



FOOD
STANDARDS
AGENCY

Managing Farm Manures for Food Safety

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

2009

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audio, large print or Braille - please contact us.**

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Summary

Intended audience:	Growers of ready-to-eat crops
Regional coverage:	UK
Legal status:	The guidance gives advice on good practice. Compliance with this advice is not required by law.
Purpose:	To give advice on how to develop safety plans that will reduce the risks of microbiological contamination of ready-to-eat crops.

REVISION HISTORY

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, the Environment Agency, the Scottish Executive Environment and Rural Affairs Department, the National Farmers Union, the Soil Association, the British Retail Consortium, the Chilled Food Association and the Food and Drink Federation.

Revision No.	Revision date	Purpose of revision	Revised by
1	2009	Guidance	Chris Rowswell

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PURPOSE AND LEGAL STATUS

1. This guidance has been produced to provide informal, non-binding advice on management and handling of farm manures. Compliance with this advice is **not** required by law.
2. Businesses with specific queries may wish to seek the advice of their local enforcement agency, which will usually be the environmental health department/trading standards of the local authority.¹

INTRODUCTION

3. Farm manures, both solid manures and slurries, are beneficially applied to agricultural land to meet crop nutrient requirements and to improve soil fertility. Around 96 million tonnes of farm manures are applied to approximately 4.3 million hectares of agricultural land each year in the UK. These manures can contain pathogenic microorganisms (*e.g. Escherichia coli* O157, *Salmonella*, *Listeria*, *Campylobacter*, *Cryptosporidium* and *Giardia*) which may cause foodborne 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 run-off and leachate from stored manures.
4. 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 foodborne 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.

¹ In Northern Ireland the Enforcement Authority is the Department of Agriculture and Rural Development (DARD) Quality Assurance Branch.

SCOPE

5. This guidance provides practical advice on ways of reducing the **risks** of foodborne 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 research, largely funded by the Food Standards Agency, on pathogen occurrence and survival in farm manures during storage and following land spreading. The guidance is equally applicable to conventional and organic growers.
6. These guidelines apply to all ready-to-eat crops, but growers of higher 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.
7. The guidance provides growers in the UK with advice to develop safety plans that will reduce the risks of microbiological contamination of ready-to-eat crops. Many 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 in this guidance.

READY-TO-EAT CROPS

8. 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.
9. Although washing crops thoroughly after harvest will reduce the risks of foodborne illness, it does not guarantee removal of all pathogenic microorganisms, and not all crops are routinely washed. Therefore, it is important that other precautions are taken.

MAIN SOURCES OF MICROBIAL CONTAMINATION

10. 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.
- Run-off 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

11. 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. Temperatures above 55°C are 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:** Microorganisms die out over time. The rate at which this happens depends on environmental conditions. In some conditions they can survive for several months.
12. **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

13. 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. 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 run-off from yards or manure storage areas.

USE OF STORED AND TREATED MANURE

14. 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.
15. **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 with a purpose-built compost turner. This should generate high temperatures over a period of time (e.g. above 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 the 'Sources of Information and Advice' section for details.
16. **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.

17. **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

18. **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.**
19. Dung deposited by livestock should be considered as a potential source of pathogens.
20. **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 treated or batch stored solid manure or slurry	✓ Anytime before drilling/planting
Spreading fresh solid manure or slurry	✗ 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) there should be a minimum 6 months gap between livestock grazing and harvest. To minimise risks further, the guidance in the table above should be followed where practically possible.

LAND APPLICATION AND SOIL INCORPORATION

21. 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 the 'Sources of Information and Advice' section for details.
22. Design and locate manure storage areas to ensure that water pollution risks are reduced; this should include adequate containment measures.
23. 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 run-off and indirect contamination of nearby crops. Keep a detailed record of manure application date, type and rate.
24. Although pathogens can be killed by exposure to sunlight, you should incorporate manures into the soil as soon as is practicable. This will reduce the potential for direct crop contamination as well as reduce odour and ammonia emissions.

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

MANURE APPLICATIONS

25. Manure should not come into direct contact with ready-to-eat crops during the growing season.
26. **Do NOT apply manure to growing ready-to-eat crops after drilling/planting.**

FIELD OPERATIONS

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

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

IRRIGATION AND WATER USE

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

KEEP LIVESTOCK AND PETS OUT OF GROWING CROPS

30. 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

31. 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

32. Ensure that all harvesting machinery and equipment are clean. Do not drive vehicles through any manure or run-off from manures between the field and the packhouse.
33. 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.
34. Fruit, such as apples and pears, that have come into contact with the ground should not be used for human consumption either as fresh fruit or unpasteurised juice, where livestock have grazed in the orchard within 12 months of harvest.

STAGE 4: GENERAL MANAGEMENT

35. 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.
36. 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. 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.
37. Always follow Good Agricultural Practice and guidance in the relevant Codes, see the 'Sources of Information and Advice' section for details, to ensure that environmental impacts from manure applications are reduced.
38. 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

Food Standards Agency, Helpline: 0207 276 8829 or www.food.gov.uk

Horticultural Development Company, Tel: 01732 848 383 or www.hdc.org.uk

'Keeping It Clean'. DVD providing guidance to growers on reducing the risk of microbial contamination in ready-to-eat crops Available free to members.

Chilled Food Association, Tel: 01536 514 365 or www.chilledfood.org

Microbiological Guidance for Produce Suppliers to Chilled Food Manufacturers, ISBN 1-901798-03-8.

Provides guidance to growers on the main microbial food safety hazards and their controls.

DEFRA, Tel: 08459 556 000 or www.defra.gov.uk/

Code of Good Agricultural Practice for the Protection of Air, Soil and Water. Information on farm waste management plans and avoiding water pollution. Download free from: www.defra.gov.uk/farm/environment/cogap/index.htm

Fertiliser Recommendations for Agricultural and Horticultural Crops (RB209). <http://www.defra.gov.uk/farm/environment/land-manage/nutrient/fert/rb209/index.htm>

The Scottish Government, Tel: 08457 741 741 or <http://www.scotland.gov.uk>

Prevention of Environmental Pollution from Agricultural Activity. Information on preventing pollution from agricultural operations and activities. Download free from: <http://www.scotland.gov.uk/Publications/2002/08/15309/10495>

Department of Agriculture and Rural Development (DARD), Tel: 028 9052 4999 or www.dardni.gov.uk

The Code of Good Agricultural Practice. Download free from: <http://www.dardni.gov.uk/index/publications/pubs-dard-environment/content-codeofgoodagripractice.htm>

Health and Safety Executive, Tel: 01787 881 165 or www.hse.gov.uk/

Preventing Access to Effluent Storage and Similar Areas on Farms. HSE Information sheet AIS 9. Download free from: <http://www.hse.gov.uk/pubns/ais9.pdf>

ADAS, Tel: 0845 766 0085 or www.adas.co.uk

Environment Agency, Tel: 08708 506 506 or www.environment-agency.gov.uk/

Fresh Produce Consortium, Tel: 01733 237 117 or www.freshproduce.org.uk

Waste Resources Action Programme, Tel: 0808 100 2040 or www.wrap.org.uk

The Soil Association, Tel: 0117 314 5000 or www.soilassociation.org/

Association for Organics Recycling,

Tel: 0870 160 3270 or www.organics-recycling.org.uk/

Campden BRI, Tel: 01386 842 000 or www.campden.co.uk

Provides HACCP in Agriculture and Horticulture guide.

APPENDIX 1: 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	Salad and Soft Fruit	Horticulture
Top fruit * (apples, pears etc.) Stone fruit * (plums, cherries etc.) Vines * Nuts *	Lettuce and leafy salads Radish Onions Beans (including runner, broad and dwarf French) Vining peas Podded peas sold fresh Mangetout Cabbage Cauliflower Calabrese/broccoli/kale Courgettes Celery Red beet Carrots Herbs Asparagus * Garlic Shallot Spinach Chicory Celeriac Fennel Soft fruit * (currants and berries)	Soil based protected cropping (including tomatoes, cucumbers, peppers, cress etc.) Mushrooms

***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. The fruit must not come into physical contact with the manure/soil.
- Perennial crops, such as fruit, vines, nuts etc, during the dormant period, but only where edible parts of the crop will not subsequently be in physical contact with the manure.

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 to reduce the risks of indirect contamination via surface run-off from manure heaps/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.
- Do **not** apply fresh solid manures and slurries within **12 months** of harvest, including a minimum period of **6 months** before drilling/planting.
- Do **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 crops from aerosol and windborne drift during manure spreading, or by run-off from adjacent fields where manure has been spread.
- Ensure water sources used on the farm are not contaminated with manures or run-off.
- 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 into contact with the ground should not be used for human consumption either 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. is 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 fields used for ready-to-eat crops.
- 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 higher risk crops, such as baby leaf salads, may wish to apply more rigorous controls.