effluent, Spentwash, Clusterbean, Fertilizers.

Introduction

Spentwash is an agro-industrial waste generated during alcohol production in distilleries. At present in India, there are 319 distilleries with the capacity of producing 3.29 billion litres of alcohol which in turn generates 49.35 billion litres of wastewater (Kumar and Chopra, 2013). Utilization of industrial effluent in agriculture either for irrigation or cultivation of the crop with the nutrients in spentwash has been increased in recent times (Tharakeshwari and Jagannath, 2011). Most of the crops showed higher yield with respect to different concentration of effluent application. Since spentwash generated contains organic and inorganic nutrients exceeding the normal level; proper treatment of the wastes is emphasized before using it for either irrigation or composting. Hence the effluent undergoes biomethanation process to reduce the high bio-chemical oxygen demand and chemical oxygen demand and the resulting product is called as post-methanated distillery effluent which can be further utilized in agriculture. On the other hand, Extensive use of inorganic fertilizer not only degrades the soil quality but also affects the productivity of the crop. The application of post-methanated effluent for crop production reduces the environmental impact of inorganic fertilizer on soil properties which in turn reduces the need of inorganic fertilizer. This research was carried out to study the effect of post-methanated effluent application on crop growth, yield and quality.

Materials and Methods

Field experiments

Field experiment was conducted using cluster bean varPusaNavabhar Hybrid as test crop at Research and Development Farm, M/s Amaravathi Co-operative Sugar Mills Ltd., Krishnapuram, Udumalpet, Tirupur District, Tamil Nadu to assess the different doses of PMDSW on the physico-chemical properties and microbial properties of soil, growth, yield and quality of cluster bean. Experimental plot was ploughed and divided uniformly into 24 plots of 20 m^2 (6 m X 3.3 m).

Among other Macro nutrients, Nitrogen plays an important role in increasing the agricultural production and as a constituent of protein; it increases the nutritive value of food. It also influences the quality of environment. So, the treatments were fixed based on the N requirement of the cluster bean (25 kg N ha^{-1}) crops and N content of the post-methanated distillery Spentwash (1200 mg L^{-1}).

The plots were applied with treatments which comprises of PMDSW application by 5.21, 10.42, 15.63 and 20.83 KL/ha as basal application. The amount of P_2O_5 supplied through the above doses of PMSW was also calculated and the balance P_2O_5 was applied basally through fertilizer. Application of potash fertilizer was skipped because the PMDSW contains sufficient quantity of potassium.

Details of field experiments

S.No	Particulars	Cluster Bean
1.	Soil type	Red sandy loam
2.	Soil series	Irugur
3.	Soil taxonomy	Typic*Ustorthent*
4.	Variety	PNB
5.	Duration	75-80 days
6.	No. of. treatments	6
7.	No. of. Replication	4
8.	Design	RBD
9.	Plot area	20 sq.m
10	Plot size	6 m X 3.3 m
11	Seed rate	10 Kg/ha
12	Spacing	45 X 15 cm
13	Nutrient Recommendation	25:50:25 NPK kg ha^{-1}
14	Date of Sowing	6.11.15

Treatment details

T_1 – Control (RD of NPK)

T_2 – 25% N (5.21 m^3 ha^{-1}) through PMDSW + 75% through inorganic fertilizer

T_3 – 50% N (10.41 m^3 ha^{-1}) through PMDSW + 50% through inorganic fertilizer

T_4 – 75% N (15.62 m^3 ha^{-1}) through PMDSW + 25% through inorganic fertilizer

T_5 – 100% N (20.83 m^3 ha^{-1}) through PMDSW
T_6 – Absolute Control

Calculated quantity of PMDSW was uniformly applied in each plot for the treatments T_2 to T_5. Then, the applied PMDSW were mixed with soil by ploughing for providing better soil aeration and consequent reduction of BOD level in the soil-water system. All the cultural practices including gap filling, thinning, weeding and plant protection measures were carried out as per the TNAU recommendations.

Biometric observations

Growth attributes

Biometric observations were made by randomly selecting five plants (cluster bean) in the plot area of individual treatments at 30 and 60 days after sowing (DAS) and at the time of harvest. The growth attributes like plant height, number of leaves and numbers of internodes were recorded and the mean values obtained were expressed as per the SI system of units.

Yield attributes

Yield attributes like Number of pods per plant, pod weight, Number of seeds per pod were recorded as per the standard procedures and the mean values obtained were expressed as per the SI system of units.

Quality attributes

Quality attributes like Crude fibre and Crude protein was recorded as per the standard procedures presented in Table 1 and the mean values obtained were expressed as per the SI system of units.

Results and Discussions

Influence of PMDSW on growth, yield and quality attributes of Cluster bean

Application of PMDSW in soil increased the growth attributes of cluster bean viz., plant height, number of internodes per plant and number of leaves per plant when compared to control. Basal application of PMDSW @20.83 kL ha^{-1} recorded the highest plant height, number of internodes per plant and number of leaves per plant than the control which may be due to the increased availability of nutrients which in turn increased the photosynthetic activity and results in increased yield (Gahlot *et al.*, 2011). The yield attributes like number of pods per plant, number of seeds per pod, pod weight (gm), pod length (cm) and pod yield (kg ha^{-1}) were significantly influenced by the basal application of PMDSW. It might be due to the influence of spentwash on the physico-chemical properties, organic carbon and available nutrients in soils (Devarajan *et al.*, 1993). Among the treatments, the maximum pod weight, pod length, pod yield, number of pods per plant and number of seeds per pod was obtained at PMDSW @ 20 $kLha^{-1}$ and the application of PMDSW influence the dry matter production significantly (Goyal *et al.*, 1995). Among the treatments, the maximum crude fibre was recorded in T_5 (2.63%) and minimum in T_1; the crude protein was maximum in T_5 and minimum in T_1(Table 1). Thus it indicates that PMDSW application increased the quality when compared to control. This is in confirmation with Zalwadia *et al.*, (1997), who reported that application of distillery spentwash increased the level of organic carbon, N, P, K and Ca in soils with significant increase in yield of crops like sugarcane, rice, cotton, maize, sorghum, bajra and red gram. In *Citrus maxima* the shoot length, leaf number/plant, leaf area, chlorophyll content and phytomass exhibited a gradual increase upto 10% effluent concentration application (Rani and Srivastava, 1990).

Table.1 Effect of Post Methanated Distillery Spentwash (PMDSW) on yield and Quality attributes of cluster bean

Treatments	Yield parameters					Quality parameters	
	No. of. pods/ plant	No. of. seeds/pod	pod weight (gm)	Pod yield (kg ha^{-1})	DMP (kg ha^{-1})	Crude fibre (%)	Crude protein (%)
T_1	9.25	7.3	3.72	3.45	10675	1.87	3.16
T_2	10.25	7.5	3.74	3.65	11283	1.88	3.20
T_3	11.50	7.5	3.76	3.73	11461	2.12	3.33
T_4	11.50	7.75	3.94	3.86	12543	2.13	3.28
T_5	12.50	8.25	4.67	3.90	12728	2.63	3.90
Mean	**11.00**	**7.65**	**3.97**	**3.71**	**11738.00**	**2.08**	**3.33**
SEd	0.57	0.40	0.21	0.19	613.39	0.04	0.05
CD (0.05)	1.25	NS	0.46	NS	1336.49	0.08	0.10

T_1: Control - 100 % RDF (25:50:25 NPK kg ha^{-1})
T_2: 25 % N through PMDSW (5.21 m^3 ha^{-1}) and 75 % N through inorganic fertilizer
T_3: 50 % N through PMDSW (10.41 m^3 ha^{-1}) and 50 % N through inorganic fertilizer
T_4: 75 % N through PMDSW (15.62 m^3 ha^{-1}) and 25 % N through inorganic fertilizer
T_5: 100 % N through PMDSW (20.83 m^3 ha^{-1})
T_6:Absolutecontrol

In conclusions, this study reveals the efficiency of utilizing post Methanated distillery spentwash for Cluster bean cultivation in combination with different dosage of spentwash application. The different treatments followed showed sustainable growth and yield out of which 100% Basal N (20.83 KL ha^{-1}) through PMDSW recorded the highest plant height, number of internodes per plant and number of leaves per plant than the control

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