ABN 84 816 063 155
PO Box 151 Curtin ACT 2605
www.sfmca.com.au

Manufactured Stock Feed Best Before and Use by Date Guideline

This document is provided to SFMCA full members as a guide to how to determine a suitable 'Use by Date' for correct labeling requirements and communication to end users so as to be compliant with the FeedSafe™ Code of GMP.
These guidelines are provided to assist stock feed manufacturers in determining what is an acceptable period from manufacture to use by date. Information is provided relating to the factors that impact on the "shelf life" of stock feed and methods of verifying effective use by dates.

Factors influencing feed deterioration

1. Moisture content is a major factor affecting shelf life. When the moisture content of feed or a part of a feed exceeds 12.5%, there is an increased risk of feed deterioration. Be aware that an average of 12.5% means that some samples will have higher than 12.5% moisture and so present a risk. Moisture content is measured using a drying oven, as well as use of NIR technology for rapid analysis. Caution needs to be taken with use of raw materials containing higher moisture levels.

In addition to moisture content, Water activity (aW) quantifies the amount of free or unbound water and has been recognised as having greater significance with mould growth than moisture content. To measure water activity, laboratories use an electronic device to measure vapour pressure. Typically, as the temperature increases, aW increases. Water activity levels can range from 0.0 to 1.0. The higher the activity rate, the more quickly bacteria and mould grow.

The addition of water to feed through ingredient addition or application of steam during pelleting increases the water activity. Inadequate cooling post pelleting can result in higher water activity and potential for higher rates of feed deterioration.

Stock feed typically has water activity levels below 0.6, for mould growth to occur a water activity above 0.6 is required and for bacterial growth over 0.8.

2. Raw Materials in use can make feeds more prone to deterioration. In particular inclusion of higher levels of molasses increases water activity and moisture content. Attention needs to be given to the use of raw materials from other milling processes such as millmix/millrun where the flour mills utilise water in wheat conditioning. Raw materials should be monitored to ensure they do not contain excessive levels of moisture, sorghum can at times exceed the maximum 13.5% moisture receival standard.

3. Bagged feed packaging material impacts on the ability of the feed to "breathe" during storage. As many manufacturers have moved to either tighter woven poly bags or more solid plastic bags, there is reduced capacity for air circulation and potential sweating of bags. A critical factor when looking at changing packaging materials is to complete feed deterioration studies to ensure there are no unexpected problems following the change.

4. Feed cooling – inadequate airflow through the cooling process post pelleting, steam flaking or steam rolling is seen to limit the capacity to reduce moisture content to acceptable levels. The manufacture of larger diameter cubes is also known to present greater risk as longer cooling times are required to reduce feed temperature and moisture content. Operating coolers through high humidity periods presents greater challenges in reducing moisture content. Bulk feed inadequately cooled and delivered in bulk silos can result in sweating and condensation within the silo, with an increased risk of mould growth.

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5. Storage climatic conditions directly impact on the feed's shelf life. This especially applies in tropical conditions, experiencing both higher humidity and temperatures. Feeds that show no physical deterioration in dry climatic conditions can be prone to mould growth when supplied into tropical areas. Feeds that are exported and pass through tropical areas in shipping containers are significantly more prone to deterioration.

6. Storage silo condition, silo ventilation and/or leaking silos can result in poor feed storage and reduced shelf life. At the mill, finished product silos and bins need to be regularly inspected and repaired as required. On farm storage conditions can often be less than desired. Delivery drivers should be trained to identify problems when delivering feed and alerting both the farm manager and feed company. Both at the mill and on farm, silos and bins should be completely emptied and cleaned out on a regular basis.

7. Direct sunlight has a detrimental effect on feed active constituents such as vitamins and feed additives. Bagged feeds should not be stored where there is direct sunlight. This is a point of reminder for resellers supply your bagged feeds.

8. Vermin control is an essential requirement to stop feed damage and bacterial contamination from rats and mice faecal material.

9. Hygiene in removing spilt feed, broken bags, old stock and dust and cobwebs is needed. This should include regular storage area inspections looking for weevil or other insect presence and actions to reduce infestation. For many mills and retail outlets lemon mite has been a recurring problem that requires vigilant hygiene controls.

What goes wrong?

Mould growth – the most common observation of feed deterioration is the presence of mould on or in the feed. This can result in feed clumping, impaired feed flow through silos and bins, reduced feed acceptability to livestock, and the potential for mycotoxin production. The following table provides an indication of the levels of mould count that are considered unacceptable for different livestock species, with pigs and poultry known to be more susceptible than ruminants to mould presence. Mould counts can be completed by commercial testing laboratories.

HYGIENE STANDARDS	QUALITY INTERPRETATION	PIG	SOW	PIGLET	BROILER	LAYER	BEEF	DAIRY
Total Mould Count TMC (cfu/g)	Good	1,000	1,000	1,000	1,000	1,000	1,000	1,000
	Acceptable	5,000	5,000	5,000	5,000	5,000	10,000	10,000
	Poor	>10,000	>10,000	>10,000	>15,000	>15,000	>50,000	>50,000

Bacterial growth requires higher levels of water activity than mould growth. Note however that bacteria can still be present at low moisture/water activity levels but will not reproduce and increase in number until a certain water activity is reached. For bacterial growth to become a significant risk for end users, the feed will already be showing the presence of high levels of mould growth. Stock feed that has deteriorated to show high levels of mould growth and potential bacterial risk should not be fed to livestock. Such feeds should never be reprocessed or remixed into other feeds.
When there are concerns over feed moisture levels, and/or higher risk raw materials are in use, or feed storage conditions are less than desirable, inclusion of mould inhibitors should be considered.

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Insect infestation – moisture and warmth are the two factors favourable for grain insect multiplication. Based on work with grain, temperatures below 15^0C help to suppress insect growth. Feed moisture levels above 12% increases the risk of insect infestation.
Ensuring raw materials used in feed manufacture do not contain live insects greatly assists in ensuring a lower risk of subsequent insect presence in finished products. A part of the mill's hygiene program, regular monitoring and inspection for insect presence and actions to reduce spilt feed and areas where insects can multiply.

Fat rancidity – where fats and oils are used as an ingredient in feed, it is advisable to ensure an antioxidant is either included within the fat or oil and/or is included in the feed. Where the feed is to be stored for an extended time period and under hot weather conditions, there is a greater risk of rancidity. Many of the feeds containing added fats are for either younger or more sensitive stock. Rancid fat products have an objectionable odour and decrease the palatability of a feed. Where there is risk of fat rancidity inclusion of antioxidants in the feed is recommended.

The Peroxide Value (PV) of an oil or fat is used as a measurement of the extent to which rancidity reactions have occurred during storage. Other methods including measurement of free fatty acid (FFA) are available but peroxide value is the most widely used.

Vitamin, medication and feed additive activity decline – these feed ingredients rely on supplying a defined activity level in the feed. Their storage prior to feed manufacture is important, with all being sensitive to higher temperatures, moisture and sunlight. After the feed is manufactured there is a decline in activity over time. This activity loss is increased where feeds are stored under higher temperature and humidity conditions. Stock feed manufacturers and nutritionists need to take account of storage conditions and shelf life when formulating active constituent levels in feed. Many of these materials suffer from oxidation, with inclusion of antioxidants being required under more challenging feed storage conditions or where there will likely be a longer period between manufacture and feed consumption.
Feed mills should initially consult with their premix and feed additive supplier as they retain have considerable knowledge and data relating to their product's shelf life. They have also been involved in completing best before studies for clients. Vitamin and medication analysis can become expensive and requires laboratories to have competency in the analysis required. Before initiating sample testing it is important to gain from the laboratory an assessment of their level of accuracy with the relevant assay.

Use by Date Validation

Stock Feed Manufacturers must validate the use by date that is placed on products supplied to end users. This can be done by completing shelf life tests. This is done by keeping product at different temperatures over a period of time, sampling and completing tests on the samples. The number of samples taken and the sampling method are important for accuracy of information. The following tests can be conducted:

- Microbial counts to identify increases over time.
    - mould counts for fungal growth,
    - bacteria, eg. Salmonella detection and count
- Vitamin levels to see whether there is any degradation over time and whether the levels have slipped below the specified level.
- Fat oxidation tests - peroxide value (PV), free fatty acids (FFA), for feeds formulated to contain higher fat levels.
- Medication levels to identify decline in activity. Note of caution – check with your medication supplier regarding accuracy/recovery of medication through analysis. Some analysis testing can be +/- 20% in accuracy.

With each of these tests it is essential to determine the starting level and compare the change over time. The feed needs to be stored under "typical" storage conditions. Some manufacturers conduct shelf life testing under more extreme conditions to ensure their products meet their best before date target.

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Best Before/Use by Date Recommendations

These recommendations are subject to individual company verification testing to support alternate time periods.

Product Type	Period	Comments	
Finished feed - general	6 – 12 months	Most feeds	
Finished feed – high fat, moisture issues	3 – 6 months	Products for younger stock containing fats and milk powder, high molasses content	
Finished feed – higher temperature & humidity storage	3 – 6 months	Summer tropical/sub-tropical climate conditions	
Mineral lick blocks and supplements	12 – 24 months		
Premix and supplements	6 – 12 months		
Liquid feeds	6 – 12 months		