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Divulging Satisfaction Levels of Residents for Household Waste Management through Vermicomposting at Dr. Rajendra Prasad Central Agricultural University: A Cross-sectional Exploration

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Authors' contributions

This work was carried out in collaboration among all authors. Author UK designed the study, performed the tabulation, wrote the protocol and wrote the first draft of the manuscript. Author SJ supervised the work as incharge of vermicompost unit. Author SPL did the exhaustive literature reviews and the statistical analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

The reduction of household wastes has been a pressing issue and is a key element of waste management programme in India. The goal of present research was to evaluate the ongoing Household Waste Management Practices (HWMPs) of the University in managing the waste generated within it. To realize this goal, researchers conducted survey and investigative study with campus residents on HWMPs being followed in the campus. In this backdrop, the present study

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was conducted with the following two objectives: To measure the Socio-Personal, Socio-psychological profiles and appraisal of on-site treatment of Household Waste of the Respondents with scientific parsimony and to quantify overall satisfaction level of the respondents as dependent variable. Out of total 750 residential quarters in the university from which 50 household heads of the quarters were selected through 'probability simple random sampling'. In qualitative methods observation, interviews, open-ended surveys, focus groups and oral history were used. Closely 90 percent of respondents were well acquainted with the fact that collected household wastes are being converted into vermi-compost inside the university campus itself. More than one-fourth of the respondents addressed the problem of throwing garbage around the metallic dustbins. In order to generate statistical information quantitative survey of satisfaction level was done which revealed that more than 80 percent respondent showed their satisfaction for HWMPs. By applying the Pearson chi-square test it was revealed that satisfaction level of the respondents were inclined 'towards satisfied to fully satisfied' categories with the chi-square value, i.e. 24.72 was significant at 1% level with P-value of 0.001. So, it can be concluded that residents were satisfied from waste management programme and thus rejecting the framed null hypothesis. So, it can be inferred that this model of waste management may be recommended and replicated throughout the country and abroad.

Keywords: Household waste management (HWM); on-site treatment; organic waste; satisfaction; vermi-composting.

1. INTRODUCTION

Catastrophic growth in population, massive urbanization, and industrialization have led to enormous municipal and domestic waste generation on a daily basis [1]; which is supposed to increase significantly in the near future and will depend on multiple factors *viz.*, population density, economic status, and level of commercial activity, region and culture. Global annual waste generation was 2.01 billion tonnes of solid waste in the year 2016 and is expected to jump to 3.4 billion tonnes over the next 3 decades i.e. a jump of around 70 Percent by 2046 due to rapid urbanization and growing populations [2]. World waste generation rate is expected to be nearly 27 billion tones/year by 2050, 1/3rd of which will be contributed from Asia, mainly from China and India [3,4]. The approx quantum of municipal solid waste (MSW) per day and per capita generated in India is 133760 tonnes and 0.17 kg per person/day in small towns to 0.62 kg per person/day in cities, respectively (Kumar et al., 2017). India produces nearly 133,760 tonnes of MSW/day, of which approximately 25,884 tonnes is treated [5,4]. Annual report of Central pollution Control Board (CPCB) 2015-16 indicated Bihar generates 1670 tonnes solid waste on a daily basis [6].

So, it was felt that satisfaction measurement is a key parameter to secure sustainability of the RPCAU, Pusa waste management programme in a long run. In this backdrop, the present study was conducted with the following two objectives: i) To measure the Socio-Personal, Socio-psychological profiles and appraisal of on-site treatment of Household Waste of the Respondents with scientific parsimony. ii) To quantify overall satisfaction level of the respondents as dependent variable.

2. MATERIALS AND METHODS

The investigation was carried out in Dr. Rajendra Prasad Central Agricultural University, Pusa during 2017-18 to know the on-site treatment of Household Waste at Dr. Rajendra Prasad Central Agricultural University, Pusa. RPCAU has 1011 employees (253 Scientists/Teachers + 758 officers/Staffs). RPCAU having approximately 5000 population residing in total 750 residential quarters in the university as reported by university estate authorities; from which 50 household heads of the quarters were selected randomly for the present study. To understand the public opinion regarding ongoing household waste management activities of the University a survey was conducted with 50 house hold to study awareness on household waste management initiatives of the University [7]. To reach the sample size of 50 researchers selected Confidence Level of 95%, Confidence Interval of 13 for the Population of 750 households and from that calculation, sample size needed was 53; so to round up sample size of 50 was taken. Face-face interview method was used to collect the primary data and for this pretested interview schedule was made, one member from the

randomly selected household in different categories of quarters was interviewed [8]. Both, qualitative and quantitative methods were used for the data collection as there exist fundamental distinction between these methods. In qualitative methods observation, interviews, open-ended surveys, focus groups and oral history were used. Both descriptive statistics and inferential statistics were used for as per the need of the present investigation.

2.1 Location of the Study Area

RPCAU, Pusa has historical significance since the foundation stone of the Agricultural Research Institute and college was laid by Lord curzon on the 1st of April, 1905 at Pusa. It lies approximately at 25°98" N latitude and 85°67" E longitude [9].

3. RESULTS AND DISCUSSION

3.1 Socio-Personal, Socio-psychological Profiles and Appraisal of on-site Treatment of Household Waste of the Respondents

3.1.1 Educational qualification of respondents

The study conducted on the profiles of the respondents (Table 1) revealed that more than half of the respondents majority of respondent were postgraduate (54%) followed by graduate (22%) intermediate (14%) and matriculate (10%). As teaching, research and extension activities are core duties of the University and these are accomplished by means of different categories of scientific, technical administrative and supporting staff. Their qualification varies depending

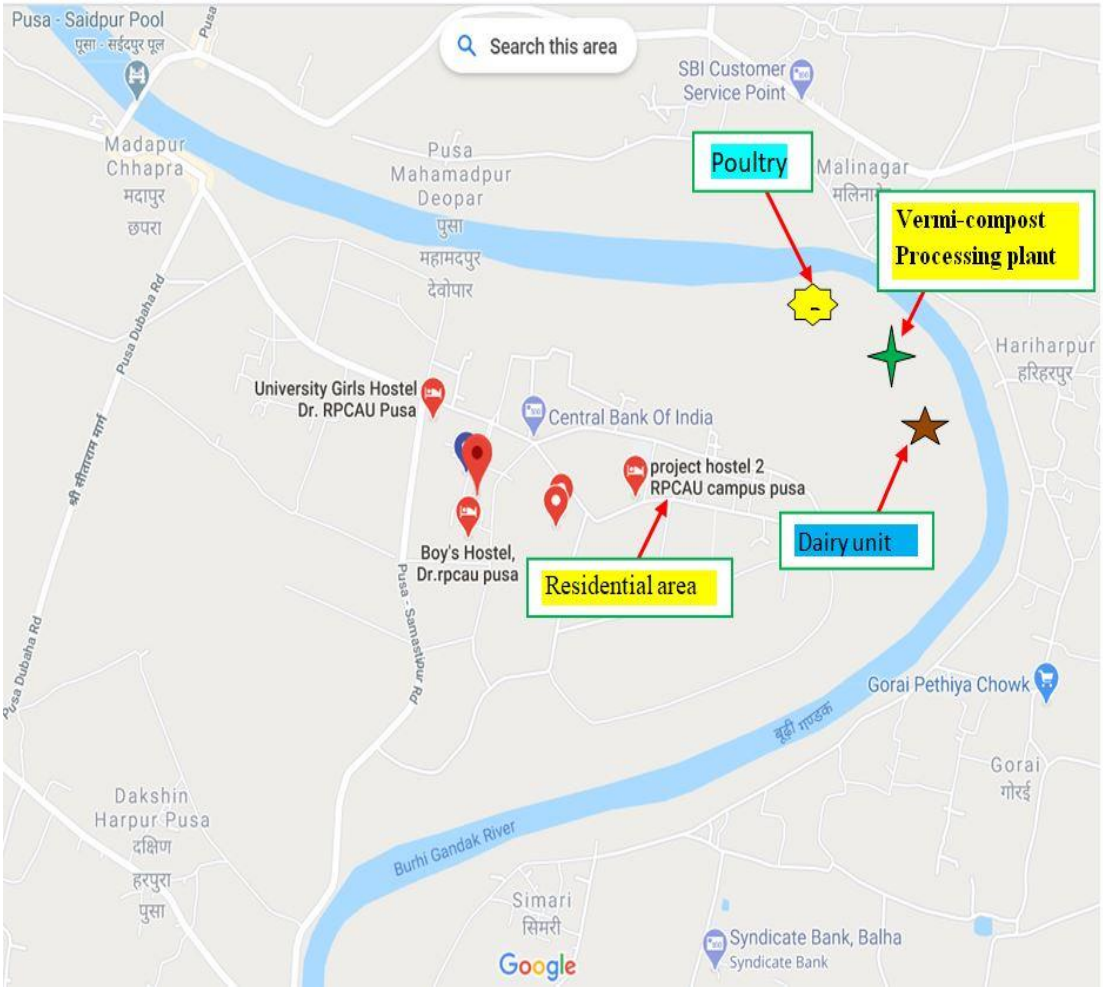

Fig. 1. Location of the study area at RPCAU, Pusa [9]

on their nature of assignments and engagement. None of respondent was uneducated, primary or middle. The percentage distributions were in order of postgraduate, under graduate, intermediate and matriculate. Academic qualifications of respondent were evaluated and depicted in Table 1.

3.1.2 Profession of residents

Being a residential university academic, administrative, technical and supporting staffs as well as the students are residing in different categories of staff quarters and hostels. The survey was conducted among the employees of the university hence only government servants of different academic background were the respondents (Table 1).

3.1.3 Component of household waste in the university campus

Survey reflects that kitchen waste as the major component of household waste (73%) followed by plastic and solid waste (8% and 7% respectively); whereas proportion of paper and other materials were 6 percent each respectively. The Figure was arrived by weighing of different waste by the researcher during the collection of household waste by the cleaning staffs during the data collection period. Thus dominance of compostable waste were dominating in the university hence to manage these waste the vermi-composting programme as run by the University is of most relevant [10]. Data also revealed that the university generates hardly 15 percent of such materials which can be managed by landfills and vendors; and other recyclable waste are hardly of total 12 percent of waste generation which further support the ongoing practices of the University (Table 1).

3.1.4 Awareness of respondents for garbage/waste

Being dominance of elite segments in the university majority were well acquainted about the negative impact of unscientific waste management hence willingly became the part of present collection system. Almost all the respondents (96%) were of the specified opinion; garbage/waste effect the environment (42%); unmanaged waste affects human health (34%) & and some respondent (20%) had also emphasized the ugly look of surroundings. Therefore awareness of respondents for ongoing practices of the University was observed.

3.1.5 Segregation of household waste at home/point source

With regards to segregation of waste at point sources, different practices were observed in different locations. But fortunate part of the system is that nobody is throwing their waste at open place. 76 percent of respondents were segregating the waste at point source and keeping it in two separate bins (green and yellow) provided by the University (Table 1), whereas 24 present were not segregating the waste at point source.

3.1.6 Disposal of household waste

76 percent of respondents were segregating the waste at point source and keeping it in two separate bins i.e. green and yellow provided by the University. Whereas 50 percent of resident also used the big iron bins installed at different sector of the university (the percent was more than 100 due to multiple responses). Survey was conducted among the residents regarding their behavior to throw their waste in metallic bins installed in different sector of the university. The employees who were either single or all the members are in active service generally opted this practice. The percentage of such family was 50 percent. Over all present system of waste collection inside the university premises found up to the level of satisfaction of the residents.

3.1.7 Availability of big iron dustbin in the surrounding area

Almost all (96%) of the respondents agreed that big iron dustbin was availability in the area. 4 percent of the respondents felt that it is kept at distant place.

3.1.8 Problem of throwing garbage around the metallic dustbins

Precisely 13 respondents (26%) addressed the problem of throwing garbage around the metallic dustbins. The reason might be the casual approach practiced by the respondents as revealed by focus group discussion.

3.1.9 Opinion apropos throwing waste around the iron dustbin

Further the population who adopted such practices was in opinion that garbage messed around the bins makes a hurdle (30.77%) to dispose their waste properly followed by height of installed bins (23.08%) and activeness of dog, rats etc (7.69% only) and 39 percent were in other views on this problem.

Table 1. Socio-personal, socio-psychological profiles and appraisal of on-site treatment of household waste of the respondents, n=50

S. no.	Variables	Categories	Frequency (%)
1.	Education	Uneducated (0)	0 (00.00)
		Primary (1)	0 (00.00)
		Middle (2)	0 (00.00)
		Matriculate (3)	5 (10.00)
		Intermediate (4)	7 (14.00)
		Graduate (5)	11 (22.00)
		P.G (6)	27 (54.00)
2.	Profession of residents	Unemployed (0)	0 (00.00)
		Business Man (1)	0 (00.00)
		Govt. Employees (2)	50 (100.0)
		Others (3)	0 (00.00)
3.	Component of household waste (measurement was done by weighing method in Kg)	Kitchen waste	NA (73.00)
		Plastic waste	NA (08.00)
		Paper waste	NA (06.00)
		Solid waste	NA (07.00)
		Others	NA (06.00)
4.	Awareness of respondents for garbage/waste	Look dirty	10 (20.00)
		Affects health	17 (34.00)
		Effect environment	21 (42.00)
		Others	02 (04.00)
5.	Segregation of household waste at home	Yes	38 (76.00)
		No	12 (24.00)
6*.	Disposal of household waste	Green &yellow dustbin	38 (76.00)
		Big iron dustbin	25 (50.00)
		Open dumping	0 (00.00)
7.	Availability of big iron dustbin in the surrounding area	Yes	48 (96.00)
		No	02 (04.00)
8.	Problem of throwing garbage around the metallic dustbins	Yes	13 (26.00)
		No	37 (74.00)
9.	Opinion of the respondents for the reasons of throwing waste around the iron dustbin	i. Height of dustbin	3 (23.08)
		ii. Garbage messed around the dustbin	4 (30.77)
		iii. Problem created by dogs and rats	1 (07.69)
		iv. Others	5 (38.46)
10.	Interval of garbage collection by waste collectors/cleaning staffs from household	Daily	28 (56.00)
		Alternate day	18 (36.00)
		Weakly	04 (08.00)
		On interval of 15 days	00 (00.00)
		Monthly	00 (00.00)
11.	Knowledge level about destiny of the household waste	i. Store in an open place out of the university campus	03 (06.00)
		ii. Burned in an open place out of university campus	02 (04.00)
		iii. Buried under the soil out of the university campus	00 (00.00)
		iv. Converted in vermin-compost inside the university	45 (90.00)
12.	Scope of improvement in present waste collection system	i. Awareness program for knowledge about this system	12 (24.00)
		ii. Improvement in the process of collecting garbage	25 (50.00)
		iii. Others	13 (26.00)

** Multiple response; NA=Not-applicable. Figures. in parentheses in column 4 indicate percentages to total*

3.1.10 Interval of garbage collection by waste collectors from household

Majority (56%) of the respondents agreed to the fact that garbage collection by cleaning staffs from household was done on daily basis. 36 percent reveled that it was done on alternate day basis. Only 8 percent said that it is being done on weekly basis. None of the respondents pointed out that it was done at interval of 15 days or monthly basis.

3.1.11 Knowledge level about destiny of the household waste

The knowledge of resident about fate of collected waste is depicted in Table 1. Exactly 90 percent of respondents were well acquainted with the fact that collected household waste are being converted into vermi-compost inside the university campus itself, whereas 10 percent of resident belong to supporting staff categories were in opinion that either it is dumped or burned. 6 percent has presumption that waste is stored in an open place outside the university campus and 4 percent thought that it was burnt in open place. This reflects that upper cadre staffs are more sensitive towards this issue than the supporting one.

3.1.12 Scope of improvement in present waste collection system

For waste collection, green and yellow dust bins had been supplied to each household/premises to keep biodegradable waste in green bin and non-biodegradable in yellow bins. Awareness campaign was organized and hand bill distributed among the households. Wastes of different categories are being collected daily with the help of trolley and stored at vermi-compost production unit for further segregation, composting and recycling. Compostable wastes utilized for vermi-composting and saleable non-biodegradable wastes are disposed through vendors while other wastes are disposed off as landfills. Despite of all these facts 50 percent of the respondents suggested improvement in the process of collecting garbage. 24 percent suggested awareness program for knowledge about this system. This endorsed the very fact the awareness should be done at periodic basis [11,12].

3.2 Overall Satisfaction Level of the Respondents

Respondents appreciated the university efforts for waste management programme of the University (Fig. 2) and it was quantified through a Likert's 4 point continuum scale. About 82 percent respondent showed their satisfaction (46% fully satisfied and 36% satisfied) from the practices; whereas few were (18%) partially satisfied and gave certain strong recommendation. The resident who live alone or both the partners are in-service suggested that waste collection time should be before 9.00 A.M.

Before applying Pearson Chi square, it was hypothesized that were no differences in frequency level of different categories of satisfaction level (null hypothesis, H_0). That means none of the differences were found in satisfaction level. By applying the Pearson chi-square test [11], it was revealed that satisfaction

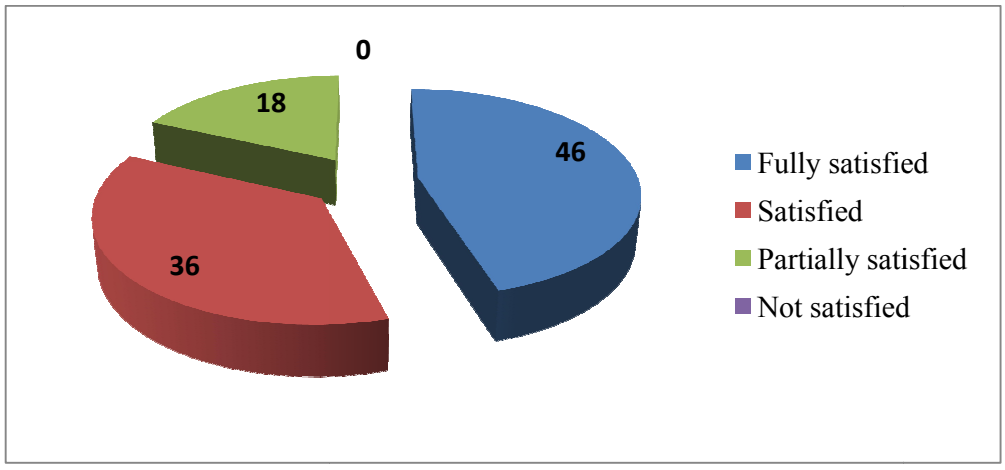

Fig. 2. Satisfaction level of respondents about waste management programme

Table 2. Distribution of respondents on the basis of their overall satisfaction level

Variable (Satisfaction level)	Respondents (n = 50)			
	Frequency	Percentage	df	Chi-sq (χ^2)
Fully satisfied	23	46.00	3	24.72**
Satisfied	18	36.00		(P=0.001)
Partially satisfied	9	18.00		
Not satisfied	0	00.00		

**Significant at 5 percent level; **Significant at 1 percent; (df = 4-1= 3). Table values of chi-sq at 3 df were 7.82 and 11.34 at 5 and 1 percent level of significance respectively*

level of the respondents were inclined 'towards fully to satisfied' categories with the chi-square value, i.e. 24.72 was significant at 1% level with P-value of 0.001. So, it can be concluded that residents were satisfied from waste management programme and thus rejecting the framed null hypothesis.

Due to diverse nature of the residents the waste collector faced difficulties to collect the waste from entire campus before the suggested time frame. To overcome this problem the university has advocated to dump their waste separately in metal bins as installed in different sectors of the University campus. Nobody gave their disagreement towards prevailing system of waste collection. Respondents' satisfaction represented the concrete feelings of them when the Household Waste management met the respondent's expectation. Contrary to the widely-held belief, Haas (1999) suggested that there is no clear relationship between expectations and satisfaction [13]. So, expectations of the households can be studied in the future study. In depth analysis of expectation was done by [12]. Choudhri et al. (2020) studied impact of 'institutional credit' and unraveled that financial support are quite helpful to improve the crop production and productivity in Fakharpur district of Uttar Pradesh [8]; so in the similar line 'household waste management through vermicomposting' impact can be studied.

4. CONCLUSION

Household wastes reduction has been a pressing issue and is a key element of waste management programme in India and abroad. So, the goal of present research was to evaluate the Ongoing Household Waste Management Practices (HWMPs) of the University in managing the waste generated within it. To realize this goal, researchers conducted survey and investigative study with campus residents on HWMPs being followed in the campus. Exactly 90 percent of respondents were well acquainted with the fact that collected household wastes are being converted into vermi-compost inside the university campus itself. In order to generate statistical information quantitative survey of satisfaction level was done which revealed that 82 percent respondent showed their satisfaction for HWMPs. Before applying Pearson Chi square, it was hypothesized that were no differences in frequency level of different categories of satisfaction level (null hypothesis, H0). That means none of the differences were found in satisfaction level. By applying the Pearson chi-square test it was revealed that satisfaction level of the respondents were inclined 'towards fully to satisfied' categories. So, it can be concluded that residents were satisfied from waste management programme and thus rejecting the framed null hypothesis. This model of waste management may be recommended for proper sanitation and environmental safe guards and to obtain quality vermicompost for agricultural and horticultural uses in effective ways in other residential institutional setup. Expectation and impact study are missing in the paper, which can be done in future studies.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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