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Effect of organic amendments and nutrient management practices on yield and quality attributes of Cumbu Napier hybrid CO (BN) 5 under treated sewage irrigation

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Abstract
Globally, Treated sewage (TS) reuse for irrigation purposes has been advocated since it shows substantial economic and agricultural benefits. This study was conducted to investigate the effect of organic amendments and nutrient management practices on yield quantitative and qualitative properties in CO (BN) 5. Field experiment was conducted at farmer's field located near Earipalayam Sewage Treatment Plant (STP), Udumalpettai during 2019-2020. The experiment was conducted in Randomized Block Design (RBD) with three replications. The treatments were managed for irrigation, with TS during entire period of growing season. A progressive increase in green fodder yield and crude protein content was observed. The highest green fodder yield (167 t ha^{-1} in the first harvest and 211t ha^{-1} in the second harvest) was obtained by the application of T_5 – (Vermicompost@5 t ha^{-1} +100% NPK) followed by T_2- (FYM@25 t ha^{-1} +100% NPK) of about (162 t ha^{-1} in first harvest and 205 t ha^{-1} in second harvest). Results revealed that TS irrigation with T_5 - Vermicompost@ t ha^{-1} +100% NPK) dose worked well, with less crude fibre content and high crude protein content relative to control- 100%NPK at 0.05 significance levels and no signs of phytotoxicity were detected. It was concluded that CO (BN) 5 produced by TS maintained all its fodder quality and that it can be produced commercially for feeding livestock.

Keywords: Treated sewage, Cumbu Napier hybrid CO (BN) 5, organic amendments

Introduction
Water deficits pose a significant threat to the growth of human populations. Water reclamation and reuse is considered to be the best strategy for meeting current and future water needs. In the other hand, water pollution in developing countries, such as India, is a highly dangerous concern.
Livestock production is the backbone of Indian agriculture contributing 4.4% to national gross value added at current prices during 2014-2015 (Anon., 2018a) [4, 5]. The demand for milk will be around 400 million tonnes in the year of 2050 (Anon., 2018b) [4, 5] against the current scenario which is 165.4 million tonnes (Anon., 2018c) [4, 5]. India is the largest milk producer, but the per capita milk production is very low, owing to an enormous deficit in the supply of feed stuffs. (Mishra and Pandey, 2011) [13, 18]. The total area under cultivated fodder is only 8.4mha which is not sufficient to meet the needs of the growing livestock populations (Mohan *et al*., 2017) [14]. The availability of green forage from various sources is only 40% of the required quantity. Bridging this gap is a matter of prime concern.
Cumbu Napier Hybrid CO (BN) 5 released by the Tamil Nadu Agricultural University, Coimbatore is an interspecific hybrid between fodder Cumbu IP 20594 x Napier grass FD 437. Winter hardy, rapid regeneration potential, free from pests and diseases, superior ratooning rendering seven cuttings per year are the unique characteristics of CO (BN) 5. It had secured first rank at all national levels with reference to green fodder yield (360t/ha/year) (2010), crude protein content of 12% (2010) (Babu *et al*., 2014) [8].
In this country the agricultural sector is the main user of water and in two decades, the proportion of water allotted to irrigating is projected to decrease by 10-15 percent (CWC, 2000) [9]. The reuse of TS in agriculture for fodder crops appears to be a viable choice in this changing scenario. Hence, the present study was conducted to evaluate the effect of organic amendments and nutrient management on growth and yield attributes of CO (BN) 5 under treated sewage irrigation.

Materials and Methods

A field experiment was carried out at farmer's field (10˚36.603'N and 77˚14.879'E) located near the, Earipalayam STP, Udumalpettai during 2019-2020. Around 490m^2 of land area was utilized, and that soil had never been previously irrigated. The soil is generally sandy clay loam with pH (7.5). In this study, Cumbu Napier hybrid CO (BN) 5 was used as a test crop. In Randomized Block Design (RBD), the experiment was carried out with seven treatment and replicated thrice. The treatments are T_1- Control (recommended NPK dose), T_2 - FYM @25 t ha^{-1} +100% NPK, T_3 -FYM @25 t ha^{-1} +75% NPK, T_4 -FYM @25 t ha^{-1} +50% NPK, T_5 –Vermicompost@5 t ha^{-1} +100% NPK, T_6 – Vermicompost@5 t ha^{-1} +75% NPK and T_7 – Vermicompost@5 t ha^{-1} +50% NPK.

Green fodder yield from each plot was recorded after harvest and the yield of green fodder in tonnes ha^{-1} was noted for each plot. Proximate component analysis such as crude protein content and crude fat content was estimated by using standard methods as per AOAC (2005) [1, 7]. Crude fibre content was determined according to the methods given in AOAC (1984) [1, 7]. Data on yield parameters were analysed statistically (Steel & Torrie, 1984) [21]. The statistical tool SPSS (Statistical Package for Social Sciences) was used to compute the ANOVA and determine any significant difference (P<0.05) among the factors.

Fig 1: Study area

Results and Discussion

Green fodder yield

The effect of treated sewage on green fodder yield becomes evident from increased biomass production at first and second harvest respectively (Table.1). The treatment T_5 (Vermicompost@5t ha^{-1} +100% NPK) on irrigation with treated sewage produced the highest green fodder yield at first harvest (167 t ha^{-1}) and at Second harvest (211 t ha^{-1}) followed by T_2 (FYM @25 t ha^{-1} +100% NPK) which recorded the green fodder yield of 162 t ha^{-1} in first harvest and 205 t ha^{-1} in second harvest respectively. Whereas, the lowest green fodder yield of about 133 t ha^{-1} in first harvest and 160 t ha^{-1} in second harvest was observed in control (100% NPK). Naida (2005) has also recorded a rise in the yield of forage sorghum with irrigation usage over the entire growth cycle which could be caused by the higher level of nitrate in municipal treated wastewater. Jun-feng *et al*. (2007), Khan *et al*., (2010) [3, 11, 12], Al-Khamisi *et al*. (2011) and Khan *et al*. (2012) [3, 11, 12] also found treated wastewater improving the forage yield the crops. Mishra *et al*., (2008) [13, 18] and Thakur *et al*. (2011) [22] stated that the higher green fodder yield in the amendments applied plot might be attributed to better supply of nutrients by favourable physical environment leading to better root activity and higher nutrient absorption, which resulted in better plant growth and superior yields. The treatments influenced the green fodder yield of the CO (BN) 5 significantly. The yield was exhibited in the following trend: T_5> T_2> T_6>T_3>T_7 >T_4>T_1.

Table 1: Effect of treated sewage irrigation and organic amendments on green fodder yield of CO (BN) 5 (in tonnes/ha)

Trt No.	Green fodder yield (t/ha)	
	First harvest	Second harvest
T_1	133.74	160.59
T_2	162.05	205.51
T_3	151.99	187.09
T_4	140.32	167.38
T_5	167.17	211.03
T_6	156.27	195.96
T_7	147.40	178.73
SE (d)	4.54	3.44
CD	9.47	7.17

Significant results were observed in all the treatments

T_1- Control (100% NPK dose); T_2 - FYM @25t ha^{-1} + 100% NPK; T_3-FYM@25 t ha^{-1} + 75% NPK; T_4 -FYM@25 t ha^{-1} + 50% NPK; T_5 Vermicompost@5 t ha^{-1} + 100% NPK; T_6 – Vermicompost@5t/ha + 75% NPK and T_7– Vermicompost@5t/ha + 50% NPK.

Fodder quality parameters

The plant samples were collected during first and second harvest stage from all the treatment plots and used for proximate analysis. The important fodder quality parameters

viz., crude protein, crude fibre and crude fat contents were analysed.

Crude protein content

In general, crude protein content of leaves was higher than stems (Table.2). There was significant difference between treatments with respect to crude protein content. Among the treatments, T_5 (Vermicompost @5t ha^{-1} + 100% NPK) recorded the highest crude protein content of about 13.21% at first harvest and 13.34% at second harvest. The treatments T_2 (FYM @25 t ha^{-1} +100% NPK), T_3 (FYM@25 t ha^{-1} +75%NPK) and T_6 (Vermicompost@5 t ha^{-1} +75% NPK) were almost equal in terms of crude protein content, which were on par (12.16% – 12.77%) at first harvest and (12.51%-12.90%) at second harvest. Among the treatments tested, T_1 (Control – 100% NPK) had the lowest crude protein content of about 7.60 % at first harvest and 7.66 % at second harvest. Significant differences were noticed between treatments with respect to crude protein content because there were significant differences in nitrogen content among the treatments. Soni *et al*., (2016) [20] reported that the highest crude protein content of 9.76% in first cut and 8.34% in second cut of fodder sorghum was observed in sewage irrigation. This may be caused by the fact that many nutrients, particularly nitrogen, play an important role in the synthesis of plant proteins in waste water. Sufficient amounts of micronutrients are likely present in rhizospheric environments that induce additional nitrogen intake and can ultimately improve protein synthesis, and simultaneously some elements namely Cu and Zn get associated with protein structure and nitrogen metabolism (Jacob *et al*., 1995) [10].

Table 2: Effect of treated sewage irrigation and organic amendments on quality parameters of CO (BN) 5 in (%)

Trt. No	Crude protein (%)		Crude fibre (%)		Crude fat (%)	
	First harvest	Second harvest	First harvest	Second harvest	First harvest	Second harvest
T_1	7.60	7.66	11.00	11.52	6.00	5.00
T_2	12.77	12.90	27.50	26.83	7.33	6.66
T_3	12.16	12.51	25.00	23.86	6.67	6.00
T_4	9.36	11.16	23.50	21.33	6.33	5.33
T_5	13.21	13.34	21.00	18.89	8.00	7.00
T_6	12.68	12.69	18.00	16.50	7.00	6.33
T_7	9.97	11.55	15.00	15.17	6.66	5.67
SE (d)	0.24	0.37	0.46	0.44	0.15	0.12
CD	0.51	0.77	0.96	0.92	0.31	0.25

T_1- Control (100% NPK dose); T_2 - FYM @25t ha^{-1} + 100% NPK; T_3-FYM@25 t ha^{-1} + 75% NPK; T_4 -FYM@25 t ha^{-1} + 50% NPK; T_5 Vermicompost@5 t ha^{-1} + 100% NPK; T_6 – Vermicompost@5t/ha + 75% NPK and T_7 – Vermicompost@5t/ha + 50% NPK.

Crude fiber content

In general, crude fibre content of stems was more than that of leaves (Table. 2). The highest crude fibre content of 27.50% at first harvest and 26.83% at second harvest was recorded in T_2 (FYM @25 t ha^{-1} + 100% NPK) followed by 25% at first harvest and 23.86% at second harvest was recorded in T_3 (FYM @25 t ha^{-1} + 75% NPK). The lowest Crude fibre content was recorded in T_1 (Control-100% NPK) of about 11% at first harvest and 11.52% at second harvest. Pandey and Roy (2011) [18] reported that the hybrid Napier grass has crude fibre content of 30.50%. Owens (2009) [16] reported that the lower values of acid fiber (>30%) in the fodder are considered of good nutritional values. Soni *et al*., (2016) [20] reported that the high nitrogen and other nutrients contents present in sewage might have resulted in increase in leaf to stem ratio and consequently, an increase in forage proteins, while a decrease in stem fibre could be due to water content and solution carbohydrate enlargement that could eventually result in the NDF (Neutral detergent fibre) decrease in fodder. Some researchers have previously reported similar findings about the reduction of plant fibre in sorghum and some other forage crops with waste water irrigation. (Rusan *et al*., 2007) [19].

Crude fat content

In general, the crude fat content of the leaves was higher than the stem (Table 2). Among the treatments, crude fat content was ranged from 8 % to 6.00 % at first harvest and 7.00% to 5.00% at second harvest. The treatment T_5– Vermicompost@5 t ha^{-1} + 100%NPK (8.00% at first harvest and 7.00% at second harvest) showed the highest crude fat content followed by T_2 – FYM @25 t ha^{-1} + 100% NPK (7.33% at first harvest and 6.66% at second harvest). Among the treatments, T_1 – Control (recommended dose of NPK) showed the lowest crude fat content of about 6.00% at first harvest and 5.00% at second harvest. Soni *et al*., 2016 [20] stated that the crude fat content remained un-influenced by different irrigation quality water.

Conclusion

The current research found that the impact of TS on plant performance showed significant differences. It resulted in relatively highest green fodder yield in T_5 – Vermicompost@5 t ha^{-1} +100% NPK compared to Control (100% NPK). The forage plants looks vigorous and healthy in all organic amendments applied treatments when compared to control.

Based on the results of the study, it can be concluded that treated sewage irrigation with organic amendments increased crude protein content and green fodder yield. This suggests that the cultivation of CO (BN) 5 with effluent irrigation is a viable option to increase the fodder productivity. Thus, the use of wastewater can effectively contribute by recycling the nutrients present in the wastewater and by filling the increasing gap between water demand and water availability.

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References

1. AOAC. Official Methods of Analysis, 14th Ed. Association of Official Agricultural Chemists, Washington DC 1984.
2. Agunwamba JC. Analysis of socioeconomic and

environmental impacts of waste stabilization pond and unrestricted wastewater irrigation: interface with maintenance. Environ. Management 2001;27(3):463-476.
3. Alkhamisi SA, Abdelrahman HA, Ahmed M, Goosen MFA. Assessment of reclaimed water irrigation on growth, yield, and water-use efficiency of forage crops. Applied Water Science 2011;1(1-2):57-65.
4. Anon. National Accounts Statistics 2016. Central Statistical Organization, GOI 2018. http://mospi.nic.in/publication/national-accounts-statistics-2016.
5. Anon. Annual Report 2017-18. Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare, Government of India 2018. http://www.dahd.nic.in/reports/annualreport-2017-18.
6. Anonymous. IGFRI Vision 2050 2018. http:// www.igfri.res.in/2013/Vision-2050.pdf
7. AOAC. Official Methods of Analysis. 18th edn. Association of Official Analytical Chemists Arlington, VA, USA 2005.
8. Babu C, Iyanar K, Kalamani A. High green fodder yielding new grass varieties. Electronic Journal of Plant Breeding 2014;5(2):220-229.
9. CWC. Water and Related Statistics. Information Systems Organization, Water Planning and Organization Wing, Central Water Commission, RK Puram, New Delhi 2000;66:451.
10. Jacobs JS, Rigby F, Mckenzie M, Ryan Ward G, Burch S. Effect of nitrogen on pasture yield and qualitative for silage in Western Victoria. In The Australian Agronomy Conference (No. 2007) 1995.
11. Khan MA, Shaukat SS, Hany O, Jabeen S. Irrigation of sorghum crop with waste stabilization pond effluent: growth and yield responses. Pak. J Bot 2010;42(3):1665-1674.
12. Khan MA, Shaukat SS, Shahzad A, Arif H. Growth and yield responses of pearl millet (*Pennisetum glaucum* [L.] R. Br.) irrigated with treated effluent from waste stabilization ponds. Pakistan Journal of Botany 2012;44(3):905-910.
13. Mishra B, Sharma A, Singh SK, Prasad J, Singh BP. Influence of continuous application of amendments to maize-wheat cropping system on dynamics of soil microbial biomass in Alfisol of Jharkhand. Journal of the Indian Society of Soil Science 2008;56(1):71-75.
14. Mohan S, Dar EA, Singh M. Fodder quality of teosinte fodder as influenced by nitrogen, phosphorus and zinc application. Int. J Pure Appl. Biosci 2017;5:596-604.
15. Nadia el-sawaf. Response of sorghum spp. to sewage waste-water irrigation. Int. J Agric & Bio 2005;6:869-874.
16. Owens E. Fodder solutions Equine Digestibility Trial. Fodder Solutions. Solutions Equine Digestibility Trial. Equine University 2009.
17. Panday KC, Roy AK. Forage Crops Varieties 2011.
18. Pandey R, Mishra A. Livestock fodder requirements and household characteristics in rural economy of hilly region, Uttarakhand. ENVIS Bulletin: Himalayan Ecology 2011;19:1-5.
19. Rusan MJM, Hinnawi S, Rousan L. Long term effect of wastewater irrigation of forage crops on soil and plant quality parameters. Desalination 2007;215(1-3):143-152.
20. Soni PG, Yadav RK, Kumar A, Yadav G, Kumar G, Yadav T. Effect of Domestic Wastewater and Irrigation Schedules on Quality of Fodder Sorghum. Journal of Soil Salinity and Water Quality 2016;8(2):173-179.
21. Steel RGD, Torrie JH. Principles and Procedures of Statistics. McGraw Hill Book Co., Inc., Singapore 1984.
22. Thakur R, Sawarkar SD, Vaishya UK, Singh M. Impact of continuous use of inorganic fertilizers and organic manure on soil properties and productivity under soybean-wheat intensive cropping of a Vertisol. Journal of the Indian Society of Soil Science 2011;59(1):74-81.
23. Wang JF, Wang GX, Wanyan H. Treated wastewater irrigation effect on soil, crop and environment: Wastewater recycling in the loess area of China. Journal of Environmental Sciences 2007;19(9):1093-1099.