1001

Use of Computer-assisted Learning in Training on Grain Quality Management

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Abstract: Computer – assisted learning (CAL) incorporates elements of computer technology into traditional learning, The latter includes pictorial material such as graphs, still photographs, videos but also accommodates animations, sound and computer simulations, The training modules can be recorded on CDs or DVDs reducing their cost below that of printed materials.

A series of tutorials related to grain storage management have been developed over a number of years by an international group of grain scientists from Australia, China, Indonesia, Thailand and Vietnam, The topics comprised in the tutorials are based on the research results of the grain scientists from the collaborating countries covering a period of over twenty years and on the industrial practice, Tutorials include: integrated commodity management; biology, ecology and identification of grain pests; moulds and mycotoxins; pest control options and temperature and moisture manipulation of grain in storage.

The tutorials have originally been developed in English and then translated into Bahasa Indonesia, Chinese mandarin, Thai and Vietnamese, A series of training courses have been conducted in collaboration with research and extension organisations and grain industry in China, Indonesia, Thailand and Vietnam, The paper describes the lessons learnt from the use of CAL as a training tool aiming at improving grain quality in storage.

Key words: computer – assisted learning, multilingual tutorials, integrated commodity management

Introduction

Grains represent an important proportion of stored produce, Given the current price increases of food worldwide, it is obvious that reducing the loss of grain in storage should have a high priority, Preserving grain quality in storage requires a good understanding of the mechanisms leading to losses and knowledge of ways to prevent them.

An understanding of the diverse factors involved in preserving grain quality, and the sometimes complex interactions between them, is essential for efficient management of grain postharvest operations, These factors include environmental conditions, mainly temperature and relative humidity, physico-chemical and biological properties of grains, pests and moulds, physical and chemical treatments, storage structures and handling.

As grains are traded internationally, it is also important to know the market requirements for acceptable treatments, especially with regard to the types of chemicals used and acceptable grain residue levels, Furthermore, there may be restrictions regarding pests with quarantine status, Such pests, if positively identified, will require a specific, often costly, treatment. However, if not properly identified, they may enter a country where they are not present and cause significant economic damage, with likely adverse consequences for the importer and/or exporter,

In practice, there are often various existing methods for grain quality preservation during storage but they may not be known to the majority of potential users or not used properly, The reason for these shortcomings is that technical, managerial and economic disciplines related to grain preservation may not be integrated in the production system, Moreover, there is often insufficient awareness in the industry about the results from the recent scientific research in grain preservation conducted by universities or research organisations, Dissemination of knowledge related to various aspects of grain quality preservation is therefore a key to the successful implementation of preventive and curative measures leading to postharvest loss reduction,

Another issue is the fact that training should be provided to those that are actively involved in the work on the ground, i. e. , in the grain depots or quality control laboratories, The staff in such places may be technically qualified

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and experienced but not sufficiently proficient in English to take advantage of a training tutorial in that language. In order to make the training more effective for this important audience the training materials it is preferable to conduct the training in their own language, Multimedia, multilingual computer-assisted learning (CAL) systems have the potential to address these issues and convey the appropriate technical concepts and practices to the target audiences in an effective manner.

Computer Assisted Learning

Systematic research into various disciplines related to stored grain protection has been carried out by a number of research organisations in leading grain-producing countries, This involved various disciplines such as entomology, fumigation, modified atmospheres and other pest control measures, storage engineering, integrated commodity management, mycology and mycotoxins and grain drying.

Since many of the grain protection measures depend on moisture content control, climatic conditions, grain thermophysical properties have been determined and computer – based heat and mass transfer simulations have been developed. As a result, sophisticated research tools have been developed and extensively tested in developing safe drying systems throughout South – East Asia, selected locations in China and Australia.

Over the past two decades, many collaborative research projects on grain storage have been conducted by Australian research organisations and research organisations throughout Asia, This work has resulted in numerous publications, industrial applications and training courses, Most of these collaborative projects have been funded by research grants from the Australian Centre for International Agricultural Research (ACIAR) and training grants jointly provided by ACIAR and AusAID.

Integration of various elements of required for management of grain quality in storage can be achieved through integrated commodity management (ICM) [1]. The aim of ICM is to use the resources available at a storage complex in rational way to create a dynamic combination of practices designed and implemented to protect stored grain. The key characteristics of successful ICM are a suite of effective and economic storage options, good stock management, and a monitoring and hygiene program that is both regular and efficient to cope with any storage or processing situation. Moreover, ICM provides a systems approach that can be used to introduce new techniques into a storage system in an effective and methodical way.

Decision tools can assist in the implementation of ICM by identifying, the key issues implicated in a particular storage situation through explicit and rigorous analysis of the underlying problems and facilitating interactions between various management levels through improved training[2].

CAL has the potential to make a significant contribution to the training of quality management staff and to the transfer of technology from the laboratory to the field, CAL systems, which utilise the latest multimedia technologies, are inherently interactive and allow self – paced learning and more effective communication of complex concepts to trainees. They can be structured to allow students to explore alternative management options and learn the consequences of their actions. This can happen in individually or in small groups[3].

Embracing these principles, a series of projects lead to the development of decision-support information systems and training tools to facilitate the rational and sustainable management of quality of grain in storage.

A Multilingual, Multimedia CAL System for Managing Grain Quality Postharvest

Grain Storage Tutor[4] has been developed in several phases. The initial project began in Indonesia where the national central grain storage system relies on the combined use of fumigant and spraying of bag-stack surfaces and the fabric of storage structures with contact insecticides, BULOG, the agency responsible for rice marketing and storage in Indonesia, needed to improve cost-efficiency and reduce the pesticide residues in grain, The initial objective of developing Grain Storage Tutor was to achieve more effective integration of quality management strategies, with an emphasis on pest biology and control procedures, such as fumigation, modified atmospheres and use of insecticides. The package was developed initially in English and later translated into Bahasa Indonesia, to provide a better understanding of issues involved in making quality management decisions and facilitate improved decisions-making. Training courses were conducted in Bahasa Indonesia and the feedback from participants used to enhance the package and translate the material into other Asian languages.

As a result, new tutorials were written in-

cluding the identification of moulds and detection of mycotoxins and also on principles and applications of grain drying. The latter, based on several years of collaborative research conducted in the region, included a number of unique features such as thermophysical data of the main grain varieties grown in the region, several years of weather data of principal grain growing locations and also drying simulation models. The drying simulations models included several grain quality models so that various drying scenarios could be tested for given crop under a range of climatic conditions. The results outputs of the simulations could be used by the users to choose the most appropriate scenario in terms of drying time, cost and grain quality. The existing tutorials were expanded, particularly in the area of grain quality management and pest control options by including the ASEAN Fumigation Manuals, An interactive insect determination system was also added.

All tutorials were produced in English and then translated into Bahasa Indonesia, Chinese Mandarin, Thai and Vietnamese. The translations included captions of the graphs, sound tracks of the videos and most of the features of the simulations.

Main Features of Grain Storage Tutor

The examples of the start – up and of the contents pages are given in Figures 1 – 3.

Fig. 1 The start – up page of Grain Storage Tutor with instructions in five languages

Some country-specific content was added, with translation into all four languages. Examples include outdoor storage practiced in the Philippines and flat-bed dryers used in Vietnam, Hyperlinks within text and a sophisticated menu system facilitate navigation between modules and access to pictures, graphs, simulation models and videos. All the tutorials are indexed making searches very easy. There is a

Fig. 2 The general entry page of Grain Storage Tutor in English and the front pages in five languages

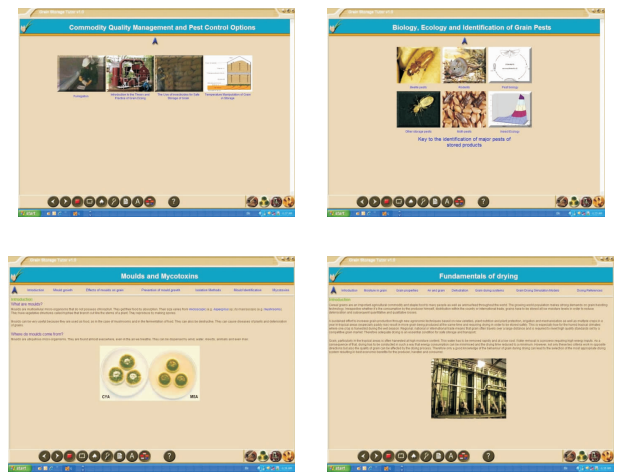

Fig. 3 The four main modules of Grain Storage Tutor in the English version

possibility of switching between languages by clicking on an icon at the bottom of the screen.

Use of Grain Storage Tutor for Training

Grain Storage Tutor has been tested in several countries. There have been international training courses using the English version as well as courses in the Philippines (in English), in Indonesia (both in English and in Bahasa Indonesia), in Thailand (in Thai) in China (in Chinese Mandarin) and in Vietnam (in

Vietnamese). A training facility established at the Post-Harvest Institute (PHTI) in Ho Chi Minh City in Vietnam allowed a thorough testing in the presence from a number of representatives from various sectors of the food industry, Both general and specialised training courses were conducted in Ho Chi Minh City, Hanoi, the Mekong Delta and Dak Lak, in the coffee-producing Highlands of central Vietnam.

The training courses involved the demonstration of the software, hands-on exercises in the utilisation of the package, especially with regard to the use of computer simulations, and practicals in laboratories or warehouses. There were two options, a general training, involving all modules and taking 3 – 4 days or a specialist training, e. g, for fumigators taking 1 or 2 days. At the end of every training course, course contents and mode of delivery were assessed by the participants. The results of the assessment were incorporated into the subsequent improved pre-release version of the package. Despite initial teething problems, mainly due to lack of adequate computer hardware, the training courses were successful and well received by the participants. The collaborating Vietnamese agencies, namely PHTI and the Plant Protection Department (PPD), based in Ho Chi Minh City, have shown an enthusiastic support for this approach of training and organised a number of additional courses. As a result, in excess of 600 personnel have been trained.

Following completion of the various trial training courses in Vietnam, Indonesia, Thailand, China and the Philippines, a revised version of Grain Storage Tutor was released in early 2005.

Since then, further training courses have been conducted in various countries, often organised by the agencies involved in the initial training courses. There were three training courses using Grain Storage Tutor in Thailand (Bangkok, Chiang Mai and Bangkok) involving a total of over 100 participants. The majority of the participants came from the industry.

A series of courses were conducted in various regions of China. There were courses in Harbin and Mishan (Heilongjiang province in Northeast China), Beijing (at the China Agricultural University), two in Chengdu, Sichuan province in Southwest China (organised by Chengdu Grain Storage Research Institute) and in Guiyang, Guizhou Province, (organised by Guizhou Institute of Mountain Environment & Climate), Like in Thailand, most of the participants came from the industry.

Grain Storage Tutor, developed with funding from Australian Centre for International Agricultural Research (ACIAR) and AusAID, is becoming a widely-used tool for training throughout Southeast and East Asia.

There are obviously other training packages using multimedia techniques that have been developed in the last decade. One of them is the Canadian Grain Storage CD – ROM' developed by the University of Manitoba. It is focusing on the Canadian grain storage conditions and includes mainly topics such as common names of insects and mites, methods to control stored grain insects, phosphine corrosion calculator and a computer program for stored grain management,

Another package is the Managing On-farm Grain Storage CD developed by Quality Wheat CRC in Australia. It is focusing on wheat and includes wide range of topics related to quality such as standards and inspection, structures and equipment, grain hygiene, farm safety, economics, HACCP planning of pre and post – harvest operations, a comprehensive glossary of terms and an interactive part including problem solving in questions related to grain management.

There is also a number of internet based training resources such as Grain Elevators and Processing Society in the USA (http://www.geaps.com/) or the Purdue University based archives:

The CD-based training resources have the advantage of being capable of accommodating a number of features such videos, animations and computer simulations which are not possible with printed materials. Moreover, the upgrades are significantly less expensive than those of printed media, Whilst internet-based resources can be updated frequently, limited internet bandwidth is often a severe constraint for materials such as videos.

Conclusions

Grain Storage Tutor, has been shown to be a flexible and comprehensive tool for dissemination of knowledge required to improve grain quality in storage. Although not the only resource of its type, it has been thoroughly tested by a large and diverse range of users, whose feedback has facilitated the refinement of the system into its current form. The ability to communicate information in the native language of the countries in which the training will be delivered makes the package particularly attractive

in comparison to similar, but less comprehensive training packages.

Last but not least, despite its success, developments in the grain preservation techniques continue and thus it will be necessary to update the content in the near future.

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