

A HIERARCHY FOR LAND APPLICATION OF ORGANIC WASTES: INFLUENCE OF URBAN STAKEHOLDERS

Tanto M. T., Magette W. L.

School of Architecture, Landscape and Civil Engineering, University College Dublin, Belfield, Dublin 4, Ireland. Tel: +353-1-716-3214. william.magette@ucd.ie

1 INTRODUCTION

1.1 Background

Organic “wastes” arise from living systems, either directly (*e.g.*, animal manures and green wastes such as garden cuttings) or indirectly (*e.g.*, paper and processed food wastes). The Landfill Directive (99/31/EC) seeks to alter the way wastes are managed in the EU by *inter alia* forbidding the use of landfills as a repository for a variety of organic wastes. As organic wastes are an inevitable by-product of day-to-day human activity, management options other than landfilling must be used to assure compliance with the EU's waste management hierarchy. An obvious management option for organic wastes is their application to land; this technique has been used for as long as recorded history.

While the use of land for the application of organic wastes is conceptually valid, a number of constraints determine the extent to which this management option is actually viable. These constraints include technical, economic and legal requirements, as well as attitudes among many stakeholders within the agricultural / food supply and consumption chain.

Heretofore, research has focused on the technological aspects of applying organic wastes to land, from which excellent compendia have been produced (*e.g.*, Burton and Turner 2003). Knowledge gained from well over a century of global research has informed the establishment of a variety of legal instruments to “guide” the appropriate use of organic wastes on land (*e.g.*, Nitrate Directive). Fundamental to most legislation have been the concepts of beneficial use (as opposed to dumping), either to realise agronomic potential, minimise environmental risks (European IPPC Bureau 2003), or both. The principle of a “land limiting constraint” follows directly from the beneficial use concept and is the foundation for nutrient management planning. Technological and legal constraints limit the availability of land (Magette and O'Reagan, 2007). Less well studied are attitudinal constraints.

1.2 Research Objectives

This research began on the hypothesis that there is inadequate land in Ireland to accommodate all the organic wastes that are suitable for land application. The overall goal was to develop a hierarchy to inform public policy by which the demand for land as a waste receptor should be addressed. Specific objectives were to:

- Test the fundamental hypothesis;
- Determine legal and technical constraints on land application of wastes in Ireland;
- Define the attitudes of major stakeholders in the land application of wastes;
- Develop a means of spatially allocating wastes based on an objective environmental criterion;
- Incorporate guidance into a decision support system for use by government agencies.

This paper is focused on the results from the determination of attitudes of one group of stakeholders (urban general public) towards the use of land as an organic waste receptor.

2 MATERIALS AND METHODS

2.1 Stakeholders

Stakeholder groups identified for inclusion in the attitudinal surveys included the following: general public (rural and urban); farmers; farmer organisations (corporate level); relevant government agencies; non-governmental organisations; and supermarkets. (This paper reports results only from surveys of the urban general public).

2.2 Surveys

Questionnaires were devised with which to survey stakeholder attitudes. With slight modifications, the same survey was administered to all stakeholders. The questionnaire sought attitudes in four areas: general environmental issues, waste management related issues, knowledge of biosolids and perception of the resource value of biosolids, general knowledge about land application of biosolids and attitude towards recycling biosolids through the land system. Other than for demographic information about respondents, questions were constructed to solicit responses on a 5-point Likert scale.

2.3 Survey Administration and Analysis

For the research discussed in this paper, the urban general public stakeholder group was surveyed by door-to-door interviews. A sample size (N) of 400 households was selected to facilitate the highest level of statistical veracity within resource (time and money) constraints. All survey responses were analysed using SPSS 15.0@ (SPSS, 2007) with the Pearson chi-squared test being employed to examine the strength of relationships between responses.

3 RESULTS AND DISCUSSION

3.1 Respondent Profile

Four hundred people were interviewed from 30 electoral districts across metropolitan Dublin, Ireland in 2009. The districts were selected to encompass the variety of socio-economic conditions in the city. Except for marital status, for which the surveyed group had a higher percentage of married persons than in Dublin's general population, the demographic profile of the respondents compared favourably with that of Dublin's general population (Table 1). This gives confidence that the attitudes and opinions expressed by the study group are broadly representative of Dublin's urban population. Further, as Dublin's population comprises *ca.* 30% of the national population, the views of the study group must be considered nationally important.

TABLE 1 Characteristics of Surveyed Population and General Dublin Population

Parameter	Respondent Population (% of total)	General Population ¹ (% of total)
Male	46	49
Female	54	51
Young (18-29 yrs)	25	25
Mature (30-50 yrs)	47	47
Senior (>50 yrs)	28	28
Married	53	34
Single	39	58
Other Marital Status	8	8
Primary Education (<i>ca.</i> 6 yrs)	10	not available
Secondary Education (<i>ca.</i> 6 yrs)	25	not available
University Education (<i>ca.</i> 4-5 yrs)	65	not available

¹CSO (2006)

3.2 Environmental and Waste "Awareness"

Nearly 75% of the survey respondents were either "very concerned" (28%) or "concerned" (46%) about the state of Ireland's environment. Soil pollution and food pollution ranked lower than both water and atmospheric pollution as issues of concern. Nevertheless, when asked specifically about waste management as an issue, almost all (95%) respondents either "strongly agreed" (49%) or "agreed" (46%) that this was a serious environmental issue in Ireland. Similarly, *ca.* 90% of the surveyed population "strongly agreed" (36%) or "agreed" (54%) with the concept of waste as a "resource". Given this attitude, it was not surprising that virtually all (99%) of respondents either "strongly agreed" or "agreed" that waste should be recycled. In contrast, respondents' understanding of the term "organic waste" was less pronounced; only 13% were "highly aware" of this term, while 38% said they were "aware" and 37% said they were "somewhat aware". However, after receiving an explanation (from the interview team) that organic waste will "break down" or "degrade", and possibly contain beneficial elements, respondents were generally able to correctly identify organic wastes from a list of seven wastes presented to them (all of which were organic)

(Table 2). It should be noted that the questionnaire administered to respondents contained brief descriptions of the seven waste types, without specifically referring to them as organic wastes.

TABLE 2 Percentages of Surveyed Respondents Correctly Identifying Seven Waste Types as “Organic Waste” (N=400)

Waste Type	%
Municipal Biosolids	62
Industrial biosolids	12
Sewage sludge	47
Agro-industrial biosolids	48
Municipal compost	90
Mushroom compost	83
Animal manure	89

Measures of environmental and waste “awareness” generally showed no correlations with specific demographic characteristics of the surveyed population. Thus, broadly speaking, the entire survey group had similar attitudes and awareness levels regardless of age, gender, marital status and education.

3.3 Difference in Views about Specific Organic Wastes

Although the surveyed population agreed with the concept that “wastes” are “resources” (see Section 3.2), there were striking differences in their views about specific organic wastes as resources. While over 90% of the respondents considered manure, municipal compost and mushroom compost each to be a resource, far fewer (71%) said municipal biosolids were a resource. An even smaller proportion of respondents classified industrial biosolids (17%), sewage sludge (26%) and agro-industrial biosolids (35%) as a resource. These results show a clear difference in the way the surveyed population perceived different organic wastes. One can safely infer that Ireland’s urban population has a generally “positive” or “receptive” attitude about certain organic wastes, and a “negative” or “cautious” attitude about others. Collectively, “biosolids” and sewage sludge fall into the latter category.

3.4 Attitudes towards Land Application

Not surprisingly for an urban population, most respondents had little or no knowledge about the practice of land application of wastes; only 36% said they had a “working knowledge” of the practice. These results were highly correlated with the age of respondents. In contrast, a majority (77%) of respondents said they were aware that land was being used as a recycling option for organic wastes in Ireland. This measure also was significantly correlated with age, but not gender or education. When asked “to what extent do you agree with organic wastes being spread on land?” 60% said they “agreed” and 22% said they “strongly agreed”. When this question was asked in relation to *land on which food for humans is produced*, slightly fewer people (75% of respondents) either agreed or strongly agreed with this idea.

Despite the overwhelmingly positive attitude towards applying organic wastes on land (even “food growing” land), there were large differences in the extent to which respondents agreed with specific organic wastes being used on “food producing land”. Nearly 87% of respondents agreed that municipal composts (derived primarily from food scraps and garden trimmings) should go on food growing land; yet, only 34% agreed this should be a practice by which to manage municipal biosolids (treated sludge from municipal wastewater treatment plants), and only 3% agreed that sewage sludge (untreated biosolids from wastewater treatment and sludge removed from onsite systems) should go on food producing land. Similarly, less than 7% of respondents agreed that industrial biosolids should be applied to food producing land, and only 38% of respondents felt agro-industrial biosolids should be managed on land used to grow food for humans. Respondents felt similarly about these wastes being applied to grazing land.

Respondents that answered in the affirmative to the question “Will it concern you that food is grown using organic waste as a fertilizer?” were offered a selection of seven possible reasons for their attitude, from which they could identify as many as were applicable to them. They were also given the opportunity to supply their own reasons. Table 3 summarises the study group’s responses.

TABLE 3 Reasons for Concerns about Land Application of Organic Wastes (N=400)¹

Reason	% of Respondents Identifying Reason
Previous bad experience	5
Uncertainty about fate of pollutants	5
Psychological revulsion	17
Lack of knowledge	18
Smell	37
Doubts procedures and practices	48
Doubts waste treatment processes	41
Heavy metals and toxins	69
Fear of the unknown (unquantified risk)	41
Disease causing organisms	56
Food pollution	44
Health impacts	59

¹Respondents could select as many reasons as desired.

4 CONCLUSIONS

Dublin's urban population, and by extension, much of Ireland's general population, is environmentally conscious, and aware that waste management is a serious environmental issue. Further, these stakeholders are favourably inclined towards the use of land as a management alternative for organic wastes. However, this attitude does not extend to all organic wastes. Untreated human wastes (*e.g.*, septage from onsite wastewater treatment) and industrial / agro-industrial wastes (*e.g.*, food processing wastes) are perceived to be unsuitable for application to land. Interestingly, it is non-agricultural organic wastes such as these for which land in Ireland appears to be in short supply (Tanto and Magette, 2009). A variety of reasons inform the public's attitudes about land as a receptor for organic wastes. These attitudes, and their underlying motivators, must be addressed in any strategy that attempts to make use of land as a waste management alternative.

ACKNOWLEDGEMENTS

This research was supported by the Environmental Protection Agency and the Department of Environment, Heritage and Local Government under the ERDTI Doctoral Fellowship Programme (Grant 2006-PhD-S-22) as part of Ireland's National Development Plan 2000-2006.

REFERENCES

- Burton C H, Turner C 2003. *Manure Management: Treatment Strategies for Sustainable Agriculture*, 2nd ed. Silsoe Research Institute, Silsoe, United Kingdom. 451p.
- European IPPC Bureau 2003. Reference Document on Best Available Techniques for Intensive Rearing of Poultry and Pigs. European Commission, Joint Research Centre, Institute for Prospective Technological Studies, Seville, Spain. 383 p.
- Magette W L, O'Reagan M 2002. Strategic determination of organic waste recycling opportunities. In: *Proceedings of the 10th International Conference of the Ramiran Network. Slovak Republic, May 14-18*. pp. 125-128.
- SPSS 2007. SPSS for Windows, Rel.14.0 Statistical Package for Social Sciences. SPSS, Inc., Chicago, Illinois, USA.
- Tanto M T, Magette W 2008. Composition and distribution of organic waste in Ireland: implications for land application practices. In: *Proceedings, EurAgEng2008, International Conference on Agricultural Engineering. Crete (Greece) 23-25 June 2008*