Case studies of waste minimisation on farms

Etude de cas de « minimisation » de la production de déchets à la ferme.

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Abstract

In 1996 a research project was set up to investigate whether waste minimisation principles could be applied in agriculture. Information was collected on existing practices and disposal routes on ten farms : types included dairy, beef/sheep, intensive pigs and poultry, arable, mixed arable/livestock and field vegetables. Opportunities for waste minimisation were identified together with the farmer. On the 10 farms studied, a total of 50 new opportunities were identified. These arose from savings in wasted animal feeds, reductions in water and energy consumption, savings in purchased fertiliser through better utilisation of animal wastes, reductions in wasted crop produce in the field or store and potential for recycling some packaging.

Keywords : Waste Minimisation, Energy, water, feed, fertiliser, packaging, plastics, sheep dip, pesticides, manual.

Résumé

Un projet a été développé en 1996 pour évaluer le principe de « minimisation » des déchets à la ferme. Les informations recueillies ont porté sur les pratiques courantes et sur les schémas de résorption sur 10 exploitations : celles-ci comprenaient une exploitation laitière (bovins/ovins), une porcherie et une exploitation avicole (volailles intensives) ; cultures, polyculture/élevage et légumes.
Les opportunités pour minimiser les déchets ont été identifiées en compagnie de l'exploitant agricole. Ceux-ci vont d'économies dans l'aliment du bétail gaspillé à la réduction de la consommation d'eau et d'énergie, à des économies dans l'achat de fertilisants chimiques à travers une meilleure utilisation des déjections animales, à des réductions dans le gaspillage des récoltes au champ ou lors du stockage et au potentiel de réduction des emballages.

Mots-clés : minimisation déchets, énergie, eau, aliment, fertilisant, emballage, plastiques, pesticides.

1. Introduction

EU and UK Government overall strategies on waste[1] and sustainable development[2] include strong encouragement of recycling in order to minimise waste streams going to landfill or incineration.

Two recent projects in U K industry[3] [4] aimed specifically at waste minimisation, have proved very successful at identifying specific opportunities for modifying processes so as to reduce, eliminate or recycle waste streams, often at minimum cost. There was therefore interest in whether waste minimisation principles could be applied to agriculture. Study 1, outlined below, indicated that this is in fact the case. Whilst this study received some publicity, it was felt that a self- help manual for farmers might help the techniques to become more widely adopted.

There has been considerable concern over the increasing use of pesticides[5]. It has been suggested that use might be reduced by alternative strategies to reduce weeds, pests and diseases[6] [7]. Disposal of spent sheep dip has given rise to concerns over water pollution[8]. The use of veterinary medicines has been questioned where there is a possibility of residues entering the food chain. Disposal of containers and packaging for both pesticides and veterinary products may pose pollution risks.

2. Objectives

2.1. Study 1

The overall objective was to quantify the economic and environmental benefits that could be obtained by farmers through a policy of waste minimisation.

2.2. Study 2

The overall objectives were :

(a) To carry out further case studies to identify the opportunities for waste minimisation and reduction in environmental impact from pesticides and veterinary products, including spent sheep dip.

(b) To produce a user-friendly manual and pilot the draft manual on at least 20 farms of different types.

3. Methodology

3.1. Study 1

The existing methodology which had been developed for industry involved (a) gaining company commitment, (b) establishing an evaluation team, (c) collecting data on processes, (d) ranking options for waste minimisation, (e) technical and economic feasibility analysis, (f) reporting and implementation of recommendations and (g) review and feedback following implementation [9]. This was simplified and adapted for use in this study. Leading farmers / innovators representing the following representative farm types were studied:

- Dairy (all grass) (2 FARMS)
- Beef / Sheep
- Intensive Pigs
- Mixed Arable / intensive pigs
- Arable (cereals/roots) (2 FARMS)
- Intensive Poultry
- Mixed Arable / dairy
- Field Vegetables (including packhouse)

A series of proforma check lists were drawn up to collect data and identify all significant waste generation processes for specific enterprises. Costs of disposal if known, were recorded. Disposal routes for waste were categorised using a series of codes. The audit was carried with the farmer, manager, or member of farm staff appropriate to the tasks being studied.

A comparison was made with existing standards, where these were available. Information on good environmental practice for agriculture is contained in MAFF's Codes of Good Agricultural Practice for the Protection of Water, Air and Soil [10] [11] [12]. Appropriate data sources were used for other inputs [13] [14] [15]. If outputs or usage were particularly high or near the standard, then a cause and possible remedy was sought.

Annual statistics on fertiliser use[16] confirm that farmers often virtually ignore the potential contribution from organic manures. On the farms with livestock, therefore, an assessment of likely crop nutrient requirements and their supply from current fertiliser use and from farm manures was made, using typical values for manure nutrient content[13]. Any potential excess or shortfall in nutrient supply was then identified and new recommendations for fertiliser and manure use were made

3.2. Study 2

3.2.1. Further Case Studies

Twelve farms of different types were identified. For the pesticides three were farms with arable crops and three with field vegetables. For the sheep dip / veterinary products, three were farms with lowland sheep and three with upland sheep. A detailed audit was undertaken with the farmer, as in the previous study.

3.2.2. Manual

Methodology used in the draft manual was based on procedures established in Study 1 [17]. Appropriate specialists were used to provide data for 20 individual sections on different operations. The draft manual contained 93 pages. Some topics received up to 6 sides of A4 questions and information and some received only 2 sides. Piloting of the manual was carried out both by farmers, and by ADAS

Consultants in conjunction with their farmer clients, who were asked to complete the sections for the wastes appropriate to the farm. Feedback on the technical content and ease of use of the manual was established, using a questionnaire to facilitate analysis.

4. Results

4.1. Study 1

4.1.1. General

A total of 50 new opportunities were identified. Eight of these related to livestock feed, five to electricity, and eighteen to wastes. The largest potential saving on an individual farm was £9,725 per annum. Table 1 shows opportunities by number, category and value. These figures include "cost-neutral" opportunities identified, where there will be little difference in costs, but an environmental benefit could be obtained e.g. by accumulating and segregating items for recycling. In all but five cases, payback period was less than three years. In 25 cases, costs were zero or minimal, although 12 of these were cost neutral with little financial benefit.

In addition a total of 24 worthwhile existing practices was recorded, with a total estimated gross annual value of £76,500. Seven were in the animal feed category.

Of an annual total of 308 outputs of non-livestock wastes, such as packaging and plastics, a total of 104 were burnt and 48 recycled as scrap.

ITEM	NUMBER	TOTAL ESTIMATED GROSS VALUE £/YEAR	AVERAGE GROSS VALUE, £/YEAR
Feed	8	5,370	671
Packaging	1	700	700
Fertilisers	4	3,388	847
Chemicals	0	-	-
Fuel	1	400	400
Electricity	5	4,543	909
Other inputs	4	948	237
Wastes	18	9,022	501
Produce	9	11,157	1,240
TOTALS	50	35,528	710

Table 1
Waste minimisation opportunities by number and annual gross value

4.1.2. Environmental Benefits

As a result of improved use of manures there would be a reduced risk of nutrient losses to ground and surface waters. A potential total annual reduction of 19 tonnes of fertiliser purchased could be achieved on four of the farms, thereby avoiding energy and other inputs for manufacture and transport. In addition, 38 less half-tonne capacity polypropylene bags would need disposal. A estimated annual total of 43.5 tonnes of feed wasted could be avoided on four farms, thereby avoiding

energy inputs for growing crops and energy for processing and transporting feed. An estimated total of around 200 tonnes of crop loss could be avoidedeach year thereby avoiding energy and other inputs for growing the crops, but also in several cases, reduction in risks of potential ground water pollution due to effluent release from stockpiled crop waste. On three farms, potential energy savings totalling 76,000 kWh per annum were identified for space heating-benefits resulting in reduced CO_2 emissions from power generation utilising fossil fuels. On farms producing silage, there was a potential for plastic bale wrap or sheet to be recycled, reducing inputs required for plastic manufacture and obviating the current practices of burning or burial and educing CO_2 and dark smoke emissions.

4.2. Study 2

Pesticides : All but one of the six farms studied used independent advice to determine pesticide use. This approach minimised the number of applications during the season, particularly on arable and root farms.

Four of the six farms had modern application machinery less than five years old. These modern machines were fitted with electronic flow/area meters with a display in the tractor cab which allowed for accurate calculation of pesticide requirements in relation to field sizes, thus reducing the amount of surplus pesticide left in the tank after applications were completed.

Many of the farms studied had a large amount of pesticide in store and often bought material in a large number of small containers. The use of larger container sizes and matching of orders to requirements would not only give potential cash savings of up to 5%, but also lead to fewer containers being left in store and a reduced number of waste containers to be disposed of. The current practice on all six farms studied was to dispose of all combustible waste pesticide packaging by burning. There is a considerable opportunity for waste recycling in this area: The Producer Responsibility Obligations (Packaging Waste) Regulations 1997 should lead to the introduction of returnable containers by pesticide manufacturers.

Veterinary Products : All farms had regular discussions with their veterinary surgeon over drug treatments with the aim of using the most cost effective drugs as appropriate. Generally the person in charge of veterinary treatments had no formal training but years of farming experience. There was no evidence of excess use of veterinary medicines. However, some opportunities for waste minimisation were identified as follows : Several of the farms were not weighing animals before dosing to calculate accurate dose rates for stock. All farms could implement a more rigorous isolation policy for animals brought on to the farm before mixing with other stock. This would help to reduce the risk of importing disease and ultimately reduce the need for veterinary medicines.

Adoption of better disposal routes for packaging and used needles would eliminate any potential hazards associated with disposal in the rubbish bin along with other wastes.

Sheep Dip : The predominant reasons for dipping were prevention of blow fly strike, prevention of sheep scab and control of ticks. Bloom dipping was carried out on two of the six farms where mule ewe lambs were sold in the autumn. All farms were dipping once in the season and some twice. Four of the farms had their own dipping facilities with dip baths ranging in size from 900 to 2025 litres. The age of the baths varied from 8 to 60 years. Half of the farms were using organophosphate dips and the other half were using synthetic pyrethroids.

Spent sheep dip was generally diluted with dirty water or slurry and spread on land. The area of land and application rate was generally not known with any accuracy. Farmers were however taking care to select fields that had no obvious water courses and were apparently suitable for dip disposal.

The frequency of dipping was not excessive on any of the farms and was in accordance with good management practice. However pour-on chemicals have reduced the amount of dipping on 5 out of the six farms over the past few years.

Most farms could increase the length of time allowed for dipped sheep to remain in the draining pens, hence reducing the amount of dip concentrate required for topping up the bath. Isolation of new stock on arrival on the farm for a period of 3 to 4 weeks would reduce the chance of infecting the whole flock, and could therefore reduce the amount of dipping required.

There are only small cost savings to be made by implementing the waste minimisation opportunities identified. Environmental benefits of these would be small.

5. Conclusions

A number of overall conclusions were drawn.

5.1. General use of waste minimisation in agriculture. In agriculture, implementing the process of waste minimisation draws together various skills, including agronomy, stockmanship and engineering. Worthwhile opportunities exist for waste minimisation and recycling on farms, but not at the level which has been experienced in other industries. On 10 farms studied, a total of 50 new opportunities were identified. Where savings can be made, the payback period is often less than 3 years. Substantial environmental benefits could occur as a result of suggested changes a number of existing good practices were identified, which could be taken up by others, if appropriate to their farms.. Better agricultural

plastics recycling facilities are urgently required, as these materials are often contaminated with soil, crop or other residues.

5.2. Pesticides, Veterinary Medicines, Sheep Dip. On the farms on which further case studies were carried out there was little opportunity to reduce the number or rate of applied pesticide sprays on the basis of currently accepted good agronomic practice. However, areas for waste minimisation included the opportunity to reduce the quantity of pesticides in store and improved disposal/recycling of waste containers and packaging.

There was no evidence of excess use of veterinary medicines. However, several of the farms were not weighing animals before dosing to calculate accurate dose rates for stock. Some re-assessment of regularly used vaccines/wormers should be made in an attempt to rationalise drug use. All farms could implement a more rigorous isolation policy for animals brought on to the farm before mixing with other stock. Small environmental benefits might result from such policies.

The frequency of sheep dipping was not excessive on any of the farms and was in accordance with good management practice. However, most farms could increase the length of time allowed for dipped sheep to remain in the draining pens. Isolation of new stock on arrival on the farm for a period of 3 to 4 weeks would reduce the chance of infecting the whole flock, and could therefore reduce the amount of dipping required. More attention to the correct spreading rates for spent dip and considering use of a proprietary additive to aid degradation of spent dip prior to land spreading would help minimise undesirable environmental effects.

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