



Chapter 5

Care of the Crops

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Link to Chapter 05 Grown in Totnes Case Study



The harvest is in and hopefully you're pleased with the yield, but it's not ready for the mill or grain store yet. Until the crop is dried and cleaned (which needs to happen soon after harvest) it won't be fit for human consumption. Here is an overview of important considerations for the on-farm processing of the harvest, including records you may wish to keep at this point.

The second part of this chapter looks at storage. It is likely you'll be wanting to process your harvest little by little, over the course of the year, until the next harvest. Whilst grains and pulses are incredibly stable in comparison to perishable fruits and products requiring refrigeration, they still need some TLC and are susceptible to issues such as moisture, mites and other pests.

5.1 Drying and Cleaning

Two activities that need to be undertaken and planned for immediately after harvest (within 48 hours) are the cleaning and drying of the crop. Ideally the crop should be cleaned first to eliminate the weeds, and then dried; weeds bring in much of the moisture (particularly in organic systems) and so more energy will be required for drying. Cleaning within 48 hours can remove 80% of the moisture; stabilising the crop quickly makes it easier, and cheaper, to dry. In the case of wheat: dry down to 14% for milling; 16% to stabilise it. If it is not possible to both clean and dry within 24 hours of harvest then it is imperative that the crop is dried in this timescale. Cleaning can then happen when time allows as your crop will now be stable. The presence of moisture risks the crop heating up and spoiling due to microbial action.

☐ Having the on-farm activities of harvesting, cleaning, drying and storing all in one place is more efficient and cost-effective. Grain transport is expensive and logistically complex.

☐ Prior to harvest, ensure cleaning and/or drying equipment is working and available. This includes any supporting infrastructure such as trailers, extra tractors (e.g to drive the PTO shaft or manoeuvre grain around), an auger etc.

☐ Prior to harvest, ensure that you have clean, dry and vermin-proof storage for the grain to go to.

Cleaning options:

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- Winnower with appropriate sizes of mesh, this will depend on the size of the crop and the size of the contaminants.

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- You can use a polisher to clean grain. Unfortunately a lot of weed seeds and other bits simply get polished and come through with the grain, so you then have to sieve the grain by hand with a grain riddle. You can do it this way if you have a lot of hands and a lot of sieves, and are not processing too much grain. Alternatively it's more efficient to use strong fans and winnow it bucket to bucket to get the fine seed and chaff out¹.

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- Use a professional seed cleaning firm (to clean to milling standards). A grain cleaner is unlikely to clean the grain to milling standards, hence the need to use professional seed cleaners. Note that most seed cleaning companies will 'dress' the seed with a chemical for conventional seed sowing; you don't want this for milling so you may have to wait until they have dressed all of the seed in your area and then cleaned down their machines before coming to you, unless they can simply bypass the dressing stage.

5.1.1 Cleaning Considerations

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- Be aware that normally a seed cleaning company will eliminate the small seeds, as these are seen as inferior quality and therefore a waste product, but if you are growing Populations* of crops the small seeds can be a part of the

¹ Many thanks to John Letts for his advice

genetic diversity of your mix and eliminating them is counter-productive; in this case you will need to instruct the seed cleaning company, and this can mean that you have more admix (non crop items such as twigs, stones and weed seeds) in your crop. A good cleaner will be able to balance these two conflicting needs by finding the appropriate mesh size. It is possible to remove weed seeds without removing small seeds using traditional cleaning equipment. Cleaning systems vary a lot.

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- If using a seed cleaning contractor check that they will be able to access your farm - they can use big vehicles.

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- On the farm you will need somewhere flat and big enough for the cleaning vehicle to park and manoeuvre dumpy bags or trailers of grain around.

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- Using a seed cleaner is also a handy way of getting the crop weighed - make sure that you ask if the company has this facility, as taking the harvest to a weighbridge will cost a lot in haulage.

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- Assuming that the grain is going into dumpy bags, label the bags with the following details:

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o Name of the crop

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o Date of harvest

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o Date of cleaning

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o Weight of bag

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o Name of farm/farmer who grew the crop

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o State if organic/biodynamic etc.

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- o Create a Crop Intake code to be used to trace the grain through all stages of processing from cleaning to selling

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- o Record the moisture content of each dumpy bag



You may find it useful to print the labels in advance and colour code them depending on the crop - this makes the different crops clearly visible from each other.

5.1.2 Drying Options



- In small quantities (up to 1 tonne), and if you have plenty of space, the grain can be spread out, off the ground, to dry naturally



- If 0.5 - 2 tonnes of grain, with a moisture content of 20% or lower, and the ambient air is not damp, then grain spikes attached to a Hoover or a fan can be used. It is normal to suck air out rather than blow air in.



- An adapted trailer with a perforated floor underneath can be used to blow warm air through the crop



- Grain driers are generally for over 6 tonnes. Although smaller old ones may be found, they require a tractor to drive the PTO shaft and another tractor will be required for loading. Germination of your crop can be damaged if it is heated too quickly; doing it slowly and carefully will eliminate this risk.

5.1.3 Factors Affecting Drying

The science of drying is affected by a number of factors:



- Moisture content



- Aeration



- Temperature



- Humidity

Wikipedia has a useful link that explains how these factors influence one another:
[Grain drying](#)

* Denotes items featured in the [Glossary - Chapter 11](#)

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5.2 Storage

- The Soil Association have produced a useful factsheet on Storing Arable Crops:
[Soil Association factsheet-arable-storage.docx](#)
- (See [3.1.1 Building Practicalities](#))

Necessary attributes of your storage space:

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- Dry

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- Vermin-proof

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- Level floor

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- Good access for farm vehicles

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- Sufficient space and clearance for manoeuvring grain around

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- Pallet racking is a useful way of saving space by stacking dumpy bags 2 or 3 high; assuming that the building has sufficient height

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- If storing grain in dumpy bags, ensure they are off the ground and put on pallets to maximise air flow and stop moisture entering from the ground

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- If using metal storage units/containers they will create a lot of condensation. They need to be both well-insulated and ventilated

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- Keep cool so that insects don't breed in the pile and to prevent bacterial action; heating up is less likely to be an issue with small piles of crops

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- Separate the crop storage area from the processing and bagging areas ([See GinT Case Study 3.3.2 - Layout of Processing Premises](#))

5.2.1 Vermin Prevention Methods

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- Carry out a comprehensive survey of the exterior and interior of the unit to identify entry points

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- Vermin-proof the property, filling any gaps larger than pencil thickness

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- Place metal plates at the base of ill-fitting doors to block gaps

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- Fit metal baffles onto pole stands of storage structures and to pipes and cables that lead to the roof or window level - this will prevent rodents from accessing the upper part of a store

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- Place mesh wire on windows and in eaves

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- Paint the walls with a band of gloss paint on a smooth mortar from the ground until at least one metre high, to create a smooth barrier that rodents can not climb. This is useful in brick or other rough-walled buildings

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- Place mouse traps inside the storage facility

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- Use cats as low-cost and non-chemical rodent control

5.2.2 Storage Options (for dried crops)

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- Dumpy bags - must be confident that the unit is vermin-proof and store the bags off the ground on pallets, ideal when dealing with relatively small quantities of multiple crop types.

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- Grain silos - these are ideal; the more sophisticated ones can regulate airflow

and temperature and are vermin-proof, however they are an expensive outlay, particularly if you have several crop types that need to be stored separately. Small ones storing 1.6 tonnes are available and buying second hand is much cheaper; check for signs of rust on the inside and any holes. Clean out the silo annually ensuring that no old grain and potential pests are left in before adding the new harvest.

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- Shipping Containers - need to be ventilated and insulated to prevent condensation and mould.

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- Plastic bags (with the exception of specialized hermetic storage bags) are not suitable for storing grain or seed because plastic impedes the circulation of air.

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- Small metal silo bins (including recycled oil drums) can hold 100 - 3,000 kg of grains or pulses, and are an efficient and low-cost storage system suitable for small-scale farmers.

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- Hermetically sealed bags or cocoons of various sizes (50 kg–300 MT) work on the principle that grains release carbon dioxide which rapidly replaces the oxygen in the sealed container. Once the oxygen is exhausted, pests and fungi die.

5.2.3 Gluten Free

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Legally, to label your products as gluten free you need to be sure that they contain 20 parts per million (ppm) or less of gluten. In reality this means that you can not have any gluten products in your unit at all without complete segregation of the two areas. These sites provide useful info about the intolerance:

- [Gluten in Grains](#)
- [Coeliac UK: Home](#)

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5.3 Crop Quality & Measuring

5.3.1 Pathogen Testing

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- The legal and moral obligation is to sell safe food. There is no legal obligation to get grains tested, however if you have reason to doubt their safety then it is advisable. Mould and yeast are both naturally present, so you'll need the laboratory to explain the risk levels in order that you are able to relate the results comparatively

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- If the crop is stored at a maximum of 14% moisture and less than 10°C the risk of microbial action is greatly reduced

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- There isn't a relationship between the different mycotoxins, they can be present in the same cereal grains but not necessarily at the same time

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- Ochratoxin usually occurs post-harvest during poor storage, especially if conditions are warm as well as damp, whereas trichothecene mycotoxins are produced pre-harvest in the field

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- Ochratoxin is the main pathogen of concern for cereals

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- The presence of ochratoxin does not lead to other pathogens being present

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- Taint and smell of mould etc increases in baked products so if you detect this there is no need to test. You will need to dispose of the crop - feeding it to animals (even organic apparently) is acceptable!

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- Oats are not prone to mycotoxins, but they are to trichothecenes - test for T2 & HT2. You can use a test kit, approx £20 per test

- Laboratories:

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- o Camden BRI - not the cheapest

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- o RSSL

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- o Foodtest Laboratories: www.foodtest.co.uk

5.3.2 Visual Inspection

Regularly examine and stir your grain, look for:

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- Mites, the size of a pinhead

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- Moths

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- Mouse or rat droppings

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- Dead insects around your grain

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- Dust in the grain - a sign that something is feasting on it

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- Mould, e.g pink colouring on the grain

5.3.3 Smell Inspection

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- Smell your crop to see if you can detect musty or mouldy smells

5.3.4 Determining Moisture Content

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- Using a calibrated moisture meter allows accurate assessment and allows regular monitoring of moisture changes

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- You can however get to know moisture levels in your grain: by biting it with your teeth, pinching it between your fingers or shaking it; if the grain cracks and the kernels feel hard or make sharp sounds, the grain is dry enough for harvest (if still on the plant) or storage. If the grain is soft, it could mean it is still wet and needs further drying

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- Shake a sample of grain with dry salt in a clean dry glass jar for several minutes. If the salt sticks to the sides of the glass jar, it means the grain moisture content is above the safe moisture content level. If the jar surface is clear of salt, it means the grain is dry enough to be put in storage

5.3.5 Baking Properties of Flour²

Commercial flour undergoes a variety of tests, the results of which categorise the type of flour, e.g bread or biscuit flour, which then enables the baker to assess the type of products that can be made with that specific flour

5.3.5.1 Gluten Content

Good gluten for bread making is insoluble so the higher the wet gluten figure the better

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Hardness below 10 would be considered extra hard, 10-20 hard, 20-30 medium, 30+ soft. These are rough guidelines and millers and bakers would look for a certain hardness depending on the product

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Protein figures for biscuit flours are below 10%, anything above that would be a bread flour, depending on the type of bread. Some bread requires a protein of 11% whereas others need 13-15%

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5.3.5.2 Hagberg Number/Falling Number: This is used to detect

² Thanks to Chris Holister at Shipton Mill for this information on testing flour

sprouted/germinated kernels, which can spoil baking quality of grains due to the presence of higher concentrations of the enzyme alpha-amylase that degrades starch. Used for wheat, durum wheat, triticale, rye and barley. The Falling Number is the time in seconds required for a device to fall a measured distance through a hot flour/water mixture while heat is applied. If the enzymatic activity is high, the starch is broken down (liquefied) rapidly during gelatinization and the device falls through the relatively liquid paste in a short time. If the activity of the enzyme is low, it takes longer for the device to cover the distance of its fall. This means the falling number is high. A figure of above 250 would be expected in order to be acceptable

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5.4 Infestations and Crop Care

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5.4.1 Good Hygiene Practice is Imperative

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- Keep the unit and surrounding area as clean as possible, eliminating any vegetation or rubbish that may provide breeding grounds for storage insects and rodents

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- Sweep or Hoover any crop spillages as soon as possible

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- Keep crop bags closed

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- Livestock should be kept away from the unit

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- Clean out crop storage containers and silos as soon as they are empty

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- There may come a point at which spoiled grain has to be discarded for the sake of human health and business reputation

5.4.2 Factors for Healthy Grain storage

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- Aeration slows insect reproduction rates and maintains grain quality by cooling the temperature of the grain; temperatures above 15°C can encourage weevils in wheat and oats

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- Insects and mould thrive within an optimal temperature range: between 25°C and 34°C for most storage insects; and between 15°C and 30°C for the development of mould. Beyond this range (colder or hotter), the development of these threats to the stored products is limited, and therefore losses are negligible

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- Moisture content is described as the quantity of water bound in the grain kernels expressed as a percentage by weight of the grain or seed sample. The moisture content of dry grain ranges from 6 to 15% depending on the type of grain. Moisture content is a determining factor in the proliferation of mould and storage pests

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- Relative humidity is the percentage of water vapour in the air between the grains, and represents the equilibrium between the humidity of the air and the moisture content of the grain. If the relative humidity exceeds 65%, mould and storage insects can develop and stored grain and seed are susceptible to deterioration

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- Have sealed bait boxes for mice and rats and check them regularly for signs of disturbance, recording results to evidence that they have been done

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- Infestations from mites, moths and weevils can be eliminated by polishing the grain. This will remove the insects and any eggs and larvae, but care is needed to ensure that you separate the cleaned grain from the contaminated. Alternatively, if you have the facilities, you can freeze the grain

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- It is important that you tackle infestations as soon as they are spotted to prevent spreading and spoilage

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- Risk of contamination from other creatures such as birds, dogs, cats, bats etc

can be avoided by ensuring the crop is stored in a closed, sealed building

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5.5 Monitoring Considerations

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- Include weekly checks as part of your cleaning regime and record findings

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- o Include weekly checks as part of your cleaning regime and record findings

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- o Monitor mites etc with mite traps (cardboard envelopes with a sticky strip in them that insects stick to). These will help you spot early signs of infestations

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- o Install vermin traps, and monitor and record regularly

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- Check and record moisture levels on a regular basis and condition the crop using grain spikes if required

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- Fill in the crop intake paperwork so that you can show full traceability. This needs updating every time you remove grain e.g from a dumpy bag, and at every stage of processing, bagging, moving etc

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