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AGRICULTURAL WASTE UTILIZATION FOR HEALTHY ENVIRONMENT AND SUSTAINABLE LIFESTYLE

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Abstract

The study was conducted in two districts of Haryana state namely; Hisar and Sonipat, and a total no. of one hundred twenty farmers were selected and interviewed with the help of well structured schedule. The study revealed that awareness about the utilization of biogas plant waste, mushroom waste, wheat waste, mustard and horticultural waste was more than 70 percent. Thus, overall awareness about utilization of agricultural waste was very high but utilization of agricultural waste by the farmers was very less.

Results pertaining to benefits to farmers after utilization of agricultural waste revealed that most of the farmers were benefited in very ordinary ways like high milk yield, addition income by selling waste to brick yards, reduced expenditure on chemical fertilizers, reduced waste available for disposal, clean and safe environment, etc.

Employment opportunities will increase if industries like processing units for making value added products, handicrafts industries for making bags, mats, hats, carpets, etc., handmade paper industry, development of waste collection centers in villages and others are developed in villages.

Keywords: *Agricultural Wastes, Awareness, Utilization and sustainability*

Introduction

Agricultural wastes are basically unusable substances which may be either liquid or solid produced as result of cultivation processes such as fertilizers, pesticides, crop residues and animal waste. Agricultural waste management is part, of the ecological cycle in which everything is cycled and recycled such that an interdependent relationship is maintained in the eco-system. By waste management, all the plant wastes are placed at the right place and right time for the best utilization in order to convert into useful products and pollution control. Globally, 140 billion metric tons of biomass is generated every year from agriculture. Ministry of New and Renewable Energy (MNRE 2009), Govt. of India estimated that about 500 Mt of crop residue is generated every year. These wastes are destroyed by burning or allowed to decay in public places in the open air creating environmental pollution. Thus by managing these crop wastes in a well planned manner we can maintain a healthy environment for ourselves and all other living creatures. This study will highlight some of the trends that could be adopted in the agricultural waste management so that the farmers become aware and take full advantage of the various possibilities of plant waste cycling, recycling and further utilization for economic purpose.

Materials and methods

The study was conducted in two districts of Haryana state, Hisar and Sonipat, purposively selected. Further 6 villages were selected randomly and ten farmers were selected

randomly from each village and thereby a total number of 120 farmers having multiple cropping systems were interviewed for the study.

Results and discussion

Personal profile of the farmers (Table 1): Personal profile of the farmers indicated that most of the farmers were from middle age group (36-50 years), were educated up to metric, belonged to joint family of medium size with 4-6 members. Majority of the farmers had their main occupation as farming and land holding up to 5 acres. Among mass media exposure, utilization of newspaper among the farmers was maximum followed by TV, radio, kisan seva kendra and magazine. The extent of utilization of newspaper, radio and T.V. was daily and magazine and kisan seva Kendra was often. Out of 120 farmers only 55 (44.85 percent) farmers underwent training or workshop related to management of their waste. Among the contacts with extension officials maximum contact of farmers was with progressive farmers, followed by scientist, ADO, SDAO/SMS and NGO. The frequency of contact with progressive farmers and scientists was weekly, ADO and SDAO/SMS was whenever needed and monthly with NGO.

Table 1. Profile of the respondents

S. No.	Variable(s)	Category	No. of Respondents	Percentage (s)
1	Age (years)	Middle (36-50)	60	50.00
2	Education	Metric	43	35.83
3	Family type	Joint	85	70.83
4	Family size	Medium (5-6members)	48	40.00
5	Occupation of respondent	Only farming	98	81.67
6	Land holding	Up to 5 acres	36	30.00

Facilities available with the farmers (Table 2): Facilities available with the farmers either personal or public indicated that only 63.33% of farmers could easily avail to laborers/manpower, 39.16 % of farmers had transport facility for waste, 42.50% of farmers had personal composting units, 34.17% farmers had personal biogas plants, only 8.33% of farmers had the facility of community waste collection centers and famers did not have any common waste dumping sites or block making machine in their villages.

Awareness among the farmers about the products made from agricultural wastes

Awareness: awareness among the farmers about the utilization of agricultural waste was noticed to be very high. The result was apposite as the farmers were well educated and had regular mass media contact. Radio and TV were the most common and easily accessible source of agriculture information for farmers including contact and non contact groups, (Ahmed 2009). Farmers had regular contact with extension officials and often visited to KVKs, Sheikh *et al.* (2007) reported that ATIC is performing excellent role of information spread.

Table 2: Facilities available with the farmers

S. No	Particulars	No. of Respondents	Percentage
1	Compost plant	51	42.50
2	Transportation facility for waste	47	39.16
3	Biogas plant	41	34.17
4	Community waste collection centre	10	08.33
5	Common waste dumping site	0	00.00
6	Block making machine	0	00.00

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One hundred twenty farmers from two districts of Haryana state, namely, Hisar and Sonipat were interviewed. It was observed that 100 percent farmers were aware regarding the use of agricultural waste to make animal feed, biogas, animal shelter and its use as energy source. Awareness regarding making compost, vermicompost and organic manure was found 97.50 percent. Awareness about making poultry litter was 96.67, for generating electricity was 90.00 percent, mulching and handicrafts was 85.00 percent, making beauty products was 80.83 percent, paper, cardboard and particle board was 75.83, making briquettes was 52.50, planting bed was 51.67 and awareness about making chemicals was 40.00 percent. Low percentage of awareness was noticed regarding making activated carbon (29.17 percent) followed by Bioplastics (24.17 percent), textile fiber (20.83 percent) and utensils (00.83 percent).

Overall awareness about the utilization of agricultural wastes

The overall awareness among the farmers about utilization of different crop waste is presented in the figure 1. The figure clearly describes the awareness about the utilization of different crop waste. Awareness about utilization of wheat straw was 72.33 percent and paddy waste was observed 63.94 percent. Awareness about utilization of sugarcane waste was 62.73 percent. Awareness about utilization of cotton sticks was 61.33 percent and about utilization of mustard sticks was observed 70.08 percent. Awareness about utilization horticultural waste was 70.54, about utilization of floricultural waste was 64.12, utilization of mushroom waste was 72.50 percent, utilization of livestock waste, biogas plant waste and poultry was 68.33, 98.75 and 58.75 percent respectively.

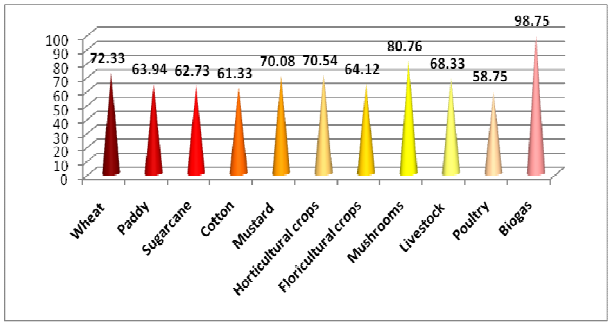

Figure 1: Overall awareness about utilization of agricultural wastes

Overall utilization of different agricultural wastes

Paddy waste: From paddy crop the byproducts or residues are paddy straw, paddy husk and rice bran but only paddy straw is being utilized by farmers. Sixty seven farmers cultivated paddy crop and all of them stored it for future use as animal feed and for making animal bed and shelter (100.00 percent), about 82.08 percent farmers sold it, 77.61 percent use

it for mulching purpose, 56.72 percent used it for composting and vermicomposting and only 1.47 percent farmers used it for fuel purpose. Paddy straw can be used as a source of energy for in small scale processing units, for carrying out various processes like washing, boiling, canning, etc. A mushroom processing unit is being run by a farmer in village Aterna of district Sonipat, his processing unit works under biomass energy. Paddy straw, cotton sticks, mustard sticks and husk is utilized as a source of energy in the processing unit.

Wheat waste: Straw is a byproduct of wheat crop. Wheat straw can be used for making many products but all the farmers store it and use it for animal feed and 57.50 percent farmers sell wheat straw as feed for animals. It was reported that, 81.67 percent farmers are aware that wheat straw can used for making particle board but neither they sell wheat straw to particle board industries nor they utilize it to make other products like briquettes, dry flowers, hats, mats, carpets and other handicrafts. The results has been found consonant with the result of Rose Marie Garay *et al*. (2009) who found that particle board can be made with crop residues mixed with wood from *pinus radit,* all the crop residues like wheat straw, corn and rice straw are suitable for making particle boards but best results were with wheat straw and corn stubbles.

Sugarcane waste: From sugarcane crop, residues are sugarcane trash and bagasse. From the farmers those who cultivated sugarcane (43farmers), 48.83 percent used the bagasse as fuel in making jaggery, 46.51 percent turned it into compost/vermicompost and only 11.62 percent sold it to paper/cardboard industry or power plant. Farmers used sugarcane trash to feed their animals (100.00), composting/vermicomposting (46.51), sell as animal feed (16.28) and use it for mulching (1.67). Apart from composting and feeding bagasse and trash to animal, bagasse can also be used as planting for growing green fodder. Beside this sugarcane bagasse has one more important use which is production of biogas; this is similar to the findings of Dellepiane et.al (2003) who conducted the study due to the existing difficulty of finding energy sources and reducing pollution, the use of renewable sources and highly efficient technologies for electrical energy production, the combination of these two aspects, namely, a molten carbonate fuel cell system fed with biomass derived syngas. In particular, the biogas comes from bagasse and barbojo, the sugarcane residues. So far in developing countries they have been wasted or partly used with poorly efficient technology.

Cotton waste: Seventy five farmers cultivated cotton crop. Cotton sticks which are left after the picking of cotton are used as fuel and stored by all the farmers. Cotton sticks were not utilized for any other purpose. If the farmers sell the cotton sticks to power plants, plywood industries, particle board industries they can add to their income. Another way of changing the waste cotton sticks into useful material is by chipping and converting them into compost. Cotton waste can also be used in biogas production by treating it anaerobically. This was similar to the findings of Isci A et.al (2006), who found out that cotton wastes are a good source of biogas. Approximately 65, 86 and 78 ml CH_4 were produced in 23 days from 1 g of cotton stalks, cotton seed hull and cotton oil cake in the presence of basal medium (BM), respectively. BM supplementation had an important positive effect on the production of biogas.

Mustard waste: Mustard was cultivated by 102 farmers. Mustard sticks and husk are two major byproducts from mustard crop. Mustard sticks and husk are sold to brick industries by all the farmers who cultivate it (100.00), 90.19 percent farmers stored it for future use, percent 73.52 percent used it for burning in chulha and only 16.66 percent farmers use it for composting. A profitable way of managing mustard sticks is chipping and composting or feeding to animals after treating with ammonia. Another important material which can be made from mustard sticks are briquettes. Mustard stalk, mixed waste of tree leaves and grasses in 3:1 proportion and wood waste along with three organic binding materials (molasses, press mud and distillers dry grain) with varying concentration of 5, 10, 15 and 20%

can be used for preparing briquettes. Press mud was is a better binding agent, followed by distiller's dry grain and molasses. This was similar to the finding of the result by Andrade *et al*. (2001) who reported the physical characteristics like moisture content, bulk density, compression ratio and compressive strength desired for better utilization and safe handling and transportation are found to be best for briquettes made from press mud and mustard stalk at die pressure of 123.42 MPa.

Horticultural waste: Horticultural crops were cultivated by 64 farmers. Damaged or spoiled fruits and vegetables, dead plants, branches, leaves and unsold fruits and vegetables are the horticultural wastes. Among these damaged fruits and vegetables are turned into compost/vermicompost or fed to animals by 70.31 percent of farmers. The dead plants, branches and leaves were fed to animal by 100.00 percent and composted by 70.31 percent of farmers. Unsold fruits and vegetables are fed to animals by 100.00 percent, composted by 70.31 percent, and 26.56 percent farmers sold it after processing. Value added products can be made from surplus fruits and vegetables and then sold in market this will not only help the farmers avoid wastage but to earn more. Another way of preserving the unsold fruits and vegetables is drying them and then selling. Various chemical can also be extracted from waste fruits and vegetables like citric acid, lactic acid, acetic acid, etc. Production of Lactic acid was studied by Manoj *et al.* (2012) that it can be produced through the batch & fed batch fermentation method using hydrolyzed potato starch, results from the findings of Chunpeng Znang *et al.* (2011) concluded that potato residues can also be used for extraction of pectin.

Floricultural waste: Flowers were cultivated by only 14 farmers. After picking of flowers the whole plant is a waste along with the damaged and unsold flowers. The left flowers are generally sold at least price by 100.00 percent of farmers, used in composting, vermicomposting and green manuring by 71.43 percent of flowers. The dead plants and waste flowers are either used in composting, vermicomposting or in green manuring by 8.33 percent of farmers. The left out flowers can be dried and powdered and cut flowers can be used for making dry flowers which is an upcoming industry. The dry-flowers can be painted, colored, dyed and various floral products such as cards, pictures, wall hangings, arrangements, pot-pouris and pomanders can be prepared out of them. This was relevant to the result of study conducted by Bharati *et al.* (2007) who reported that the dry flower can be painted, colored, dyed and sold at very high prices.

Mushroom waste: Mushrooms are produced on natural materials taken from agriculture, woodlands, animal husbandry, and manufacturing industries. After mushroom crops are harvested, millions of tonnes of "spent" (used) mushroom substrate become available for other uses. The used growing medium is far from spent. It is clear from table 25 that; it is used as manure, for gardening, for making nurseries and growing vegetables by all the farmers those who grow mushrooms use the waste mushrooms for composting and vermicomposting, 16.67 percent farmers fed it to animals and used for biogas generation. The spent compost was used for vermicomposting, manuring and planting bed by 100.00 percent of farmers. Surplus mushrooms were sold at least price by all the farmers and sold after processing by 33.33 percent of farmers. Another way of handling spent substrate from *Agaricus bisporus* production is relevant with the study conducted by Danny Lee Rinker (2002), which is already in wide use in horticulture as a component of potting soil mixes; in agriculture or landscape trades to enrich soil; as a casing material in the cultivation of subsequent *Agaricus* crops, in vermiculture as a growing medium, in wetlands for remediation of contaminated water, in stabilizing severely disturbed soils, in the bio-remediation of contaminated soils, as a bedding for animals, as an animal feed, and to control plant diseases. Spent substrate from other mushroom species has found acceptance as food for animals, as ingredients in the cultivation of other mushroom species, as fuel, as a medium for vermiculture, to enrich soils, and as a matrix for bio-remediation.

Biogas plant waste: Forty one farmers possessed biogas plant. Slurry thrown out of the biogas plant is utilized by the farmers (100.00) as manure and for composting and vermicomposting by 78.04 percent of farmers. This result was analogous with the findings of Ponni *et al.* (2007) that vermicompost can be used as manure on farm, the application of FYM + vermicompost @ 2.5t/ha along with the panchagavya 3% proved to be the best treatment as it was found to record the highest plant height (83.17cm), no. of branches (38.23) and leave (1115.87) and also recorded the mass herbage (44.81g/plant).

Livestock waste: livestock was owned by all the farmers. All the farmers used the waste to make dung cakes this was relevant to the study conducted by Mehta *et al.* (2002), who reported that in Haryana all the farmers make dung cakes daily and the problems faced by the respondent in procurement of fuel were time constraint health and drudgery psychological and lastly economical problems. Only 34.17 percent of farmers used to generate biogas, 42.5 percent farmers used it for composting/vermicomposting and only 1.67 percent farmers used it for making bio insecticide. Currently the energy consumption is rising and there is need of an alternate energy source, this problem can be solved by utilizing the agriculture biomass for generating energy. A study was conducted in this context by Chaiprasert (2011) in Thailand and reported that the potential of biogas production from major sources of animal manure, agro-industrial wastes, and organic fraction municipal solid waste was annually produced 1060, 1005, and 870 million m^3, respectively. Major agro-industrial wastes, animal farm waste and municipal solid waste were sources of biogas feedstock in biogas technology. Thus a better way of producing clean energy is biogas technology.

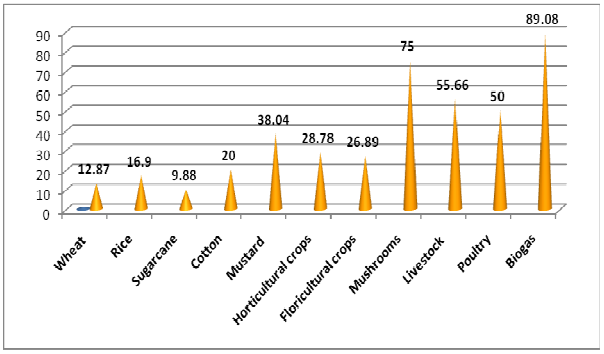

Figure 2: Overall utilization of various agricultural wastes

Gap between awareness and utilization of agricultural wastes

The huge gap between awareness and utilization is shown in the figure 3. The awareness about the utilization of wheat waste was 72.33 percent and utilization of wheat waste was 12.87 percent. Awareness about utilization of paddy waste was 69.94 percent and utilization was computed as 16.90 percent, awareness about utilization of sugarcane waste was 62.73 percent and utilization was 9.88 percent, awareness about utilization of cotton waste was computed as 61.33 percent and utilization as 20.00 percent, awareness about utilization of mustard waste was 70.08 percent and utilization was 38.04 percent, awareness about utilization of horticultural waste was computed as 70.54 percent and utilization was computed as 28.78 percent, awareness about utilization of floricultural waste was 64.12 percent and utilization was computed as 26.89 percent, awareness about utilization of mushroom waste was 80.76 percent and utilization was 75.00 percent, awareness about utilization of livestock waste was 68.33 percent and utilization was 55.66 percent, awareness about utilization of poultry waste was 58.75 percent and utilization was 50.00 percent and

awareness about utilization on of biogas waste was computed as 98.75 percent and utilization was 89.08 percent.

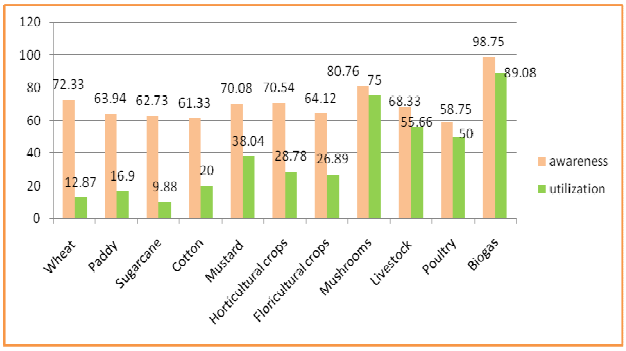

Figure 3: Gap between awareness and utilization

Conclusion

The study revealed that there was a huge difference between the awareness and utilization of agricultural waste. This difference existed due to lack of interest among the framers. Thus there is need to motivate farmers which can be made possible by organizing trainings, lectures, showing films to farmers or demonstrating waste management techniques on field.

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