

*FINAL DRAFT
(JANUARY 2005)*

MANAGING FARM MANURES FOR FOOD SAFETY

**Guidelines for Growers to Reduce the Risks of
Microbiological Contamination of Ready to Eat Crops**

INTRODUCTION

Farm manures (both solid manures and slurries) are beneficially applied to agricultural land to meet crop nutrient requirements and to improve soil fertility. Around 90 million tonnes of farm manures are applied to approximately 4 million hectares of agricultural land each year in Great Britain. These manures can contain pathogenic microorganisms (*e.g. E.coli* O157, *Salmonella*, *Listeria*, *Campylobacter*, *Cryptosporidium* and *Giardia*) which may cause food borne illness. Factors such as the age, diet and management of animals, as well as regional and seasonal influences affect the number of microorganisms in manures. These pathogens may also be present in dirty water, yard runoff and leachate from stored manures.

Up to 10% of the area used to grow ready to eat crops may receive farm manures prior to planting. **The management and handling of farm manures, particularly the length of time they are stored, are important factors in the survival of microorganisms.** The method and timing of manure applications to land can affect the length of time that pathogens survive in the soil, and the likelihood of their getting onto food crops. Additionally, dung deposited by grazing livestock is also a potential source of pathogenic microorganisms. In order to reduce any risks of food borne illness resulting from the use of farm manures and following dung deposition by grazing livestock, there is a need for due diligence in the growing, harvesting and packing of ready to eat crops.

Scope

This booklet provides practical guidance on ways of reducing the **risks** of food borne illness resulting from the microbiological contamination by farm manures of ready to eat crops. These crops provide the **highest potential** risk to food safety from manure use. The guidelines are based on recent research, largely funded by the Food Standards Agency, on pathogen occurrence and survival in farm manures both during storage and following land spreading. The guidance is equally applicable to both conventional and organic growers.

These guidelines apply to all ready to eat crops, but growers of very high risk crops, such as baby leaf or other ready to eat crops grown for speciality markets, may decide to introduce more rigorous restrictions on the use of farm manures.

The booklet provides growers in Great Britain with guidance to develop safety plans that will reduce the risks of microbiological contamination of ready to eat crops. Many of the recommendations are common sense and are already in place on farms. Others may take good management practices a step further. Four key stages in reducing the risks of microbial contamination are outlined.

Ready to eat crops

Crops such as salads, fruit and some vegetables (see Appendix 1) that are unlikely to be cooked before they are eaten are commonly referred to as 'ready to eat crops'. Crops with a short growing season, such as salads and strawberries, are particularly vulnerable to microbiological contamination.

Although washing crops thoroughly after harvest will reduce the risks of food borne illness, it does not guarantee removal of all pathogenic microorganisms, and not all crops are routinely washed. Therefore, other precautions must be taken.

Main Sources of Microbial Contamination

Contamination by both solid and liquid farm manures may occur through:-

- Application of manure to land before a crop is established
- Application of manure to growing crops
- Dung deposition on land by grazing livestock before a crop is established
- Runoff from field heaps of solid manure and from nearby fields after spreading
- Leaking or overflowing solid manure stores and slurry lagoons
- Transfer via contaminated equipment and vehicles
- Aerosol or windborne contamination
- Contamination of surface and irrigation water by livestock or manures.
- Livestock and pets having access to cropped areas

What Kills Pathogenic Microorganisms?

Pathogens can be killed either in the manure itself or after application to land. The main factors that will lead to a reduction in numbers are:-

- **Temperature** – in general, the higher the temperature the greater the level of kill, with temperatures above 55°C being particularly effective. Freezing can also reduce numbers.
- **Sunlight** – exposure to sunlight and in particular ultra violet radiation will significantly increase die off.
- **pH** – microorganisms generally survive best at a neutral pH. Acid (low pH) or alkaline (high pH) conditions will speed up the rate of kill.
- **Drying** – microorganism numbers are generally reduced when manures are dried.
- **Time** – pathogenic microorganisms die out over time. The rate at which this happens depends on environmental conditions. In some conditions they can survive for several months.

Pathogens such as *E.coli* O157 can survive for several months following the spreading of farm manures or deposition during grazing.

STAGE 1 –REDUCING RISKS BEFORE CROP ESTABLISHMENT

Site Selection

You can reduce the risks of microbiological contamination of produce by careful choice of where you grow the crop. Where possible:-

- Avoid fields that have recently received manure or have been used for livestock grazing (see below). This may be difficult where the nutrient supply and soil conditioning benefits of manures are fundamental to the system. Consider if you can adopt a rotational manuring policy and apply manures before a lower risk crop, such as a cereal.
- Reduce the risks of airborne contamination, by choosing fields that are not adjacent to livestock buildings.
- Avoid fields where there is a risk of surface runoff from yards or manure storage areas.

Use of Stored and Treated Manure

The *batch storage* of solid manures and slurries for at least 6 months (i.e. no additions of fresh manure are made to the store during this period) or ‘active’ treatment, are effective methods of killing pathogens.

Composting of solid manures is a particularly effective method of controlling microbial pathogens, but for best results, the process needs to be actively managed. The manure should be treated as a *batch* and turned regularly (at least twice within the first 7 days) either with a front-end loader or preferably a purpose built compost turner. This should generate high temperatures over a period of time (e.g. >55° C for 3 days) which are effective in killing pathogens and this temperature should be monitored. Allow the compost to mature as part of the treatment process - the whole process should last at least 3 months (*information on composting is available from a number of organisations – see Sources of Information and Advice at the end of this guidance note*).

Lime treatment of slurry (addition of quick lime or slaked lime to raise the pH to 12 for at least 2 hours) is an effective method of inactivating bacterial pathogens. Allow the slurry to mature as part of the batch treatment process for at least 3 months prior to land spreading.

You can apply batch stored or treated manures to land where you intend to grow ready to eat crops before drilling/planting.

Use of Fresh Manure

You should NOT apply fresh solid manure or slurry (i.e. manure that has not been batch stored or treated) within 12 months of harvesting a ready to eat crop, including a minimum period of 6 months between the manure application and drilling/planting of the crop .

Dung deposited by livestock should also be considered as a potential source of pathogens.

You should ensure that there is a 12 months gap between livestock last grazing in the field and harvesting of a ready to eat crop, including a minimum period of 6 months between the last grazing and drilling/planting of the crop.

Summary of Farm Manure Guidance for Ready to Eat Crops

Source	Management
Spreading solid manure or slurry: <ul style="list-style-type: none"> - treated or batch stored - fresh 	<ul style="list-style-type: none"> ✓ Anytime before drilling/planting ✗ NOT within 12 months of harvest and also at least 6 months before drilling/planting
Livestock grazing*	✗ NOT within 12 months of harvest and also at least 6 months before drilling/planting.

* Where livestock grazing is an *essential* part of the farming system (e.g. in some organic systems where risks may be lower) there should be a minimum 6 months gap between livestock grazing and harvest. Although to further minimise risk, the guidance in the table above should be followed where practically possible.

Land Application and Soil Incorporation

To make best use of manure nutrients and to reduce air and water pollution, you should follow advice in the relevant Codes of Good Agricultural Practice (see Sources of Information and Advice).

Design and locate manure storage areas to ensure that water pollution risks are reduced. This should include adequate containment measures.

Apply manures uniformly and with due regard to the environment. Observe any no spreading zones (e.g. next to watercourses or boreholes) identified in a Manure Management Plan. This will reduce the risks of runoff and indirect contamination of nearby crops. Keep a detailed record of manure application date, type and rate.

Although pathogens can be killed by exposure to sunlight, you should incorporate manures into the soil as soon as is practicable, as this will reduce the potential for direct crop contamination and also reduce odour and ammonia emissions.

STAGE 2 - REDUCING RISKS AFTER CROP ESTABLISHMENT AND DURING THE GROWING SEASON

Manure Applications

Manure should not come into direct contact with ready to eat crops during the growing season.

Do NOT apply manure to growing ready to eat crops after drilling/planting.

Field Operations

Avoid spreading manure on neighbouring fields if runoff will be a potential source of contamination of growing crops. Spreading is a potential source of wind borne contamination. Use low trajectory equipment and do not spread manures on windy days upwind of ready to eat crops.

Whenever working with ready to eat crops ensure that equipment is clean. Do not drive vehicles through any manure or runoff from manures on the way to the field.

Irrigation and Water Use

Water used on the farm is a potential route of microbiological contamination. It is very important that grazing livestock, runoff from manure storage areas, field heaps, and runoff during or following manure spreading do not directly contaminate watercourses or sources of irrigation water.

Keep Livestock and Pets out of Growing Crops

As far as possible, you should prevent livestock and pets from having access to ready to eat crops. Where necessary, check that fences and hedges are stock proof. Ask the public to keep dogs on leads where footpaths run through cropped areas.

STAGE 3 – REDUCING RISKS DURING AND AFTER HARVEST

The following guidance should be read in conjunction with other advice on good worker hygiene, packing and storage protocols and maintenance of temperature regimes.

Harvesting

Ensure that all harvesting machinery and equipment are clean. Do not drive vehicles through any manure or runoff from manures between the field and the packhouse.

When you harvest ready to eat crops, make sure that containers and packaging are clean and sanitised prior to use. Take particular care to prevent soil contamination of packing crates, if crops are packed in the field and will not be washed. Keep all animals and birds out of packhouses and storage areas.

Fruit (e.g. apples, pears etc.) that has come in contact with the ground should not be used for human consumption as fresh fruit or unpasteurised juice where livestock have grazed in the orchard within 12 months of harvest.

STAGE 4 - GENERAL MANAGEMENT

You should include the handling, storage and application of farm manures within the farm's analysis of food safety hazards or formal Hazard Analysis and Critical Control Point (HACCP) plan (if applied) and within the Control of Substances Hazardous to Health (COSHH) assessment.

Record all manure applications on fields that will be used to grow ready to eat crops, detailing the type, rate, date of application, source and management of the manure before spreading. Also, keep records of livestock grazing on fields that will be used to grow ready to eat crops, detailing the livestock type, stocking rate and end of grazing date.

Always follow Good Agricultural Practice and guidance in the relevant Codes (see Sources of Information and Advice) to ensure that environmental impacts from manure applications are reduced.

You can obtain further guidance on worker hygiene and ways to reduce the risks of microbiological contamination from amongst others, the Horticultural Development Council, the Fresh Produce Consortium and the Chilled Food Association.

Sources of Information and Advice

Available (free to members) from the Horticultural Development Council (HDC), Tel: 01732 848383 or www.hdc.org.uk

“Keeping It Clean”. A DVD providing guidance to growers on reducing the risk of microbial contamination in RTE crops.

Available from Chilled Food Association, www.chilledfood.org

Microbiological Guidance for Produce Suppliers to Chilled Food Manufacturers (ISBN 1-901798-03-8). Comprehensive document providing guidance to growers on the main microbial food safety hazards and their controls.

Available from the Fresh Produce Consortium Tel: 0207 627 3391

The Control of Microbial Hazards – A Produce Industry Guide. Provides comprehensive guidance on controlling microbial hazards.

Available from Campden and Chorleywood Food Research Association (CCFRA), Tel: 01386 842000 or www.campden.co.uk

- HACCP: A Practical Guide. CCFRA Technical Manual No 38. Second edition (1997)
- HACCP in Agriculture and Horticulture (second edition). CCFRA Guideline No 10 (2000).

Available free from DEFRA Publications, Tel: 08459 556 000 or www.defra.gov.uk/environ/cogap/cogap.htm

- The Water Code (Code of Good Agricultural Practice for the Protection of Water) -PB0587. *Information on farm waste management plans and avoiding water pollution.*
- The Air Code (Code of Good Agricultural Practice for the Protection of Air) - PB0618. *Information on farm waste treatment, minimising odours and ammonia losses*
- The Soil Code (Code of Good Agricultural Practice for the Protection of Soil) - PB0617. *Information on soil fertility, erosion and contamination.*
- Code of Practice for the Management of Agricultural and Horticultural Waste, MAFF/WOAD/SOAEFD . The code describes measures for minimising plant health risks from the management of agricultural and horticultural wastes.

Available free from SEERAD, Tel: 0131 244 6360

- Code for Prevention of Environmental Pollution from Agricultural Activity (PEPFAA), SOAEFD. *Information on preventing pollution from agricultural operations and activities.*

Available free from DANI, Tel: 02890 525041

- The Code of Good Agricultural Practice: Preventing pollution by solid manures – number 5.
- The Code of Good Agricultural practice: Preventing pollution by slurry – number 2

Available free from local Health and Safety Executive offices

- HSE Preventing Access to Effluent Storage and Similar Areas on Farms. HSE Information sheet AIS 9.

Available free from ADAS, Tel: 01623 844331 or www.defra.gov.uk/environ/pollute/farmwaste.htm

- Managing Livestock Manures: Booklet 1 – Making better use of livestock manures on arable land. ADAS, IGER, SRI
- Managing Livestock Manures: Booklet 3 – Spreading systems for slurries and solid manures. SRI, ADAS, IGER

Available free from DEFRA, Tel: 0207 2386262 or

www.defra.gov.uk/corporate/regulat/forms/agri_env/nvz/manureplan.pdf

- **Manure Management Plan: A step-step guide for farmers.** MAFF/WOAD.

Fertiliser Recommendations for Agricultural and Horticultural Crops – Defra (RB 209) 7th Edition. *Comprehensive reference book on the use of organic manures and inorganic fertilisers.* Seventh edition 2000, available from The Stationery Office (£15). ISBN 0-11-243058-9.

National Farm Waste Management Plan Register – a list of local consultants who can provide professional advice on waste management planning. Tel: 01884 234852

Guidance on Composting Processes:

The Soil Association or www.soilassociation.org – provides information and guidance for organic farmers and growers, as well as guidance on the composting of farm manures. Tel: 0117 9290661

The Composting Association – provides information and advice on composting and co-composting of farm manures with other materials. Tel: 01933 227777

The **Waste Resources Action Programme (WRAP)** – in association with the Composting Association and the **British Standards Institution (BSI)** have produced BSI's Publicly Available Specification for Composted Materials (BSI PAS 100). This specifies the minimum requirements for selection of input materials, as well as for the production and labelling of composts. Further information can be obtained from the WRAP helpline 0808 1002040 or from their website www.wrap.org.uk.

Managing Farm Manures for Food Safety

Guidelines for growers to reduce the risks of microbiological contamination of ready to eat crops

STAGE 1 – BEFORE CROP ESTABLISHMENT

- Select fields carefully so as to reduce the risks of indirect contamination via surface runoff from manure heaps and stores, and during or following the land spreading of manures.
- You can apply treated or batch stored solid manures and slurries to land before drilling/planting
- You should NOT apply fresh solid manures and slurries within **12 months** of harvest, including a minimum period of **6 months** before drilling/planting
- You should NOT graze fields within **12 months** of harvest, including a minimum period of **6 months** before drilling/planting.

STAGE 2 – DURING GROWING SEASON

- Do NOT apply manure to growing ready to eat crops after drilling/planting
- Store solid manures and slurries well away from growing areas
- Avoid contamination of growing crops e.g. from aerosol and windborne drift during manure spreading, or by runoff from adjacent fields where manure has been spread.
- Ensure water sources used on the farm are not contaminated with manures or runoff
- Ensure all equipment (including vehicles) is clean
- Keep livestock and pets out of cropped areas

STAGE 3 – DURING AND AFTER HARVEST

- Fruit that has come in contact with the ground should NOT be used for consumption as fresh fruit or unpasteurised juice where livestock have grazed in the orchard within **12 months** of harvest.
- Ensure all equipment (including vehicles) and packing crates etc are clean
- Keep livestock away from packing and storage areas
- Ensure staff observe good hygiene practices

STAGE 4 – GENERAL MANAGEMENT

- Include manure handling, storage and application in your food safety hazard analysis or HACCP plan and the COSHH assessment
- Record all manure applications and details of livestock grazing on a field by field basis
- Make all manure applications according to guidelines in the relevant Codes of Good Agricultural Practice
- These guidelines apply to all ready to eat crops, but growers of particularly high risk crops, such as baby leaf or crops grown for speciality markets, may wish to undertake their own specific risk assessment and to apply more rigorous controls.

READY TO EAT CROPS

The ready to eat crops listed below are those that can reasonably be expected to be eaten without any further processing to reduce microbiological contamination, other than by washing.

Top Fruit etc.	Salad and Soft Fruit	Horticulture
Top fruit* (apples, pears etc.)	Lettuce and leafy salads	Soil based protected cropping (including tomatoes, cucumbers, peppers, cress etc.)
Stone fruit* (plums, cherries etc.)	Radish	
Vines*	Onions	Mushrooms
	Beans (including runner, broad and dwarf French)	
	Vining peas	
	Podded peas sold fresh	
Nuts*	Mangetout	
	Cabbage	
	Cauliflower	
	Calabrese/broccoli/kale	
	Courgettes	
	Celery	
	Red beet	
	Carrots	
	Herbs	
	Asparagus*	
	Garlic	
	Shallot	
	Spinach	
	Chicory	
	Celeriac	
	Fennel	
	Soft fruit* (currants and berries)	

*Fresh manure can only be applied before planting and during the establishment of these perennial crops, and provided that there is a period of at least 12 months between application and harvest of the crop.

Note: Where it is absolutely essential to the production system, treated or batch stored manures (but not fresh manures) can be applied to the soil to supply nutrients for:

- long-season protected crops (e.g. tomatoes, peppers etc.) during the growing period. Care must be taken when applying treated or batch stored manures to avoid contact with any part of the plant. In addition, the fruit must not, at any time, be in physical contact with the manure or the soil.
- perennial crops (e.g. fruit, vines, nuts, asparagus etc.) during the dormant period, but only where edible parts of the crop will not subsequently be in physical contact with the manure.

This Guidance Note was written by Gordon Hickman and Brian Chambers of ADAS, and Tony Moore of Direct Laboratory Services Ltd (formerly ADAS Laboratories) on behalf of the Food Standards Agency (FSA). Development of the guidance was overseen by a Steering Group chaired by the FSA and involving representatives from the Department for Environment, Food and Rural Affairs (Defra), the Scottish Executive Environment and Rural Affairs Department (SEERAD), the National Farmers Union (NFU), the Soil Association (SA), the British Retail Consortium (BRC), the Chilled Food Association (CFA) and the Food and Drink Federation (FDF).