# The future of on-farm storage: a silo manufacturer's perspective

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*Abstract*

The level of on-farm storage in Australia is significant, possibly 18 Mt total capacity. The growth in on-farm storage is continuing and will change the market dynamics into the future. Increasingly, farmers are seeing the marketing and/or procurement of their grain as their responsibility.

There are many reasons why more grain is being stored at point of production or point of on-farm consumption. These may based on economic considerations such as improved returns due to improved marketing and improving farm efficiency but there are also more subjective reasons which allow the farmer to operate within a variety of other parameters.

These changes present challenges to those who are responsible for regulating and improving the grain industry. We now have more of our farmers endeavouring to store and maintain grain where once it was the sole responsibility of experts within our centralised bulk-handling system. If we are aiming for continual improvement of our quality and efficiencies, we need to ensure that farmers have the necessary technical skills. Where once grain was stored on-farm for stockfeed only, a wide variety of grains are now being stored and these need to be maintained to increasing quality specifications.

People involved in the grains industry need to evaluate the changes in terms of both how it affects their organisation, and how it affects the grains industry.

AS A manufacturer and supplier of grain storage silos, one is in regular contact with a wide variety of Australian farmers who are interested in a particular style of on-farm grain storage. Conversely, it is also true that contact is not often made with farmers who are interested in other types of grain storage (e.g. bulk sheds) or those who do not have an interest in storing grain on farm. Therefore, much of what is stated here is not statistical or scientific, but rather a gathering of thoughts collected from a select group (i.e. the 'true believers' of on-farm storage). I should also point out that our company operates predominantly within the eastern States, and therefore much of what is said here may not relate to the Western Australian experience.

The last time a survey was carried out to determine the level and nature of on-farm storage in Australia was in 1990–91. The results were published in the 1992 ABARE report 'On Farm Grain Storage in Australia' (Hunter et al. 1992). This report forms the basis of the statistical data available. However, there have been significant changes since that time.

Farmers have been storing grain in bulk on Australian farms since the 1950s Until the early 1970s the grain being stored was limited to seed and stock feed. While 'drought proofing' livestock enterprises remained important, the deregulated 1980s saw a real shift to storing grain as part of marketing tool and for improving harvest logistics. This was the beginning of boom times for silo manufacturers, punctuated only by the rural recession and drought.

The growth of on-farm grain storage has important implications for our grain industry. It is changing the marketing dynamics; the storage industry is a significant sector in the Australian manufacturing industry; there are effects on production quality; there will be changes in the role of the Bulk Handling Companies (BHCs); and there will be changes to farming economics.

## On-farm storage in Australia—the present state

The ABARE report (Hunter et al. 1992) estimated that 75% of all farms had on-farm storage totaling 14 million tonnes, of which 12.6 million tonnes was permanent.

Based on 'best guesstimates' by members of the Australian Silo Manufacturer's and Grains Storage Association, the 7–8 years since has seen an increase of around 3.2 million tonnes of vertical storage, with a significant amount of horizontal storage (both permanent and temporary) having also been added. Even allowing for the loss of some older storage capacity, it is possible that on-farm storage capacity could be around 18 million tonnes; approaching half our annual grain production!

We are still seeing growth in on-farm grain storage. Many farmers say that they want to increase their storage over time. Their plans vary from the mixed farmer planning to add a 50 tonne silo each year, to the broadacre farmer who is planning to increase storage in increments of several thousand tonnes. It is worth noting that the on-farm grain silo manufacturing industry is an important economic sector. Once again based on 'best guesstimates',

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it probably represents around $50 million, consuming around 10,000 tonnes of BHP steel per annum. As well as silo manufacturing, there is the manufacture of grain sheds, bunkers and handling equipment: all significant industries in their own right.

One major factor worth considering when evaluating the 'quality' of the storage, is the percentage of on-farm storage which is gas sealable (i.e. suitable for fumigation or holding grain under controlled atmosphere). The ABARE report suggested that 12% of storage was gas sealable, with South Australia leading the way with 35%. I would dispute these figures, as the percentage of sealed silos produced in Australia up to that time would have been less than 1% and, as far as I am aware, there were no South Australian based silo manufacturers producing sealed silos. In general, silo storage is more commonly sealed than other forms of storage, perhaps with the exception of temporary bunkers. Perhaps due to lack of understanding, questions in the 1990–91 survey did not yield the correct responses in many cases.

Since the early 1990s, there has been an increased awareness of the need and advantages of sealed storage, resulting in significant increases of sealable storage. Our company, for example, would supply about 85% of our on-farm grain silos as the sealed option. My perception is that the increased use of sealed storage tells us that farmers are realising that maintaining quality (i.e. grain free of insects and contact pesticides) is important, and that farmers are planning to be able to store their grain for longer periods.

It is worth noting that, with the help of the Grains Research and Development Corporation (GRDC), a national association of silo and grain storage related organisations was formed in the early 1990s. This group was particularly active in educating manufacturers in all aspect of grain storage and promoting the introduction of sealed silos into the market. The national body is made up of four regional associations, and is a point of contact for anybody wanting to address manufacturers in the grain storage industry.

## Why the shift to on-farm storage?

The traditional reason for storing grain was to keep seed for the next planting or for stock feed. In the 1992 ABARE report, feed storage was the key reason for 59% of farmers storing on-farm, followed by seed storage in 19% of responses. Marketing considerations were important for a significant number of grain farmers.

My perception is that the marketing consideration has increased significantly, to the point where I believe it is the prime reason for the large growth in on-farm storage. There are a number of reasons for storing grain which can all be grouped in the 'marketing' category. These are: to maximise return by selling at times of higher prices (for grain consumers, the goal is to purchase grain at times of low prices (i.e. harvest) thereby countering the traditional seasonal price fluctuation); to enable a producer to grow grains which do not have a harvest delivery option; to establish a reliable supply relationship with a customer by being able to supply grain on a year round basis; and to store grain for value adding after the harvest 'rush'.

There is no doubt that the expectation of higher prices after harvest is the major motivation for storing grain. Especially on the feed grain market, this expectation is supported by the price trends over a number of years. Farm economists argue that the costs associated with grain storage (i.e. delayed income, depreciation, and wear and tear on capital equipment and pest control) devalue the price advantage somewhat. I believe that farmers either do not believe their storage costs are as high as calculated or they choose to ignore the costs. In any case, storing grain is perceived by farmers to be profitable.

Manufacturers of grain storage may be seen to have the best of both worlds. While grain producers are aiming to store all of their production, their customers, the grain consumers, are also looking at storing all of their consumption. Livestock-based industries which are buoyant (there are not many, but dairying is one) are also increasing their storage. There are livestock farmers, for example, who are either planning or in the process of setting up, significant grain storage. They realise that they can minimise grain cost by purchasing much of their annual requirements at harvest time. Once again, one could argue as to how well the costs associated with storing grain are known. The question then is: What happens to the market dynamics if the storage capacity is duplicated at point of production and consumption?

As farmers have increased the diversity of the grains they produce, there have been difficulties delivering grain direct to convenient receival points. BHCs and grain merchants are meeting this challenge by increasing their ability handle the range of grains produced. As a consequence, I do not believe that increasing farm diversity alone will be a significant driver for increased farm storage.

As progressive producers look for ways to improve their net return or to give a level certainty to their income levels, they are increasingly dealing direct with their customers rather than through an intermediate agent. Whereas the intermediary (grain merchant or BHC) used to have the storage capacity, that storage must now be found either by the producer or the customer. In many cases, the farmer must store the grain in return for reimbursement by the customer. This is particularly the case for more specialised, higher value crops in the human consumption market. Invariably, if a producer wants to supply to a customer on this type of basis, he must be in a position to reliably supply at regular intervals throughout the year. Currently, there are on farm investments upward of $250,000 being made in storage/handling equipment where a producer has formed an ongoing strategic alliance with a single customer.

Once again the quest for increased returns has seen growth in the number of on-farm value adding enterprises. This value adding includes crushing/milling, grading/cleaning, and mixing. In some cases this value adding is a postharvest process for prompt sale, but in other cases it is part of the year-round sales strategy. Postharvest drying

could be included in this category as the farmers' returns are increased by drying the grain before sale (in many cases the product is unsaleable at higher moisture). All of these processes require the grain to be retained on-farm before sale.

Apart from the marketing issue, there are several other issues driving the increase in storage. These include improving harvest efficiencies, reducing risks, 'tax planning', and creating a more uniform cash flow.

The improved mechanisation of the harvest operation means that the limiting factor is rarely the 'header', but the ability to move grain away from the paddock. Harvest is best carried out quickly to reduce costs, allow for expensive capital equipment (headers!) to be well utilised, to reduce the risk of weather damage and because the farmer is anxious while ever the crop is still in the paddock. (One should not underestimate what a farmer is prepared to pay just to have the 'stress' of the harvest behind him.)

It has been many years since farmers in more remote areas started harvesting into their own storage and then carting to receival points at their leisure. This practice is spreading to operations which may be closer to receival points. By storing grain, the typical 'understaffed' farming operation can harvest quickly and then transport grain later (wet days!) or use contractors. This increases the time available for harvesting and reduces the time lost waiting for trucks to return and other delays.

The cash flow/tax planning issue is important. Many farmers will tell you they cannot afford to sell their grain until after 30 June so that the sale will not be recorded until the following financial year. There are also farmers who feel more comfortable when their cash income coincides with expenditure. This type of farmer will sell grain when he needs the cash; he therefore requires storage to allow him to manage accordingly.

## Problems associated with on-farm storage

In keeping with many other farming activities, the profitable storage of grain on farm requires money, skills, time and 'luck'. The first three factors are 'scarce resources' while the fourth is related to the whims of markets, weather and politics. Maintaining the quality of grain stored outside the expert controls of a large, experienced and well equipped organisation, such as a BHC, may have very serious long term implications for markets.

The cost of new grain storage or to replace existing storage varies according to the type of storage. At the lower end of the market is the 'tiger' cage. This temporary mesh bin is set up in the machinery shed. It has few insect control options and takes a lot of effort to unload and clean out. Total capital outlay is approximately $8 per storage tonne (I do not believe that they are still on the market, because of the dangers associated with their use.) At the other end of the scale is the fully sealed, elevated (cone base), aerated silo. Total capital outlay to install is upwards of $90 per tonne.

Storage must also be accompanied by handling equipment. This, once again, can vary. The lowest cost option is a 'lug around' mobile auger the capital cost of which is a minimum of $6000 (less at a clearing sale!). For a farmer with 200 t of on-farm storage, this equates to another $30 per tonne of storage. This increases significantly for the more elaborate system (e.g. bucket elevators, intake pits, tubeveyors etc) which can cost as much as the storage itself, i.e. around $100 per tonne. Just as farmers are presently spending amounts of up to $400,000 on storage, they are also spending up to $250,000 on handling equipment.

Our national farm-based storage facilities, based on suggestions of up to 18,000,000 tonnes capacity, may represent an investment with a replacement cost of around $2 billion. In addition, there are many non-capital costs, such as pest control, maintenance of equipment, and cost of deferred income and labour. It is not within the scope of this paper to analyse the nett economic cost/benefit of on-farm storage, but it is a significant cost to the farming industry.

Storing grain requires both skill and time. It is certainly not the most 'difficult' process for the farmer, but it does require the discipline of constant monitoring, maintaining good hygiene levels (cleaning headers, silos and augers), knowing when and what pest control methods to use, and controlling temperature/moisture levels in the grain. I know that less effort is put into maintaining stored grain quality than would be recommended, yet farmers seem to be turning off grain to satisfactory standards.

The skill and knowledge required extend to proper use of chemicals and fumigants, controlling aeration systems, knowing the limitations of grain storage and developing storage strategies. Fortunately, farmers have been storing grain for a long time and they know what works (perhaps not why!). Only occasionally do they move outside the bounds of previous experience and get into trouble (e.g. too high moisture, inadequate pest control or storing for too long).

One major problem that I see is that we do not have an extension service providing farmers with the support they need to further extend the limits of grain storage. The rationalisation of the State run agriculture departments means that farmers now must seek information from equipment manufacturers, the Stored Grain Research Laboratory, the Kondinin Group and publications that may be available. While the information is still available, it is harder for farmers to source. The problem that we face is that if we want to introduce new methods (e.g early harvest of legumes), the information required by farmers is not easily disseminated. This results in slower adoption of new technology and more costly mistakes along the way.

I mentioned 'luck' as factor in the success of on-farm storage. We all know it is difficult to predict markets, but storing grain for a marketing advantage relies on there being higher prices in the future. Farmers cannot hope to win every time, but they must be able to rely on trends to yield a benefit over time. To date farmers have mostly been successful—prices do tend to increase between harvests—but what happens when there is no longer a need

for grain to be moved off-farm at harvest due to lack of storage?

At present the controls and checks that we have in place to ensure the quality of our farm-stored grain do not cover every situation. We cannot guarantee the quality of every parcel of grain delivered from farm storage because we cannot be sure that the farmer both knew and followed correct procedures. I am not suggesting that we have problems and I acknowledge that key markets are protected by testing, but surely the risk of a damaging episode of substitution or contamination is increased as we move to more farm-based storage.

## Safety around farm storages

It is well documented that Australians farms suffer high accident rates. Grain storage is a significant contributor to this problem. Documented accidents include children suffocating from grain immersion, serious injuries sustained from grain augers, electrocution when mobile augers contact overhead power lines and storages collapsing onto people. We hear about the fatalities and serious accidents, but many of the near-misses go unnoticed.

We presently have a number of documents which have been developed to reduce the risk. NSW WorkCover has produced a code of practice for the design and manufacture of on-farm grain silos (Anon. 1991), the Australian Silo Manufacturers' and Grain Storage Association Code of Practice (Anon. 1990), and a number of Australian Standards including AS 3773 'Safety in Bulk Solids Containers' (Anon. 1990) and AS 3774 'Design of Bulk Solids Containers' (Anon. 1996). Unfortunately, the number of manufacturers adhering to these codes and standards is low and there are a lot of older storages on farm which pre-date these documents.

I believe that we will continue to see unacceptable levels of risk and accident around on-farm grain storages until there is greater awareness and, perhaps (unfortunately), legislation is introduced. I think we should all be very concerned about the level of risk that exists.

## Technical developments for on-farm storage

There have been several areas where attention has been given to improving systems, methods and equipment. These areas include sealing of storages, methods of disinfestation, aeration, and handling equipment.

The serious push for the use of sealed storages has been going for at least 15 years in Western Australia and perhaps 10 years in the eastern States. There is no doubt that the use of sealed storage for fumigation or controlled atmospheres is the best option to eliminate pesticide and insect contamination of grain. In the last 10–15 years significant progress has been made, with much more sealed storage now present on farms. Unfortunately, there are a few impediments to further progress in the introduction of good quality, sealed farm storage. There is still a lack of adequate promotion of the need for sealed storage. There are only a few manufacturers who are making and promoting sealed silos (many discourage customers from choosing sealed options). There has not been a definitive code or statement issued to set standards for sealed storage design (although this was a GRDC goal when it assisted setting up the silo manufacturers associations).

I strongly believe that best current disinfestation methods revolve around sealed storage combined with the use of gases including phosphine, carbon dioxide or nitrogen. Phosphine (in tablet or blanket form) is the simplest to use and has been readily accepted (although its misuse is very common). From a technical point of view, the processes using nitrogen and carbon dioxide have been trialed and will work, but I wonder how we promote their use when necessary, what we need to do to educate people to use them, what infrastructure will be required and what parameters need to be laid down so that the system is viable for on-farm use. If these processes are going to be required for on-farm storage, we should be devoting resources into this area earlier rather than later.

Grain aeration has been used in Australia for many years and it is a well researched tool. Aeration systems are readily available, and are common in some regions and rare in others. They are used extensively in northern NSW and in Queensland as they have long been used to assist in the storage of higher moisture summer crops. They are almost absent in the areas where only winter crops are grown. If we wish to extend the boundaries of our farming methods, aeration of stored grain will need to increase. As we store grains with higher value and/or oil content, harvest earlier for efficiency and/or grain quality and extend the boundaries of our cropping areas (e.g. red wheat areas), aeration will be an integral part of many more storage systems.

The actual operation of aeration systems in the field is a little haphazard. I have heard a wide variety of aeration strategies: many contradictory to each other and to what I would be recommending. As we have wider use of aeration, education will be essential.

I am not involved in the design or manufacture of handling systems. However, I often find that we are working in conjunction with a manufacturer of conveyor systems as our customer wants to know what size auger or tubeveyor they need, or we have to design our silos to accommodate a permanent system of conveyors. There is certainly a great awareness of the need to minimise damage to grain, especially in the seed, legume, oilseed and specialist grains sectors. Accordingly, we are seeing, amongst our customers, a rapid increase in the various belt-type conveying systems.

Handling and conveying grain rapidly is important for harvest efficiency. Broadacre farms, especially those using harvest contractors, are moving to larger equipment. We now see many farms with 2–7 tonne per minute conveyors, where they were once using 0.75–1 tonne per minute augers.

## The future for on-farm storage

The grain industry has been strong over the past few years. This has seen an increase in both the amount of grain being stored and the level of new storage being installed. While grain continues to be strong (and other sectors, such as wool, remain flat) we should expect to see the storage trends continue. If the fortunes of the various agricultural sectors were to be reversed, there would be an adverse affect on the growth in farm storage.

The silo industry has detected an increase in average silo size. This reflects increased farm size, increased yields, increased amount of grain retained on farm and a desire to improve convenience (efficiency). These causal factors, and therefore the trend, will almost certainly continue.

With so many stakeholders in the grain industry, I would argue that it is important to gain better data on the level of on-farm storage, to investigate the market implications of grains stored in the hands of the many producers and to determine ways to better equip farmers in their role as grain storers.

There will be improvements in the way in which grain is stored on farm as markets require improved quality and new storage is introduced. There will be a need to ensure that information is disseminated to the grain storers.

Lastly, I have been involved in the manufacture of grain silos for over 20 years and my father for 15 years before that. I have been told, on many occasions, that 'you cannot keep building silos—the market will be saturated one day'! I wonder when that will occur.

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