

QUARANTINE

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QUARANTINE can be defined as a set of measures taken to prevent or delay the entry, establishment and spread of a pest or pathogen. This chapter describes the quarantine system applied to sugarcane in Australia. The system has a number of components including legislated requirements, organisational policies, industry services, and best practice arrangements among farmers, cooperatives and contractors. Some historical background is given to indicate the success of these arrangements in preventing the introduction of potentially serious pests and pathogens and eradicating or restricting the movement of those already present. This chapter should be read in conjunction with Chapter 13 (Disease Management) and Chapter 14 (Pest Management).

Like sugarcane, most of its pests and diseases are not native to Australia. Researcher David North reported in 1923 that thousands of sugarcane varieties were brought to Australia from numerous countries in the previous decades and moved between the cane-growing regions. These movements were undertaken by government institutions, mill authorities, cane farmers and others, but North stated that some farmers had 'quite a fetish' for frequent change of varieties.

While these vigorous efforts to obtain better varieties undoubtedly benefited the industry, diseases including gumming,

mosaic, red rot, Fiji disease, downy mildew and leaf scald were all introduced and dispersed widely. Likewise, numerous insect pests including sugarcane weevil borer (*Rhabdoscelus obscurus*) were introduced.

Few, if any, precautionary measures had been applied to the importation and movement of cane and North argued for the establishment of quarantine controls. In 1935, he described an officially proclaimed quarantine used to contain and control an outbreak of gumming disease in the Tweed and Clarence River districts. No cane or plant parts could be removed from infected crops

MANUAL OF CANEGROWING

or a one-mile buffer zone and various hygiene requirements applied within the zone. This quarantine delayed spread of gumming outside the zone for four years, allowed the substitution of the resistant variety Q813 for the susceptible Badila, and facilitated effective control within the zone.

North visited a discussion that remains current today, comparing the relative merits of 'prompt eradication by heroic measures ... against the losses ... likely to be incurred by adopting ... slower, less drastic methods of control'. He also proposed quarantine systems that exist today, including the quarantine zones between regions of the Australian sugarcane industry, isolation plots for establishing disease-free nucleus cane, and quarantine glasshouses for screening cane to be moved between widely separated regions.

Since North's time, concepts of quarantine regulation and practice have developed greatly. One enormous influence comes from the effects that quarantine has on trade. Many quarantine measures are costly to individuals, organisations and governments, through direct costs or onerous requirements. Always there is the argument of prompt versus delayed action. Often, quarantine has been used as an artificial trade barrier. Largely because of these trade issues, some principles have been defined and adopted in State, national and international forums by agreement, treaty and/or legislation.

These principles include that quarantine measures may be applied only against a pest or pathogen that is not present in the country/region and is likely to enter and establish in the country/region, or that is not widely distributed, or is subject to an active and official program for containment, suppression or eradication, and that is known or has the potential to cause economic damage.

In addition, quarantine measures need to be: scientifically based or substantiated; the least drastic measures available that will achieve the desired goals; balanced in terms of their costs, the risk that they may be

insufficient, and the benefits expected; and applied consistently and transparently.

THE LEGAL BASIS FOR QUARANTINE

International

Many of the principles in State and national quarantine legislation are based in the International Plant Protection Convention (IPPC) of 1951, which is administered by the Food and Agricultural Organisation (FAO) of the United Nations.

More recently, the General Agreement on Tariffs and Trade (GATT) has resulted in many countries upgrading their quarantine services and facilities to deal with the more open international trade that has evolved. A raft of methodologies and standards that are followed internationally have been developed under the IPPC.

Commonwealth

Quarantine at the Commonwealth level is conducted by the Australian Quarantine and Inspection Service (AQIS), under the Commonwealth *Quarantine Act 1908*. The public best knows AQIS for its control points at airports, but AQIS has a number of responsibilities that affect the sugarcane industry.

The Nairn Committee reviewed Australian quarantine intensively in 1996 and among the recommendations in its key report was the establishment of an Australian Plant Health Council. This has been formed as Plant Health Australia Ltd (PHA), a company limited by guarantee, contributed to by the Commonwealth government, all State governments and interested industry organisations. PHA is intended to provide a whole-of-industry and whole-of-government approach to plant health issues, resources and programs.

State

Sugarcane is grown in three Australian States, Queensland, New South Wales and Western Australia. Queensland legislation is used as a model to describe the type of legislated

powers and the structures that apply to sugarcane health. Similar legislation exists in the other two states, but reference should be made to the agriculture departments of those States if specific details are required.

In Queensland, the *Plant Protection Act 1989* (PPA) establishes a range of powers to prevent, control or remove pest infestation of plants. The Animal and Plant Health Service (APHS) of the Queensland Department of Primary Industries provides legislative and related support to BSES in discharging this function. APHS is responsible for administering the PPA in relation to plants other than sugarcane and can also act in relation to sugarcane.

The main objectives of the PPA of significance to sugarcane are to prevent, control or remove pest infestations of plants in Queensland. A pest is a plant or animal (not vertebrate), virus or viroid, or plant disorder that is harmful to the growth or quality of crop plants.

For action to be taken under the PPA, an organism must be declared as a pest. For this reason, organisms that are exotic to Queensland and are regarded as a risk are normally declared as pests, allowing prompt quarantine action in the event of an incursion.

Conventionally, plants are declared as pests if they act as an alternate host of a pathogen (i.e. the pathogen spends a part of its lifecycle on the pest plant before attacking the crop in question). Weeds are normally not declared; instead they are acted against under the *Rural Lands Protection Act*. Under PPA, non-approved sugarcane is taken to be a pest.

The PPA is implemented through subordinate legislation (regulations and notices) and the actions of inspectors. The Governor-in-Council makes regulations, in a process that takes several days at minimum. For more urgent action, the Minister may act without reference to Parliament through a notice. Regulations can be enduring unless they

include a 'sunset date', but notices generally have maximum lifetimes of 21 days.

Sugarcane smut provides a recent example. When this exotic disease was detected in the Ord River Irrigation Area in 1998, it was not a declared pest in Queensland. Within three days, after a process of drafting and discussion between interested parties, the Minister for Primary Industries issued the *Plant Protection (Sugarcane Smut) Quarantine Notice 1998*. This notice declared smut as a notifiable pest, established a quarantine area for smut (the whole of Queensland), and prohibited the introduction of smut or anything that was potentially contaminated into the quarantine area. In the ensuing 21 days, further consultation between States and with the sugar industry took place and a regulation was drafted and made by the Governor-in-Council to replace the notice. The terms of the regulation were consistent with the notice, but had been modified, strengthened and made more practical through the consultation.

Inspectors enforce notices and regulations and can also act under general powers prescribed in the PPA. The Chief Executive Officer (CEO) may appoint inspectors under the PPA, usually after they have undertaken a training course and demonstrated their competence. An inspector is appointed in most mill areas and some specialist plant pathologists and entomologists are also appointed, so that an emergency can always be dealt with rapidly.

The powers of an inspector are substantial. They can act against a specific pest infestation, by giving quarantine directions to the landowner in relation to the land, the pest, a crop, an appliance, produce, etc. For example, when sorghum seed from the Ord deemed to be infested with smut was planted in Bundaberg, an inspector gave directions to the landowner which included the instruction to let the crop grow undisturbed, destroy it after a specific time, disinfest any machinery being brought off the

MANUAL OF CANEGROWING

field, and not plant sugarcane for a specified period until all smut spores were expected to be dead.

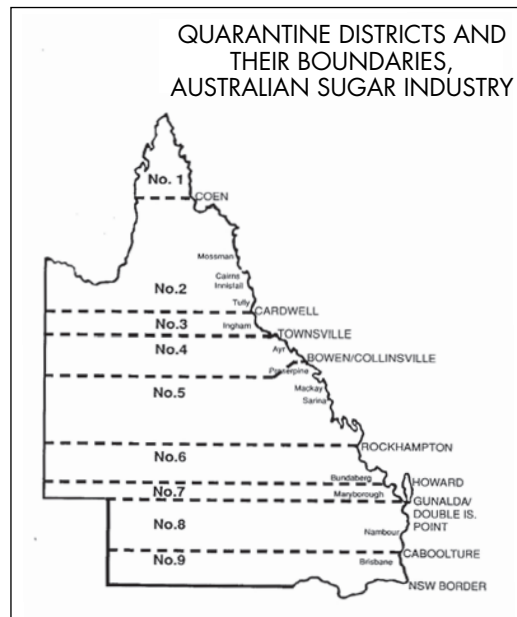
An inspector has a range of general powers to assist in performing his duties, or in ascertaining whether the provisions of the PPA have been complied with, or in investigating possible offences against the PPA. These include entering and searching places (but not dwellings), stopping people or vehicles, seizing and removing things, and requiring information and records to be given. An inspector can be appointed with limited powers, for example, if they are appointed for a function such as inspecting and certifying machinery or plant sources.

An inspector is able to direct the destruction of an infested crop. Under certain guidelines, an inspector may also deem a crop to be infested. For example, if the inspector considers that a crop is close to an infested crop and the pest is likely to have spread into it, or if a crop has been planted using infested seed, action may be taken, even when no symptoms are evident.

The PPA contains no mechanism for the payment of compensation for destruction of an infested crop or of one deemed to be infested. Likewise, with no compensation due, orders may be given to destroy volunteer plants (including abandoned crops) and non-approved sugarcane (taken to be a pest). Under some circumstances, it may be necessary to destroy a healthy crop in order to prevent, control or remove a pest infestation. Only the CEO of BSES can order destruction of a healthy crop and the owner is entitled to compensation.

Maximum penalties under the PPA are substantial, depending on the offence. For example, a landowner that does not comply with a quarantine direction from an inspector may be prosecuted and face a fine of up to \$75 000. If the owner is a corporation (many farms are owned by companies), five times this fine applies. Also, an inspector may carry out the unsatisfied directions and a charge for costs may be put on the land.

After the outbreak of sugarcane smut (an exotic disease) in the Ord River Irrigation Area, a regulation was made to prevent entry of smut into Queensland from the Ord. A similar proclamation was made in New South Wales. Restrictions apply to the importation of sugarcane or soil or machinery from a sugarcane farm in the Ord into Queensland. Further restrictions apply to the entry of this machinery to sugarcane land in Queensland, or its sale in Queensland. An inspector under the *Plant Protection Act 1989* (Qld) should be consulted if such activity is being contemplated.



MANAGING EXOTIC PESTS AND DISEASES

Australia is free of a number of important pests and diseases of sugarcane. Measures can be taken to ensure that incursions do not occur, or that they are detected as early as possible. It may be possible and economic to eradicate the pest or disease. Otherwise, some pre-emptive measures may allow damage to be minimised after the invader has become established.

Risk analysis

Quarantine activities are most effective when the threats are well understood. A methodology called Pest Risk Analysis (PRA) is used to estimate the chances that a hazardous pest or pathogen may enter a country by various possible pathways (e.g. wind or illegally imported sugarcane), become established, and result in economic damage. The PRA can be used to devise appropriate quarantine measures for identified needs. The cost of applying a quarantine measure and the restrictions that it imposes on trade must be balanced against the risk posed by the pathogen. Often the ultimate measures are unacceptable and some level of risk is unavoidable.

PRAs have been conducted for exotic sugarcane pests and pathogens in Australia and the more serious threats have been identified. Many of these lie to the near north of Australia, in the Torres Strait Islands, Papua New Guinea, Irian Jaya and Indonesia.

Using PRA, sugarcane smut was identified as a threat from Indonesia and subsequently it was found in the Ord River Irrigation Area in July 1998, most probably entering on the wind in the previous year.

Surveillance and border defence

AQIS maintains border surveillance at airports and seaports and uses a variety of methods to inform the public and detect prohibited importations of sugarcane and its pests and diseases. Sugarcane is a prohibited import without a permit. Illegal importations have been detected in the forms of cuttings of traditional varieties for planting in gardens, and prepared food that does not have a permit and has not been heat-treated.

The Northern Australia Quarantine Strategy (NAQS), a unit of AQIS, is charged with surveillance for exotic pests and diseases in coastal northern Australia and offshore in collaboration with nearby countries. A team of NAQS scientists regularly surveys these locations. BSES and NAQS collaborate by way of sharing information and training.

BSES also works with Northwatch, a quarantine program of the Queensland Department of Primary Industries. One of Northwatch's functions is surveillance for quarantine pests and diseases in northern Australia, up to the coastal strip where NAQS takes over.

Response to an incursion

When an exotic pest incursion is discovered in Australia, such as when sugarcane smut was discovered in the Ord River Irrigation Area, the response chain of action follows the Generic Incursion Management Plan (GIMP).

In the case of sugarcane in Queensland, the initial emergency response would be conducted by BSES, in conjunction with the Animal and Plant Health Service of the Queensland Department of Primary Industries. DPI must inform the Chief Plant Protection Officer (CPPO). The CPPO convenes an Incursion Management Consultative Committee (IMCC) comprised of the agriculture departments of each State and representatives of industry. The IMCC develops proposals for the eradication or containment and/or management of the pest, and puts these to the Plant Health Committee (PHC) of the Standing Committee for Agriculture and Resource Management (SCARM) for consideration.

If eradication is considered feasible and justifiable and it is proposed, PHC coordinates funding of the eradication program. If eradication is not considered to be an option, the control program is a matter for the States and industry.

MOVEMENT OF SUGARCANE

International

Sugarcane breeders require continuing access to foreign commercial varieties and basic germplasm (undeveloped varieties of sugarcane and related species). Mainly, they are to be used in crossing to obtain new genes or gene combinations, but sometimes, foreign varieties prove valuable for commercial production.

MANUAL OF CANEGROWING

Varieties are obtained under agreement with other countries or industries. The agreement includes provision of Australian varieties in exchange. Both countries test these varieties for resistance to major pests, particularly those that are not present in the other country. This arrangement enables 'pre-emptive' plant breeding to identify resistance or incorporate it into local varieties before the possible incursion of an exotic pest.

Agreements are being developed with major exchanging partners, to ensure that the most promising varieties are exchanged each year under high standards of hygiene. In source countries, canes for export are selected from the field after disease inspection, but BSES maintains a quarantined collection of Australian commercial varieties and elite plant breeding selections, available for export. These canes are put through the same quarantine program as canes being imported. BSES encourages exchanging countries to follow a similar policy.

At some stage in the future, this system may evolve into a formal germplasm exchange network, in which quarantine of cane from various countries is conducted centrally, before international distribution of the cane. BSES varieties may also be sold to a country that cannot offer useful varieties or services in return.

Many insects and diseases can be transported in cane setts, so a range of quarantine measures is used before, during and after movement. Before importation, a permit is obtained from AQIS that stipulates conditions for importation. A pest risk analysis has been conducted to identify serious sugarcane pests and diseases, where they occur, and the quarantine measures necessary to prevent their entry and establishment.

A phytosanitary certificate must be obtained from the equivalent of AQIS in the country of origin. This provides assurances that no disease threats were known to be present in the vicinity of the cane's origin. It may be required for the cane to be treated

with hot water, fungicide and/or insecticide in the country of origin. On arrival, the cane is carefully inspected and if infested, may be further treated or destroyed. The cane is ordered into post-entry quarantine at BSES, Indooroopilly, in containment glasshouses and laboratories that are registered by AQIS for that purpose.

The system used by BSES is based on international standards. Samples of pith tissue are taken from the setts for testing for pathogens. The cane is given a short hot-water treatment (30 min at 50°C) to kill many possible fungal, bacterial and arthropod infestations, then planted in artificial growth media in pots. A plant pathologist inspects the cane for disease symptoms on several occasions.

When the cane is mature, a few setts are given another hot-water treatment (soaked in water at ambient temperature for 2 days, then bathed in hot water for 3 hours at 50°C) to kill some pathogens. These setts are planted and grown to maturity, during which time further inspections are made. At the same time, the ratoon of the first crop is grown for 3 months and inspected, then destroyed. If no pathogens or diseases are detected in quarantine, AQIS will release the cane on BSES' recommendation. If a pathogen or disease is detected, action will depend on the case. It may be possible to eradicate the infection. Alternatively, rapid destruction and decontamination may be necessary, possibly including any canes that have been in proximity to the infection. The cane would then be re-ordered from a more secure source.

The main quarantine measures used are:

Avoidance

Obtaining the cane from a source that is free of quarantine pests.

Eradication

Treating the cane with hot water, fungicide and insecticide before movement, to control or eradicate many pests; applying further hot-water treatments on arrival and during quarantine.

Isolation

Planting and growing the cane in a glasshouse that excludes insects and that is remote from commercial sugarcane.

Indexing for disease

Using a combination of methods for detection of quarantine pests and diseases including:

visual inspection—closely examining the cane for arthropods, disease symptoms, fungal structures, etc, on arrival; further visual inspections for disease symptoms during plant growth in quarantine;

microscopic inspection—some pathogens are visible only with the aid of a microscope;

isolation—growing bacteria and fungi on artificial agar media in sterile laboratory conditions;

serology—probing extracts of the cane with antibodies specific to the pest. A common format for these tests is the enzyme-linked immunosorbent assay (ELISA);

molecular diagnostics—probing extracts of the cane for small parts of the genetic material (DNA or RNA) of a pathogen. The polymerase chain reaction (PCR) is the most common method, in which a known genetic fragment of the pathogen is amplified millions of times to a detectable level, using sophisticated chemical and physical processes;

electron microscopy—visual detection of pests at extremely high magnification.

Recently, substantial resources have been allocated to improving quarantine security and establishing world's best practice in quarantine at BSES. A new quarantine complex was built in 1994. Sensitive tests (serological and molecular) for several key pathogens have been implemented to supplement visual inspection and eradication protocols.

When all requirements in post-entry quarantine are completed, the cane is released to breeding stations or the party that requested the importation. Usually, foreign

commercial varieties are sent to Woodford Sugar Experiment Station for disease resistance testing, to various stations for field performance testing, and to Sugar Experiment Stations at Meringa and Bundaberg for cross breeding.

Australia

Movement of sugarcane is controlled under the *Plant Protection Act 1989*, under which nine quarantine zones are established. The quarantine zones and the associated regulations are currently under review. To move cane between zones, a permit should be obtained from a BSES inspector, who will examine the facts and determine whether it is safe to move the cane. Usually, cane for planting would need to meet the standard of Approved Seed for a permit to be granted. Cane being moved for plant breeding is covered by strict guidelines in the BSES Plant Breeding Manual. Researchers planning to move samples of sugarcane for purposes such as CCS testing must obtain a permit.

The BSES plant breeding system needs to supply fuzzi (seed heads) to all plant breeding stations, from where the crosses are made at Meringa in northern Queensland and Bundaberg in southern Queensland. Most pests and diseases are not carried in fuzzi, which is packaged in vacuum-sealed bags, so quarantine is not required. After several years of selection, only a few hundred elite selections remain from the seedlings, and these must be transported again. They are returned to crossing stations to be used as parents and also sent to other regions for testing in other environments. Quarantine is applied to the cane at this time as follows:

Fiji disease

Cane can be exchanged between areas with similar risk. Thus, cane can be sent between Meringa, the Herbert and the Burdekin (where Fiji disease has never been detected), and between Mackay and Bundaberg (where Fiji disease has not been detected for over a decade). As Fiji disease is present in mill areas

MANUAL OF CANEGROWING

south of Isis, movement of cane within and between these areas is strictly limited. A period of quarantine is needed to send cane from areas of higher risk to areas of lower risk (from south of Isis to Bundaberg, Mackay or north Queensland; and from Bundaberg or Mackay going to north Queensland). This cane is grown for two cycles in a quarantine glasshouse at Indooroopilly. On arrival, it is given cold-soak long hot-water treatment (CSLHWT) and planted in artificial soil. It is inspected for disease symptoms in the plant and ratoon crops. The ELISA test for RSD is applied to all cane. Cane from areas south of Isis is tested for *Fiji disease virus* using a highly sensitive PCR test. Use of this test may allow the quarantine period to be reduced to one year for cane from north of Maryborough.

Other systemic diseases and insect pests

A strict policy exists to prevent movement of ratoon stunting disease and other systemic diseases and insect pests onto stations or farms. If ratoon stunting disease or another disease was present in a trial, it would introduce extra error into the trial and prevent the determination of the genetic potential of varieties. Also, if pests were taken into an area or onto a farm, they may cause economic damage and could adversely affect cooperation between research groups and farmers.

The policy is that all cane to be moved for planting must be from an approved source. That is, the cane must be no more than one year from long hot-water treatment, must have been tested for ratoon stunting disease, and must have been inspected by a suitably experienced person for quarantine pests. Cane being brought onto a research station or moved between regions (except out of quarantine at Indooroopilly) must be given a further long hot-water treatment on arrival.

Cane for research

Universities and other research groups frequently request BSES and CPPBs to

provide sugarcane to be used in research. It is important to obtain this cane from high quality sources, since the presence of a pest or disease could ruin the experiment or other experiments nearby. Worse still, the cane may eventually be sent back to a BSES station or a farm and carry the infestation with it.

The following guidelines have been developed to minimise such risks. Sometimes these guidelines will impose serious delays on the proposed research, but this is not a good reason to run quarantine risks and provide or accept cane from a questionable source. It is important for researchers to plan well ahead and, if cane will be required at a time when stations cannot supply it, grow a source in quarantine conditions.

Cane for research should always be sourced from a BSES or CPPB propagation block, which has received serial CSLHWT and has been regularly inspected for systemic diseases by an experienced BSES or CPPB staff member. The cane should be tested for RSD using ELISA, phase-contrast microscopy or molecular test shortly before cutting. Cane should be subjected to CSLHWT before use to control leaf scald (*Xanthomonas albilineans*). This treatment is not necessary for cane coming from the Sugar Experiment Station at Bundaberg.

A valid permit, issued by an inspector under the *Plant Protection Act 1989* (this can be arranged by the BSES officer supplying the cane), must accompany cane crossing a quarantine boundary. Permits are issued after inspection for systemic diseases, and review of growing conditions affecting disease risk. For cane to be sent north of Bowen, issue of a permit by an inspector must be approved by the CEO of BSES.

Cane originating from south of Bowen may not be sent to north Queensland unless it has first been indexed for Fiji disease. This entails growing it to maturity in a quarantine (or PC2) glasshouse, then ratooning it and inspecting it in the young ratoon. The ratoon crop is grown under quarantine and may be sent if a permit is issued. Cane originating

from north of Bowen and sent south, to be sent again north of Bowen, must be grown at all times under quarantine or PC2 conditions, or it requires indexing for Fiji disease. Cane normally may only be sent across a quarantine boundary in the form of setts or stalks, not stools or potted plants.

Cane for tissue culture and transformation

Moving cane to be used in tissue culture requires special mention. It is often assumed incorrectly that pathogens do not pass through tissue culture—the leaf scald bacterium (*X. albilineans*) is one example that can do so. Tissue-cultured sugarcane is initiated from the growing point (apical meristem) of the cane. The usual quarantine precaution that would be applied to cane setts for leaf scald, CSLHWT, would kill the growing point. Hence, other precautions are required. Cane tops should be obtained preferentially from a place where leaf scald has not been recorded recently. Geneticin should be used in the culturing medium to control *X. albilineans*.

A permit is required to move the original cane between quarantine zones into the laboratory. A new permit is required to move cane (e.g. transformed clones) back, even to the same location or research station. This is because the cane may have been exposed to other pests during the research. It is advisable to consult a BSES plant pathologist when planning the research, to avoid any delays or potential infestations.

Before planting on a BSES station, the cane must receive CSLHWT. In the case of canes regenerated from tissue culture, this may present problems because of weakness in the cane, so the original plant should be kept until the cane has established on the station. To minimise germination problems, good nursery practices specific to sugarcane should be followed to produce sound cane for planting. A BSES plant pathologist is able to provide advice on this.

Sugarcane trash

During the 1990s, there was rapid growth in the trade of baled sugarcane trash, and this growth is expected to continue. There is some concern in the sugarcane industry that a quarantine risk is posed by this trade. Some of these concerns are well-founded, although others are not. For example, pachymetra spores or earth pearls are likely to be carried and these are not present in all sugarcane areas. This risk is reduced by the fact that most bales are for garden use or for livestock feed in places distant from sugarcane. Trash obtained from areas where Fiji disease is active has presented concern, because the insect that vectors the virus could be present in the trash. This risk is minimised if the trash is stored, milled and baled, or if it is used distant from sugarcane. Weeds that may be moved in the bales present the greatest risk.

With respect to pests and diseases but only itchgrass among weeds, this trade can be regulated under the *Plant Protection Act 1989*, because the definition of a plant 'includes the seed or seedling of or a part of a plant, whether living or dead....' Trash could not be collected from where weeds prohibited under the *Rural Lands Protection Act* occur.

At present, the review of sugarcane health regulations means that this quarantine is being dealt with under best practice principles. Where it is known that a pest risk exists in trash movement, an inspector may take action to prevent this risk. When moving trash, it is important to be aware of common law responsibilities not to spread weeds, pests or diseases.

QUARANTINE IN TRAVEL

Researchers, farmers or other people from the sugarcane industry who return to eastern Australia from overseas or from the Ord River Irrigation Area of Western Australia should be aware of the risks of carrying weeds, pathogens or insect pests. Their clothes, notebooks, cameras and any other equipment

MANUAL OF CANEGROWING

may be infested. Sugarcane smut is common in nearly all sugarcane-producing countries and the Ord River Irrigation Area and the spores of the fungus can easily be carried on clothing. Weed seeds caught in socks and removed to another location could become a serious pest.

It is recommended that all travellers, particularly if they have walked through cane fields, launder their clothing in hot water or dryclean it before returning to Australia or if this is not possible, immediately on return. Shoes should be thoroughly cleaned by scrubbing with a hot water and detergent mixture. Other equipment should be cleaned and disinfected where possible with particular care to remove all sugarcane residues. Law requires these treatments for people who visit the Ord River Irrigation Area and then travel to Queensland.

Importation of soil, sugarcane (any part) or microorganisms is strictly prohibited without a permit from AQIS. Any such items should be declared on entry, whether or not a permit is held. Any person who has been on farmland overseas should declare this fact to AQIS on arrival in Australia. Researchers need to be especially conscious of these requirements.

MOVEMENT OF USED MACHINERY AND EQUIPMENT

Many types of farm machinery are very complex and, during work, soil and plant matter can become lodged in inaccessible places. Serious weeds, pests and diseases can be carried. If this machinery is moved to another location, these 'hitch-hikers' may be dislodged and establish in the new area. Quarantine authorities are very concerned about these risks and pay close attention to used machinery. As well as these legislated controls, common law may apply to the movement of a serious weed, pest or disease by this means.

The first responsibility is on the person moving the machine—to comply with law and avoid causing damage to others by

neglect. Too often, individuals expect others to do what is required, or are in too much of a hurry to care.

International

The importation of machinery and spare parts carries a high risk of introducing a range of serious exotic pests and diseases and is closely monitored by AQIS. To be imported to Australia, an import permit is required. Machinery, whether new or used, must be cleared by AQIS. AQIS defines clean as 'clean as new' and has a nil tolerance for any contamination from soil or plant material. It is the importer's responsibility to ensure that all machinery arrives in Australia clean. Machinery arriving in an unclean state will not be permitted entry. AQIS' requirements for imported machinery, equipment and spare parts may be found on the Internet at <http://www.AQIS.gov.au/docs/border/machinery.htm>.

Australia

Both Queensland and New South Wales enacted legislation that strictly controls the introduction of used machinery from the Ord River Irrigation Area of Western Australia with respect to sugarcane smut. Anyone proposing to undertake such a movement should contact BSES or the New South Wales Department of Agriculture to ensure compliance. For Queensland (New South Wales legislation is similar but with key differences), restrictions apply to any appliance that has been on a parcel of land in the Ord on which sugarcane is growing or that has been in contact with sugarcane. Before being introduced, it must be disassembled as necessary and steam cleaned or washed with detergent under high pressure, to remove all plant material, smut spores and soil. Then it must be inspected by AQIS in the Ord and issued with a clearance certificate. The person introducing the appliance must notify BSES beforehand of the date and place it will arrive in Queensland. The appliance then cannot be taken onto a sugarcane farm or sold within a year unless

an inspector under the *Plant Protection Act 1989* issues written approval.

Similar standards apply to moving used machinery into the Ord River Irrigation Area. It is advisable to contact Agriculture Western Australia beforehand, since machinery arriving in an unclean condition will not be allowed entry.

In Queensland and New South Wales, Cane Protection and Productivity Boards (CPPBs) provide a service to the sugarcane industry by inspecting and certifying machinery for movement. Farmers, contractors, cooperatives and the used machinery industry should avail themselves of this service to protect themselves as well as their industry. The CPPB should be given at least a day's notice of the movement. The machine should be presented for inspection completely cleaned—the CPPB would be entitled to charge for any cleaning done. A set of guidelines is available for cleaning, and a checklist based on the guidelines is used for the inspection. The CPPB may direct further cleaning if required, before issuing a clearance certificate. They will send a copy of the certificate to the CPPB at the destination, and a further inspection may be conducted on arrival.

QUARANTINE IN RESEARCH WORK

Soils

Soil is a prohibited import from overseas (including as a contaminant of such items as shoes), without a written permit from AQIS. Soil from the Ord River Irrigation Area can only be brought into Queensland with written approval from an inspector under the *Plant Protection Act 1989*; the approval will list any protocols to be followed.

Transfer of soils between quarantine districts within Queensland for research purposes could spread soil-borne diseases, insect pests and weeds. Precautions should be taken to prevent spread of these pests and the soil should be fumigated, heat-treated or sterilised with formaldehyde before disposal.

Within districts, care should be taken to prevent movement of pathogens, insects and weed species.

In some cases, processing the soil samples on-site may be necessary to prevent risks of spread of pests. For example, sampling for earth pearls and soldier flies should be conducted on site wherever possible to prevent spread of these destructive insects. No sample larger than is necessary should be used.

Pathogens

The movement of pathogens either in pure culture or in sugarcane samples may be controlled strictly and researchers should consult with a BSES pathologist first. Causing greatest concern are certain pathogens that may be transmitted readily. Importation of sugarcane smut from the Ord River Irrigation Area requires written approval by an inspector. Importation of any pathogen from overseas requires a permit from AQIS.

Insects

Transfer of live insects for *in planta* research should be discussed with BSES entomologists before research is commenced. Planthoppers (*Perkinsiella saccharicida*) should **never** be sent from a district where Fiji disease has been recorded (all districts from Proserpine south) to districts north of Bowen. Care should be taken when moving aphids that may carry sugarcane mosaic virus.

FURTHER READING

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