

# Insect control in farm-stored grains—the ‘Grainsafe’ extension project

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## Abstract

The ‘Grainsafe’ extension project was commenced in Queensland and New South Wales in 1991.

The principal aim of the project is to provide grain growers and other grain industry service personnel with up-to-date practical information on appropriate measures for controlling insects in grains stored on farm. ‘Grainsafe’ is funded by the grain industry through the Grains Research Development Corporation (GRDC). It was conducted as a series of seminars in Australia’s north-eastern grain belt by the authors who have expertise and experience in agricultural extension, stored grain entomology and grain storage and handling engineering. Grain industry newspaper features, grain industry magazine articles and a comprehensive ‘Grainsafe’ Information Kit have been produced by the authors and used to complement the seminar series in this project.

The ‘Grainsafe’ team expects the project to be on-going in order to provide grain growers and service personnel with practical information as grain storage insect control technology develops.

Seminars have been held at key grain-growing centres to date, from Wagga Wagga, NSW, to Orion in central Queensland. Opportunities for improvement in farm-stored grain insect control exist in the areas of resistance of insects to protectants and fumigants, non-chemical control of insects in farm storages (for example, by use of aeration and controlled atmospheres), use of sealed (gas-tight) silos, farm hygiene and integrated pest management, and costing of farm storages as an aid to decision making on grain storage options. Seminar presentations have been designed to provide participants with an improved understanding of principles involved so that firm recommendations can be more readily accepted.

Follow-up evaluations of the project have indicated that, 85% of ‘Grainsafe’ participants intend to change various aspects of on-farm grain storage insect control in an effort to improve general marketability of farm-stored grains.

## Background

Deregulation of Australia’s domestic grain transport, handling and marketing system in 1989 has allowed grain growers to develop new marketing strategies which will involve increased use of on-farm storages. Although some grain held on-farm is for the growers’ own use as stock feed or seed, most farm-stored grain will eventually find its way onto the

market. Most markets, domestic or export, now demand either zero or very low insecticide residues on grains for human consumption. As a consequence, growers must be able to control insects in grain destined for these markets without relying on protectant insecticides.

A review of research and development initiatives for the Queensland wheat industry (Wheat and Barley Research Committee for Queensland 1989), identified farm grain storage and the control of insect pests in particular as an issue of increasing importance. Identification of priority research and development was needed for cost effective allocation of funds and to focus programs on longer-term strategic issues. To facilitate this, a Farm Grain Storage Workshop sponsored by Queensland and New South Wales state committees of the Grains Research and Development Corporation (GRDC) was held in 1991 (Andrews 1991a, b), involving specialists representing all facets of the grain industry. The objects of the workshop were to:

- summarise current technology;
- identify problem areas and deficiencies in knowledge; and
- prioritise areas for future research and development of the tropical and sub-tropical grain belt in north-eastern Australia.

The outcome of the workshop was a prioritised list of strategic research and development needs as follows:

1. Integrated extension programs and economic analyses
2. ‘Nonchemical’ technologies for stored grain protection
3. Integrated pest management systems
4. Insect resistance management
5. More effective grain insecticides and fumigants
6. Market incentives and disincentives
7. Improved instrumentation for grain quality management
8. Standards for storage facilities.

Priorities 1 to 5 were used as the framework for subject matter to be covered by the ensuing ‘Grainsafe’ extension project team.

## Market Research Underpinning ‘Grainsafe’

The ‘Grainsafe’ project team conducted a market research survey to define the target audience and the type of information needed about insect control in farm-storages (Bullen et al. 1991). The survey sought to determine the attitudes of grain growers toward newer grain storage technology on-farm. We also sought to determine grain growers’ expectations regarding the marketing of their grains in the near future and how this would affect the extent of grain stored on their properties.

Two hundred and fifty grain growers from all grain growing districts of Queensland were randomly selected for the baseline survey.

Some of the key findings of this survey were:

- It was realised that growers had a poor understanding of skills needed to successfully store grain on-farm and maintain the standard of quality demanded by markets.

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- About one-third of grain growers said they planned to store more grain for longer periods as part of their marketing strategy by 1996.
- Grain growers preferred 'nonchemical' methods to control grain storage insects, and said they would seriously consider nonchemical methods even if these methods were more costly. The 'nonchemical' options presented to grain growers were, improved farm hygiene, cooling grain with aeration, use of inert dusts (for example, 'dryacide') for treating grain and storages, 'controlled atmosphere' technology.
- About half of these growers experienced problems with storage insects in grain stored less than three months, increasing to 60% when grain was stored up to six months.
- Rejection and/or downgrading due to insects or insecticide residues cost farmers from \$5/t to \$30/t.

Coincident with the grain grower survey, the team also surveyed grain buyers and/or grain handlers to assess the extent of their problems with insect infestations of grain and also their perception of future trends in on-farm grain storage and marketability of grains. This section of the grain industry confirmed that:

- Most domestic and export markets have very stringent standards on insecticide residues and on insects present in grains.
- Insecticide/fumigant resistances were a major concern to the industry.

Using the findings from this market research exercise, the team designed the content and overall thrust of the 'Grainsafe' project. A major emphasis was placed on the concept of integrated pest management, and because many growers would continue to rely on chemicals such as protectants, at least in the short term, resistance management was also a key issue. Funding for this preliminary work was provided by the Grains Research and Development Corporation.

## Extension Output from the 'Grainsafe' Project to Date

The extension strategy involved:

- Production of 12 information bulletins covering a wide range of topics related to insect control in farm-stored grains (Table 1). The complete 'Grainsafe' kit (Bullen et al. 1993) has been widely distributed to grain growers and others servicing the grain industry.
- Conducting of a series of 'Grainsafe' seminars for groups within the main grain growing district of Queensland and New South Wales. To date, 15 such three-hour seminar meetings have been successfully completed with the valuable assistance of local extension staff from the centres concerned. It is intended to continue with this form of information dissemination because it permits free discussion of practical matters with resource staff.
- Development and production of a portable 'Grainsafe' display for use at relevant agricultural shows, conferences, field days etc.
- Publication of 'Grainsafe' material in grain industry newspapers and periodicals.

The 'Grainsafe' seminar format was of three hours duration during which bulletin authors made short presentations of the relevant material. Discussion of each topic with the audience followed.

Local departmental extension staff were involved in the planning and publicity for each 'Grainsafe' presentation. They were also provided with a comprehensive list of specialist resource people intended to assist them in more efficiently and effectively dealing with grain storage enquiries from district clients.

The 'Grainsafe' team received strong support in Queensland from the state's main bulk handling authority, Grainco Handling. Grainco's Manager, Grain Protection, Mr Barry Bridgeman was closely involved in the planning and delivery stages of the project. He prepared and delivered papers titled, 'On-farm or Central Storage—a Complementary Role', and

**Table 1.** Stored grain insect control, 'Grainsafe' information kit, list of bulletins.

Bulletin	Title	Topics
GS001	Stored-grain insect control—future challenges	Background to GRAINSAFE; deregulated grain markets; growers views; market demands
GS002	Stored grain insects—know your enemy	Major stored grain insects; type of damage; life cycle; temperature effects
GS003	Farm grain storage—what does it cost?	Calculating on-farm storage costs; capital, operating and opportunity costs; examples
GS004	Integrated pest management (IPM)	What is IPM?; IMP checklist for growers and handlers
GS005	Grain hygiene	The why, where, when and how of clean grain and equipment; how good is hygiene?
GS006	Protectants for stored grain in NSW and QLD	What are protectants?; Advantages/limitations; Dryacide; recommendations for NSW and QLD; safety
GS007	Protectant application equipment	Powder applicators; liquid applicators; pressures, nozzles, pumps; suppliers; safety
GS008	Managing resistance to chemicals	How insects develop resistance; ways for growers to manage resistance
GS009	Aerating stored grain	Benefits; moisture migration; equipment; automatic controllers; when to aerate; costs
GS010	Fumigating with Phosphine	Successful fumigation methods; sealed storage; safety; application rates
GS011	Sealed silos	Benefits; selection and operation; moisture; pressure test; maintenance; safety
GS012	Clean your harvester for quality grain	Benefits of cleaning; cleaning methods and gear; fumigation; harvester cleaning checklist

'Marketing Farm-Stored Grains—Standards and Quality Requirements'.

Dr Barry Wallbank, Stored Grains Entomologist at the Biological and Chemical Research Institute, Rydalmere presented key segments at 'Grainsafe' seminars in the five New South Wales' grain centres in 1993.

The 'Grainsafe' extension effort to March 1994 has amounted to ten 'Grainsafe' presentations in Queensland and five in New South Wales. Five more are planned for Queensland before June, 1994. Attendances have averaged 25 per seminar to date. This is considered most successful, especially in Queensland where severe drought has prevailed during 1992–94. These conditions have severely depleted the northern grain crop and therefore the immediate importance of improved stored-grain insect pest control.

### Outcomes of the 'Grainsafe' Project

At the conclusion of each 'Grainsafe' seminar, participants were asked to provide written evaluations of the usefulness, quality of the information and the standard of presentations. This 'feed back' from audiences has been most encouraging and has been used to streamline the presentations and to gauge audience needs for subsequent presentations.

Audience composition has been:

grain growers	61%
consultants/advisers	9%
silo manufacturers/agents	5%
agrichemical dealers	7%
grain merchants	8%
Bulk handling authorities/extension workers	10%

Some of the 'successes' for the 'Grainsafe' project to date are:

- 75% of participants said that the information provided in presentations or discussions covered their grain storage problems in a useful, practical sense.
- 80% of grain growers present had an improved understanding of insecticide resistance development and therefore better understood the need for improved fumigation practices and particularly the importance of sealed silos.
- 10% of participants indicated a strong interest in retro-sealing existing farm storages to enable improved fumigation of grain.
- seminar participants nominated grain hygiene as the area of most interest to them. This was followed by cooling with aeration, fumigation methods and sealed versus unsealed silos.

An additional indication of the 'Grainsafe' success to date has come from silo manufacturers. At the September 1993 'Agshow' held in Toowoomba, Queensland, four of the five silo manufacturers represented reported a sharp increase in farmer enquiries for gas-tight farm silos and aerators.

We have endeavoured to enhance general industry awareness of on-farm storage problems and practical solutions to these problems through publications such as:

- Grain Handling and Storage Feature' in *Queensland Graingrower* p. 11–14, October 6, 1993, an annual feature.
- Feature articles in grain industry magazines, for example, 'Aerating Stored Grain', *Australian Grain*, January, 1994; 'It Pays to Calculate Storage Costs', *Farming Ahead*, No. 23, November, 1993, Kondinin Group.

### Other Complementary Efforts on the 'Grainsafe' Theme

The Grains Research and Development Corporation has, in its

own right, taken the initiative in fostering interest, within the Australian silo manufacturing industry, in production of farm silos to a higher level of gas-tightness and to encourage the industry in other areas of silo quality.

In 1993, GRDC's efforts resulted in formation of silo manufacturers and grain storage associations in South Australia, Victoria/southern New South Wales and in northern New South Wales/Queensland.

The main thrust of these associations will be to develop minimum standards of quality and design in the production of new farm grain storages, in order to more adequately cater for increased demand for gastight silos of improved reliability.

### Plans for the Future

The 'Grainsafe' seminar format is considered one of the best extension strategies for improving grain growers' understanding of storage insect problems and provides an excellent medium for information on improved insect control practices. It is planned to continue this strategy.

Existing farm grain storages are generally of the nongastight or conventional type. There is potential to considerably up-grade the standard of these existing farm storages, especially by retro-sealing and fitting of appropriate aeration equipment.

Retro-sealing techniques in the southern and eastern grain belt have yet to be proven in their effectiveness. It is therefore planned to encourage information exchange on these techniques by means of retro-sealing workshops for eastern and southern grain belts. Key resource personnel are expected to include experienced, successful silo-sealing contractors from Western Australia, where, in conjunction with staff from the Western Australia Agriculture Protection Board, considerable improvements have been made in retro-sealing techniques for farm silos. This activity is planned for 1994–95 on the Darling Downs, Queensland.

### Conclusion

Australian grain growers have shown strong interest in improving the future marketability of their grains, on both domestic and export markets. Grain quality in terms of insect infestation and insecticide residues is of paramount importance.

The 'Grainsafe' extension project recently commenced in north-eastern Australia's grain belt will continue to provide an improved awareness throughout the industry of the latest and best practices in controlling insect pests in farm-stored grains.

Emphasis will continue on the integrated pest management (IPM) approach for farm use, more effective use of fumigants, installation and use of gastight farm silos, aeration of silos, possible wider use of controlled atmosphere storages on-farm and use of inert dusts as grain protectants where appropriate. The 'Grainsafe' program is essentially flexible and will be updated as new, improved technology appropriate for on-farm use becomes available.

### References

- Andrews, A.S. ed. 1991a. Farm Grain Storage Workshop—Working Papers, Grains Research and Development Corporation.
- Andrews, A.S. ed. 1991b. Farm Grain Storage Workshop—Final Report, 1991. Grains Research and Development Corporation.
- Bullen, K.S., Andrews, A.S. and White, G.G. 1991. Grain storage and protection practices on Queensland farms. Farm Grain Storage Workshop Working Papers, Grains Research and Development Corporation, 89–97.
- Bullen, K.S., Andrews, A.S., Collins, P. and White, G.G. 1993. Grainsafe Information Kit. Queensland Department of Primary Industries.
- Wheat and Barley Research Committee for Queensland 1989. Review of Research and Development Initiatives for the Queensland Wheat Industry. Report.