The need for best practice herbicide management

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Summary  Australian herbicide users face increasing challenges resulting from regulatory obligations and community expectations for ensuring the health and safety of people and the environment, safety of foodstuffs, and the protection of markets. Meeting these challenges necessitates implementation of best practice in all aspects of the herbicide management chain from purchase to final disposal of waste including: risk management; correct application technology; effective safety precautions; development and documentation of policies and procedures; competency training and mandatory record keeping. All herbicide users need to be aware of their current obligations and possible future requirements and have the knowledge and skills to implement such requirements.

Keywords  Herbicide management, best practice, pesticide management plans, safety, training, risk management.

INTRODUCTION
All weed managers, whether farmer, environmental manager or researcher, have a challenge and obligation to use herbicides wisely and to follow best practice in order to protect the safety of people, the environment, and markets for agricultural and horticultural produce.

Herbicides continue to play a major role in the profitable production of high quality and healthy food and natural fibre, as well as playing a role in protecting human and environmental health. They represent a major, and increasing, component of farm inputs (Radcliffe 2002), although sales of the 1251 different herbicides declined from $884 million in 2000 to $694 million in 2002 (APVMA 2003), due to the drought.

There is continual evolution in the regulation of herbicides and other pesticides, the technology involved in herbicide use, the farming and environmental management systems in which we use them, and in trade, market and community expectations. This is exemplified by the major changes seen since the 1990 Senate Select Committee review of Agricultural and Veterinary Chemicals in Australia (Colson 1990) and the endorsement of The National Strategy for the Management of Agricultural and Veterinary Chemicals (ARMCANZ 1998). This Strategy has set the goal of: ‘Best practice management of agricultural and veterinary chemicals to achieve ecologically sustainable and socially acceptable food and fibre production in Australia’ based on use which ‘minimises the risks to health, environment and trade; ensures long term sustainability of agricultural productivity; and best contributes to national prosperity’.

DRIVERS FOR BEST PRACTICE
There are many imperatives for herbicide users to adopt best practice. At Federal and State/Territory levels, over 60 pieces of legislation impact directly or indirectly on herbicide use (Radcliffe 2002). This legislation and ‘Duty of Care’ obligations require correct herbicide use and management of risks. However, considerable differences in legislation between States/Territories create major problems and needs to be addressed. The National Registration Scheme administered by the Australian Pesticides and Veterinary Medicines Authority (APVMA) incorporates requirements for best practice through its regulatory processes, product labelling, issuing of permits for non-registered use of products, and restrictions on the sale and use of prescribed products (APVMA 2004).


Community expectations require herbicide users to ensure products are used correctly, and to monitor this, an adverse experience reporting program has been established by the APVMA (APVMA 2004).

Community expectations are also reflected in market, trade (for example Eurepgap) and industry demands for producers to be able to demonstrate through documentation and audits that pesticides have been used correctly as part of a wide range of quality assurance (QA), environmental management system (EMS), ISO14,000 accreditation and best management practice (BMP) programs. These requirements represent major hurdles for growers because they are a quasi-regulation additional to that imposed by Government regulators. In future it is likely that farmers will be unable to find markets for their produce unless they comply with the requirements of a QA or EMS program embracing food, human and environmental safety standards (Radcliffe 2002).

Food and fibre safety through regulated maximum residue limits (MRLs) has always been a priority requiring pesticide users to comply with label directions.
Protection of the environment from pollution through misuse of pesticides, accidental spillage and drift during application is important, as indicated by the commissioning of national Spray Drift Guidelines (PISC 2002). Discussions are currently underway in Queensland regarding restricting the use of atrazine herbicide to prevent groundwater contamination (Anon. 2004). Atrazine has already been banned in the European Union.

Use of pesticides has resulted in ever-increasing incidences of pest resistance to pesticides, including herbicide resistance in weeds. This has lead to widespread calls to implement integrated weed management (IWM) as a component of good practice. An important aspect of this is to ensure wise use of currently available herbicides to prolong their useful life. Limited new chemistries for replacement herbicides are expected.

Farmers, environmental managers and researchers are always faced with limitations on finance available for weed management. Implementing best practice herbicide management will assist to maximise herbicide effectiveness and minimise costs through reduced wastage, thereby enhancing efficiencies and profits.

IMPLEMENTING BEST PRACTICE
Components of best practice and steps herbicide managers need to take for implementation are as follows.

Risk management Underpinning best practice is the requirement to manage risks. The hazards associated with the products themselves need to be identified from labels and material safety data sheets (MSDSs), and hazards associated with equipment and practices identified through safety audits. The risks posed to people, the environment and trade need to be assessed and steps taken to manage those risks. All risk assessments must be documented.

Personnel All herbicide users need to be competent. Employers, managers and supervisors have a particular responsibility to ensure operators and contractors are suitably trained. Trained operators are required by the APVMA when using prescribed products, by OHS regulations covering hazardous substances, and by State control-of-use legislation. However, States differ in who is required to be trained and the level of the training. For example, in New South Wales (NSW) all commercial users must be trained while in Victoria, only users of Schedule 7 and some environmentally hazardous products need to be trained. In NSW competence in pesticide use at Australian Quality Training Framework (AQTF) level 2 training (those working under direct supervision) is the minimum standard. In other States, competence at level 3 (independent operator) or no training is required. This situation is volatile as States review their legislation. At level 3, the ChemCert National Training and Accreditation Program for agricultural and veterinary chemical users meets all requirements. Other programs are also delivered by a range of providers.

Product purchase Purchases should be made by responsible persons. Some retail outlets will only supply to those who hold appropriate chemical user accreditation. It is recommended that products are purchased only from companies and retail outlets which are Agsafe accredited – the standard required by AVCARE, the Australian agvet chemical industry Association, as part of its stewardship program.

Quantities sufficient for immediate use only should be purchased because products do not have an indefinite shelf life and there is a capital cost when stored.

Transport Herbicides must be transported safely, and the products themselves protected from loss or damage. For those products classed as Dangerous Goods, there are extra legal obligations: vehicles may require placarding with warning signs; the driver may need a special licence and carry appropriate documentation; and when loading products they must be checked for compatibility. Commercial carriers have particular responsibilities (NOHSC 2001).

Storage Legal and QA obligations for storage require that products are stored in a manner that protects people, animals and environment as well as the integrity of products themselves. Stores should be appropriately situated, bunded to contain spills, be well lit, well ventilated, locked and with appropriate warning signs. Depending on quantities of Dangerous Goods stored, the store may require a licence from regulatory authorities.

Handling Risks must be minimised during manual handling, loading and unloading from vehicles, filling into spray tanks and measuring concentrate. Hazards include the heavy weights of large drums and the toxicity and environmental danger of concentrates.

Handling practices which minimise risks include closed measuring and filling systems utilising calibrated pumps and measuring devices, and using refillable Envirodrums® or similar. Costs and efficiency of the process should also be considered. A ‘nurse tank’ of clean water at the application site can greatly improve logistics of refilling as well as providing a source of clean water for washing.

Application While Australian users have access to world class application technologies, adoption in some sectors has lagged despite the significant efficiencies
which can be gained (Radcliffe 2002). Frequently, the way in which herbicides are applied is the weak link in safe and efficient herbicide management.

There are many spraying and non-spraying ways to apply herbicides. Best practice requires a thorough understanding of the principles of application, the spraying process, and how spray droplets behave. Important considerations are: selection of the most appropriate equipment for the herbicide and the situation in which it is to be applied; the adjustment of that equipment to maximise effectiveness and minimise waste and drift; the correct selection of spray nozzles to ensure the droplet sizes generated are the most efficient biologically while not posing a drift hazard; and calibration to ensure correct dose. Advanced technologies like global positioning guidance systems, spray monitors and controllers can further improve efficiencies. Controllers which can be preprogrammed to apply a set volume rate of spray, and which at the completion of the job print out a record of application parameters, are now available. Precision technologies like variable rate herbicide application are making their way into the commercial world.

At the conclusion of application, decontamination of all equipment is necessary to prevent carryover of herbicide residues to the next job and to ensure people handling the equipment are not exposed to chemical.

All equipment must be maintained in good working condition. In NSW, penalty notices can be issued by Pesticide Inspectors to prevent harm or likely harm from unsafe practices and use of defective application equipment (EPA 2003).

Prior to application, risk assessments must be conducted on equipment, the herbicide itself, and possible effects in the area surrounding the application site (Workcover 2004, NOHSC 2001). The concept of an ‘awareness zone’ (Kent et al. 2000) to determine who and what might be affected, is a good one.

Consultation with those who might be affected by herbicide use is recommended. In NSW draft regulations on notification recommend consultation and may mandate operators notify those likely to be affected in sensitive areas and public places (EPA 2004).

**Personal safety** Personal safety must be a priority, and ensured through risk assessments and implementation of safe working systems, standard operating procedures and documented emergency procedures (Workcover 2004, NOHSC 2001). Personal protection equipment (PPE) appropriate to the hazards and risk must be issued to herbicide users and instruction given on its correct use. PPE must comply with Australian Standards.

All herbicide users must know basic first aid and the steps to take in the event of exposure and poisoning.

**Environmental safety** The community demands that herbicides are used in environmentally friendly ways and that possible pollution through herbicide spray and vapour drift, runoff and leaching into the groundwater is prevented. Again, risk assessments must be conducted.

A range of measures can be used to minimise spray drift (PISC 2002) including: minimise the generation of fine driftable droplets by choosing appropriate nozzles and sprayer pressure, and using adjuvants; modifying application equipment to trap fine droplets under covers or hoods, or to reduce the distance droplets travel to the target; using air assistance to transport droplets to the target; ensuring spraying is only conducted in acceptable weather conditions of temperature (10–30°C), relative humidity (greater than 45%), wind speed (less than 10–15 km h⁻¹) and atmospheric stability (do not spray if a temperature inversion is present); and using vegetative buffers and non-spray zones between application sites and sensitive areas.

Herbicide users need to be aware of surroundings, communicate with those who may be affected, and use appropriate drift management techniques in an integrated package.

**Waste disposal** Acceptable and safe disposal of unwanted herbicide concentrate, left over herbicide mix, empty containers and rinsate from equipment decontamination remains problematic for many despite the significant advances in recent years.

The drumMUSTER® drum disposal scheme is an excellent disposal and recycling pathway for eligible containers (has drumMUSTER® logo). Since its inception in 1999, over 4 million drums (6000 tonnes) have been recycled into such things as plastic fence posts, tomato stakes, drainage pipe, and wire. Containers which are not eligible for drumMUSTER® must be disposed of with care to avoid creating contamination hazards (drumMUSTER 2004).

Waste chemical may be disposed of through the ChemClear® program (ChemClear 2004). Disposal of waste not accepted by ChemClear remains a concern because of the potential to create contaminated sites. Diluted left over herbicide mix and rinsate from equipment washing after application is usually best disposed of in the area where the herbicide was applied, provided there is no risk to the environment.

Considerable research into acceptable disposal pathways is required.

**Record keeping** It is often said that it is not possible to prove a thought. Documentation of decisions is therefore required to prove due diligence if things go wrong. Records are also required by legislation, quality
assurance programs and basic good management to assist with decision making and to ensure there is no confusion or misunderstanding. Historical records are essential for herbicide selection for resistance management, or in the event of poor product performance or insurance claims.

The requirements for record keeping are extensive, so a good, practical system is required (OKE 2001). Records which must or should be kept include:

- standard operating and emergency procedures;
- risk assessments of each individual herbicide and how it is used, plus a risk assessment of all herbicide management practices;
- herbicide application records (spray logs or spray diaries);
- material safety data sheets (MSDS) of all products used;
- records of training of operators;
- area treatment records (e.g. paddock records);
- job orders – directions in writing given to an operator or contractor;
- accidents and incidents including human exposure, chemical spills and clean up procedures;
- chemical store records including a register of all products stored, and stock control records; and
- notification and consultation records.

Pesticide management plans In order to demonstrate implementation of best practice, herbicide users, and contractors in particular, need to document the whole process via a workplace pesticide management plan. Contractors may need such a plan to be eligible for contracts. Elements of such a plan include: workplace policies; standard operating procedures; emergency procedures; roles and responsibilities; risk assessments; and full records.

CONCLUSION
Herbicide users are strongly advised to adopt best practice even though complying can be a difficult and expensive exercise. However, it is worthwhile due to the benefits it brings in helping to meet regulatory obligations, reduced wastage, improved weed management, minimisation of potential adverse affects to health and environment, protection of markets and maximisation of food and fibre quality, value, and profits. It also helps to demonstrate due diligence and minimises liability in the event of litigation.

Resources to assist herbicide users implement the requirements are available from a range of sources including government agencies like regulatory authorities and Departments of Agriculture and Environment. An excellent Chemical Risk Management Kit (OKE 2001) giving guidelines to implement best practice, complete risk assessment checklists, a complete pesticide management record keeping system, and signs for the chemical store and workplace is available along with assistance with formulating pesticide management plans.

To cope with the continually evolving challenges now and in the future, herbicide users must adopt new and enhanced technologies, implement best practice, and embrace a culture of continuous improvement. It is part of the triple bottom line of balancing people, planet and profit.

REFERENCES