Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.2786

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (4):** 577-581 (2017)

International Journal of Pure & Applied Bioscience

Review Article

OPEN ACCESS

Prospects of Agro-Industrial Waste for Sustainable Soil Productivity-A Review

Fozia Shafiq Wani*, **Andleeb Mushtaq Khan and Juvaria Jeelani**

Division of Soil Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar- 190025 (J&K), India

*Corresponding Author E-mail: foziawani88@gmail.com

Received: 1.04.2017 | Revised: 10.04.2017 | Accepted: 11.04.2017

ABSTRACT

Agro-industrial wastes are generated during the industrial processing of agricultural or animal products. Products such as bran, straw of wheat, straw of rice, hull of soy, corn, rice, sugar cane molasses, beet molasses, bagasse of sugarcane, cassava flour and its wastewater are representative candidates of agro-industrial waste[8] (Thavasi et al., 2014). These wastes are generated in large amounts throughout the year, and are the most abundant renewable resources on earth. Agro-industrial waste hold good nutrient value and can be used as an ammendent in soil.They significantly improve crop yield and soil fertility. Reduce the global dependence on fertilizers, fossil fuels etc. Due to the large availability and composition rich in compounds that could be used in other processes, there is a great interest on the reuse of these wastes, both from economic and environmental viewpoints. The economical aspect is based on the fact that such wastes may be used as low-cost raw materials for the production of other value-added compounds, with the expectancy of reducing the production costs. The environmental concern is because most of the agro-industrial wastes contain phenolic compounds and/or other compounds of toxic potential; which may cause deterioration of the environment when the waste is discharged to the nature.

Key words: *Agro-industrial wastes, Bagasse, Husk, Pressmud, Spent wash.*

INTRODUCTION

Wastes are unwanted or unusable materials. Waste is any substance which is discarded after primary use, or it is worthless, defective and of no use.

Waste comes in different forms:

- Agriculture waste
- House hold waste
- Human waste
- Industrial waste
- Biomedical waste
- Radioactive waste

Agro-industrial wastes are generated during the industrial processing of agricultural or animal products. Those derived from agricultural activities include materials such as straw, stem, stalk, leaves, husk, shell, peel, lint, seed/stones, pulp or stubble from fruits, legumes or cereals (rice, wheat, corn, sorghum, barley) bagasses generated from sugarcane or sweet sorghum milling, spent coffee grounds, brewer's spent grains, and many others. resources on earth.

Cite this article: Wani, F.S., Khan, A.M. and Jeelani, J., Prospects of Agro-Industrial Waste for Sustainable Soil Productivity-A Review, *Int. J. Pure App. Biosci.* **5(4):** 577-581 (2017). doi: http://dx.doi.org/10.18782/2320-7051.2786

A proper use of such industrial wastes will influence the productivity of the soil as well as maintain healthy environment.

- **WASTE BY-PRODUCTS FROM SUGAR FACTORIES**
- **PRESSMUD**

Pressmud or filter cake, a waste by-product from sugar factories, is a soft, spongy, amorphous and dark brown to brownish material which contains sugar, fiber, coagulated colloids, including cane wax, albuminoids, inorganic salts and soil particles. By virtue of the chemical composition and high content of organic carbon, the usefulness of pressmud as a valuable organic manure has been reported by several workers[3]. Said Ghulam *et al*[1]., concluded that effect of different treatments of pressmud on soil fertility parameters and nutrient availability was quite remarkable (Table 1). Organic matter, total nitrogen and available P and K increased progressively with increasing rates of pressmud application. Application of different doses of pressmud also affected the physico-chemical characteristics of the soil positively (Table 1). The increasing level of pressmud application from 2 t ha^{-1} to 20 tones ha^{-1} decreased the dry bulk density of the soil and increased the total porosity. Rangaraj *et al*[6]., also reported in their research experiment that agro-industrial wastes (pressmud, coir pith) as organic manures favourably improved soil organic matter, microbial population and enhanced the soil macro (N, P, K) and micro nutrients (Zn,Cu, Mn and Fe).

Table 1: Effect of Press Mud on Soil Fertility Parameters[1]

TREATMENTS	SOIL FERTILITY PARAMETERS (mg kg^{-1})									
	O.M	Total N	Avail P	Avail K	Cu	Fe	Dry Bulk Density (g cm^{-3})	Total Porosity (%)	pH	EC (dsm^{-1})
Control	8000	310	8.2	161	4.5	4.0	1.32	50.00	8.1	0.39
Fertilizer (NPK)	8000	340	24	173	4.5	4.0	1.32	50.00	8.1	0.39
P1 (Pressmud 2 t ha^{-1})	8160	400	52	186	5.0	4.0	1.32	50.00	8.1	0.42
P2(Pressmud 4 t ha^{-1})	8300	460	106	205	5.0	4.5	1.32	50.20	8.0	0.42
P3(Pressmud 6 t ha^{-1})	8410	590	161	219	5.5	4.5	1.30	50.20	8.0	0.46
P4(Pressmud 10 t ha^{-1})	8480	680	220	234	6.0	5.0	1.30	50.40	7.9	0.50
P5(Pressmud 15 t ha^{-1})	8560	820	296	251	6.5	5.0	1.28	50.40	7.9	0.55
P6(Pressmud 20 t ha^{-1})	8590	840	312	270	6.5	5.0	1.28	50.60	7.8	0.53

- **BAGASSE**

Bagasse is the fibrous matter that remains after sugarcane or sorghum stalks are crushed to extract their juice. It is used as a biofuel and in the manufacture of pulp and building materials. Bagasse is an extremely inhomogeneous material comprising around 30-40% of "pith" fibre, which is derived from the core of the plant and is mainly parenchyma material, and "bast", "rind" or "stem" fibre which comprises the balance and is largely derived from sclerenchyma material. It has been found to be the best substrate for the growth of cellulolytic and ligninolytic microorganisms an excellent carrier for bacterial inoculants. Osama *et al*[5]., (Table 2) concluded that with increase in bagasse content from 0t/ha to 75t/ha bulk density of soil decreased while as porosity and N, P, K content of soil increased.

Table 2: Effect of Bagasse on Properties of Soil[5]

	CHEMICAL PROPERTIES			PHYSICAL PROPERTIES	
Treatments	**N %**	**P ppm**	**K Kg^{-1} soil**	**Soil bulk density ($g\ cm^{-3}$)**	**Porosity %**
Bagasse 0 t/ha	0.028	11.32	1.14	1.71	35.5
Bagasse 15 t/ha	0.036	15.51	1.82	1.58	40.4
Bagasse 45 t/ha	0.049	19.50	1.91	1.52	42.6
Bagasse 75 t/ha	0.052	21.32	1.98	1.45	45.3

Table 3: Effect of Rice Husk on Properties of Soil[4]

Treatment	**PHYSICAL**		**CHEMICAL**			
	Bulk density ($g\ cm^{-3}$)	**Total porosity (%)**	**Total nitrogen (%)**	**Available P (ppm)**	**Electrical Conductivity (m mhos/cm)**	**Soil acidity (pH)**
Control (RH0)	1.34	49.3	0.086	3.40	47.5	6.16
RH at 2 tons ha^{-1}	1.29	51.3	0.098	3.80	15.0	6.50
RH at 4 tons ha^{-1}	1.19	55.1	0.130	4.45	10.0	6.57
RH at 6 tons ha^{-1}	1.17	55.8	0.131	4.90	10.0	6.78
LSD	0.0384	4.303	0.0439	0.3375	14.16	0.450

- **WASTE BY-PRODUCT FROM RICE MILLING INDUSTRY**
- **RICE HUSK**

Rice husk from paddy (Oryza sativa) is one example of alternative material that has a great potential. Rice husk is a major by-product of the rice milling industry. Rice husk is an agricultural residue abundantly available in rice producing countries. During milling of paddy about 78 % of weight is received as rice, broken rice and bran. Rest 22 % of the weight of paddy is received as husk. The annual rice husk produce in India amounts is generally approximately 120 million tons. Around 20% of paddy weight is husk. Ogbe *et al*[4]., concluded(Table 3) that both the physical and chemical properties of soil were affected by the application of rice rusk as compared to control.

- **WASTE BY PRODUCT FROM DISTILLERY**
- **SPENT WASH**

During the production of alcohol from molasses the waste product is the effluent called spent wash. The distillery spent wash is hot, highly coloured and acidic, apart from containing high percentage of dissolved inorganic and organic matter, the latter being particularly responsible for high biochemical oxygen demand (BOD) and the polluting nature of the waste. Spent wash of Indian distilleries also contains higher amount of potash. In India, about 15,000 million liters of spent wash is produced annually from 246 distilleries which is characterized by undesirable color, foul odor, high biological oxygen demand (BOD: 5,000–8,000 mg l^{-1}) and chemical oxygen demand (COD: 25,000–30,000 mg l^{-1})[2] and can be used for irrigating the crops only after dilution. When the effluents with high BOD values are discharged onto the agricultural fields, these can create problems to some of the soil processes. Spent wash is very rich in organic component and possess high BOD value. Due to its richness in nutrients its use for the agricultural purposes is very common. Upon application of spent wash increase in organic matter, nutrient and soluble carbon has been previously reported. Use of spent wash for the agriculture purposes also avoid many environmental risks associated with the water pollution. Sharma[7] concluded that the physical properties of soil were significantly influenced by different doses of effluent and chemical fertilizer (Table 4). Increasing dose of effluent and decreasing dose of chemical fertilizer decreases the bulk density of soil. However, water holding capacity and porosity increases with increase in effluent doses. Lowest bulk density and highest water holding capacity and porosity of soil was recorded under 25% recommended dose of chemical fertilizer + 75% effluent treatment. Electrical conductivity, organic carbon and total K of soil were significantly influenced by different doses of effluent and chemical fertilizer. Soil pH, total N and total P of soils does not influence by spent wash and chemical fertilizer. Available primary, secondary and micro nutrients (N, P, K, Ca, Mg, S, Fe, Zn, Cu, Mn and Mo) content of soil was significantly influenced by different doses of effluent and chemical fertilizer. Highest available primary, secondary and micro nutrients content of soil was recorded under 25% recommended dose of chemical fertilizer + 75% effluent treatment.

Table 4: Effect of Spent Wash on Physical Properties of Soil In Sugarcane[7]

Treatment	Bulk density (g/cc)	WHC (%)	Porosity (%)	pH	EC (dSm^{-1})	O.C. (%)	N (%)	P (%)	K (%)
100% RDF	1.43	27	33.5	7.9	0.36	0.56	0.51	0.17	2.10
75% RDF+25% effluent	1.38	30	35.0	7.8	0.39	0.61	0.52	0.18	2.23
50% RDF+50% effluent	1.33	33	36.2	7.7	0.41	0.65	0.52	0.19	2.33
25% RDF+75% effluent	1.29	35	37.3	7.5	0.42	0.68	0.53	0.19	2.43
CD (P=0.05)	0.05	2.7	1.3	NS	0.02	0.03	NS	NS	0.11

CONCLUSION

- Agro industrial waste hold good nutrient value and can be used as an amendment in soil.
- 'Waste-to-Wealth' perception of agricultural waste.
- Significantly improve the crop yield, soil fertility.
- Reduces the global dependence on chemical fertilizers, fossil fuel etc.

REFERENCES

1. Ghulam, S., Khan, M.J., Usman, K. and Rehman, H., Impact of pressmud as organic amendment on physico-chemical characteristics of calcareous soil. *Sarhad Journal of Agriculture*, **26:** 565-570 (2010).
2. Jain, R., and Srivastava, S., Nutrient composition of spent wash and its impact on sugarcane growth and biochemical attributes. *Physiology and Molecular Biology of Plants*, **18:** 95–99 (2012).
3. Nehra, A.S. and Hooda, I.S., Influence of integrated use of organic manures and inorganic fertilizers on lentil & mungbean yields and soil properties. *Res. on Crops*, **3:** 11-16 (2002).
4. Ogbe, V.B., Jayeoba, O.J. and Amana, S.M., Effect of rice husk as an amendment on the physico-chemical properties of sandy-loam soil in lafia, southern-guinea savannah, Nigeria. *Production Agriculture and Technology*, **11:** 44-55 (2015).
5. Osama, A.M., Elamin, A.A. and Abdelgani, M.S., Effect of sugar cane bagasse, cattle manure and sand addition

on some physical and chemical properties of the clay soils and sunflower production in central of sudan. *International Journal of Scientific & Technology Research*, **3:** 47-52 (2014).

6. Rangaraj, T., Somasundaram, E.M., Amanullah, M., Thirumurugan, V., Ramesh, S. and Ravi, S., Effect of agro-industrial wastes on soil properties and yield of irrigated finger miller (*Eleusine coracana L.Gaertn*) in coastal soil. *Res. J. Agric. & Biolog Sci.*, **3:** 153-156 (2007).
7. Sharma, A., Effect of spent wash and chemical fertilizer on sugarcane yield and properties of soil. *Technofame- A Journal of Multidisciplinary Advance Research*, **3:** 25 -29 (2014).
8. Thavasi, R., Marchant, R. and Banat, I.M., Biosurfactant applications in agriculture.**In:** *Biosurfactants:Production and Utilization Processes, Technologies and Economics*.[Eds N. Kosaric and F.V.Sukan]. NewYork, pp. 313–326 (2014).