Import Risk Analysis (IRA) for the Importation of Fresh Pineapple Fruit

Draft IRA Report

Part A

April, 2002

AGRICULTURE, FISHERIES AND FORESTRY - AUSTRALIA

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GLOSSARY OF TERMS AND ABBREVIATIONS

AFFA	Commonwealth Department of Agriculture, Fisheries and Forestry - Australia
ALOP	appropriate level of protection
AQIS	Australian Quarantine and Inspection Service
Area	an officially defined country, part of a country or all or parts of several countries
Biosecurity Australia	a major operating group within the Commonwealth Department of Agriculture, Fisheries and Forestry - Australia. Biosecurity Australia protects consumers and animal and plant health, and facilitates trade, by providing sound scientifically based and cost effective quarantine policy
Category of suitable host	an area where ecological factors favour the establishment of a pest whose presence in the area will result in economically important loss
Control (of a pest)	suppression, containment or eradication of a pest population
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Entry (of a pest)	movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled
Entry potential	likelihood of the entry of a pest
Establishment potential	likelihood of the establishment of a pest
Establishment	the perpetuation, for the foreseeable future, of a pest within an area after entry
FAO	Food and Agriculture Organization of the United Nations
Fresh	not dried, deep-frozen or otherwise conserved
ICA	Interstate Certification Assurance
ICON	AQIS Import Conditions database
Introduction potential	likelihood of the introduction of a pest
Introduction	entry of a pest resulting in its establishment
IPPC	International Plant Protection Convention, as deposited in 1951 with FAO in Rome and as subsequently amended
IRA	import risk analysis
ISPM	International Standard on Phytosanitary Measures
National Plant Protection	

Organisation .... official service established by a government to discharge the functions specified by the IPPC

Non-quarantine pest .... pest that is not a quarantine pest for an area

Official .... established, authorised or performed by a National Plant Protection Organisation

Official control (of a regulated pest) .... the active enforcement of mandatory phytosanitary regulations and the application of mandatory phytosanitary procedures with the objective or eradication or containment of quarantine pests or for the management of regulated non-quarantine pests

Pathway .... the ordered sequence of steps leading to an outcome, or event

PBPM .... Plant Biosecurity Policy Memorandum

Pest .... any species, strain or biotype of plant, animal, or pathogenic agent, injurious to plants or plant products

Pest categorisation .... the process for determining whether a pest has or has not the characteristics of a quarantine pest or those of a regulated non-quarantine pest

Pest free area .... an area in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained

Pest risk analysis .... the process of evaluating biological or other scientific evidence to determine whether a pest should be regulated and the strength of any phytosanitary measures to be taken against it

Phytosanitary measure .... any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of quarantine pests

PRA .... pest risk analysis

PRA area .... area in relation to which a pest risk analysis is conducted

QP .... Quarantine Proclamation

Quarantine pest .... a pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled

Spread potential .... likelihood of the spread of a pest

Spread .... expansion of the geographical distribution of a pest within an area

SPS .... Sanitary and Phytosanitary

SPS Agreement .... WTO Agreement on the Application of Sanitary and Phytosanitary Measures

WTO .... World Trade Organization

This *Draft IRA Report* contains the following information:

- introductory discussions of the background to this import risk analysis (IRA), administration issues, Biosecurity Australia's framework for quarantine policy and for import risk analysis, the international framework for trade in animal- and plant-derived products, and Australia's current policy for importation of fresh pineapple
- an outline of the method for, and results of, pest categorisation, risk assessment and risk management
- draft quarantine conditions for the import of fresh pineapple
- further steps in the IRA process
- a summary of stakeholder comments received on the Issues Paper and Biosecurity Australia's response
- a summary of research conducted by Biosecurity Australia on the effect of methyl bromide fumigation, crown removal, top-waxing and harvesting maturity on pineapple fruit.

Additional technical information was received by Biosecurity Australia (BA) after the Issues Paper for this IRA was released. The information prompted BA to further investigate the potential quarantine risks associated with weed seeds in pineapple crowns and the effect of methyl bromide fumigation on pineapples, and re-assess existing import conditions for pineapples. BA undertook research into the effect of methyl bromide fumigation, crown removal, top waxing and harvest maturity on pineapples.

A description of the research conducted by BA is presented as part of this draft IRA. The major findings of the research were that:

- Pineapple crowns are a natural receptacle for weed seeds and arthropods.
- Removing the crown has no significant effect on fruit quality or shelf life.
- Crown removal combined with top waxing is detrimental to quality and shelf life.
- Crown removal combined with top waxing and methyl bromide fumigation is extremely detrimental to quality and shelf life.
- Any negative effects of fumigation are most noticeable when the fruit is treated for six hours.
- Methyl bromide fumigation for 2 hours is as effective against external feeders as fumigation for 6 hours.

The risk assessment identified that weeds were of major concern for the identified pathway and risk management measures were required to reduce the risk to an acceptable level. The risk assessment also identified nine arthropod pests and one fungal disease as requiring risk management measures to reduce the risk to an acceptable level. Risk management options to reduce the likelihood of introducing these pests are proposed as part of this draft IRA. The pests of concern are placed into five groups for the purposes of summarising the risk assessment and assigning the proposed risk management measures. The groups are weeds, mealy bugs (6 species), lepidopterans (2 species), fig beetle (1 species) and *Fusarium subglutinans* (1 species).

Due to the large number of pests considered in this draft IRA the pest risk assessment and risk management stages are presented in two sections: weed pests and non weed pests (arthropods, gastropods, nematodes, fungi, bacteria and viruses). The pest categorisation, risk assessment and risk management sections are first presented for the weed pests, then for the non weed pests. As described in later sections, the risk assessment and risk management presented for non weed pests takes into account the risk management options proposed for the weed pests.

Biosecurity Australia considers that the phytosanitary risks associated with the importation of pineapples can be managed by applying a combination of risk management options, in particular: registration of source plantations; pest-free areas for *Fusarium subglutinans*; in-field control for false codling moth; de-crowning; pre-export fumigation of all consignments with methyl bromide; and phytosanitary inspections pre-export and on-arrival.

This draft IRA precedes the preparation and release of the final IRA. The final IRA will contain the same components, but will have been revised to take account submissions about the draft IRA that are received from stakeholders.

While preparing the final IRA, Biosecurity Australia will submit its recommendations to the Director of Animal and Plant Quarantine (the Director) for consideration. The Director will consider the recommendations and make the final determination. The Director’s determination and the final IRA will be sent to all stakeholders. Any stakeholder of the opinion that the IRA process has not been properly followed, including that the analysis failed to consider a significant body of relevant scientific or technical information, may appeal to the Director. If the appeal is upheld, Biosecurity Australia will rectify the deficiency. If the appeal is rejected, the policy will be adopted.

To assist the reader in considering this draft IRA, Biosecurity Australia has decided to present it in two separate parts, Part A and Part B. The key components of Part A include a summary of the pest categorisation and risk assessment, the proposed risk management options and the draft quarantine conditions, as well as a summary of the stakeholder comments on the Issues Paper. Part B includes details of the pest categorisation and risk assessment steps.

AUSTRALIA'S BIOSECURITY POLICY

Legislative framework

AFFA's objective is to adopt biosecurity policies that provide the health safeguards required by government policy in the least trade-restrictive way and that are, where appropriate, based on international standards. In developing and reviewing quarantine (or biosecurity) policies, pest risks associated with importations may be analysed using import risk analysis — a structured, transparent and science-based process.

The *Quarantine Act* and its subordinate legislation, including the *Quarantine Proclamation 1998* (QP 1998), are the legislative basis of human, animal and plant biosecurity in Australia. The *Quarantine Amendment Act 1999*, which commenced in June/July 2000, incorporates major changes to the *Quarantine Act* as recommended in the report of the Australian Quarantine Review Committee (AQRC, 1996).

Section 4 of the *Quarantine Act* defines the scope of quarantine as follows.

In this Act, quarantine includes, but is not limited to, measures:

- *for, or in relation to, the examination, exclusion, detention, observation, segregation, isolation, protection, treatment and regulation of vessels, installations, human beings, animals, plants or other goods or things*
- *having as their object the prevention or control of the introduction, establishment or spread of diseases or pests that will or could cause significant damage to human beings, animals, plants, other aspects of the environment or economic activities.*

Quarantine Risk

The concept of level of quarantine (or biosecurity) risk has been introduced as the basis of quarantine decision-making. When making decisions under the *Quarantine Act*, decision-makers must consider the level of quarantine risk and must take prescribed actions to manage the risk if it is unacceptably high. Section 5D of the *Quarantine Act* includes harm to the environment as a component of the level of quarantine risk.

Section 5D: level of quarantine risk

A reference in this Act to a level of quarantine risk is a reference to:

(a) *the probability of:*

(i) *a disease or pest being introduced, established or spread in Australia or the Cocos Islands; and*

(ii) *the disease or pest causing harm to human beings, animals, plants, other aspects of the environment, or economic activities; and*

(b) *the probable extent of the harm.*

Quarantine Proclamation

Subsection 13(1) of the *Quarantine Act* provides that the Governor-General in Executive Council may, by proclamation, prohibit the importation into Australia of any articles or things likely to introduce, establish or spread any disease or pest affecting people, animals or plants. The Governor-General may apply this power of prohibition generally or subject to any specified conditions or restrictions.

QP 1998 is the principal legal instrument used to control the importation into Australia of goods of quarantine (or biosecurity) interest. A wide range of goods is specified in *QP 1998* including animals, plants, animal and plant products, micro-organisms, and certain other goods which carry a high risk if uncontrolled importation is allowed — e.g. soil, water, vaccines, feeds.

For articles or things prohibited by proclamation, the Director of Animal and Plant Quarantine may permit entry of products on an unrestricted basis or subject to compliance with conditions, which are normally specified on a permit. An import risk analysis provides the scientific and technical basis for biosecurity policies that determine whether an import may be permitted and, if so, the conditions to be applied.

The matters to be considered when deciding whether to issue a permit are set out in Section 70 of *QP 1998* as follows:

70 *Things a Director of Quarantine must take into account when deciding whether to grant a permit for importation into Australia*

(1) *In deciding whether to grant a permit to import a thing into Australia or the Cocos Islands, or for the removal of a thing from the Protected Zone or the Torres Strait Special Quarantine Zone to the rest of Australia, a Director of Quarantine:*

(a) *must consider the level of quarantine risk if the permit were granted; and*

(b) *must consider whether, if the permit were granted, the imposition of conditions on it would be necessary to limit the level of quarantine risk to one that is acceptably low; and*

(c) *may take into account anything else that he or she knows that is relevant.*

The matters include the level of quarantine risk (see above), whether the imposition of conditions would be necessary to limit the quarantine risk to a level that would be acceptably low, and anything else known to the decision maker to be relevant.

Environment

While protection of the natural and built environment has always been an objective of Australian quarantine policy and practice, recent amendments to the *Quarantine Act 1908* make explicit the responsibility of quarantine officers to consider impact on the environment when making decisions. In particular, the scope of quarantine (as described in Section 4 of the *Quarantine Act*), and the level of quarantine risk (as described in Section 5D of the *Quarantine Act*), include explicit reference to the environment.

Environment is defined in Section 5 of the *Quarantine Act* as:

... all aspects of the surroundings of human beings, whether natural surroundings or surroundings created by human beings themselves, and whether affecting them as individuals or in social groupings.

When undertaking an import risk analysis, Biosecurity Australia fully takes into account the risk of harm to the environment to ensure that the biosecurity policies developed reflect the Australian Government's approach to risk management. This is achieved through the involvement of Environment Australia in decisions on the import risk analysis work program and, for particular import risk analyses, discussions on the scope, the likely risks, and the expertise which may be required to address those risks. Environment Australia may identify additional technical issues that it believes should be considered during an import risk analysis, and may nominate officers with relevant expertise who would be available to participate in the import risk analysis.

Policy framework

The primary purpose of biosecurity is to protect Australia from the entry, establishment and spread of unwanted pests and diseases that may cause social, economic or environmental damage, while minimising the restrictions on the entry of agricultural commodities.

Due to Australia's unique and diverse fora and fauna and the value of its agricultural industries, successive Australian Governments have maintained a highly conservative but not a zero-risk approach to the management of biosecurity risks. This approach is evident in the strictness of all biosecurity-related activities, including policies on imported commodities, procedures at the border and operations against incursions of pests and diseases.

Recent inquiries into Australia's biosecurity regime have recognised that it is impossible in practice to operate a zero-risk biosecurity regime. In 1979, the Senate Standing Committee on Natural Resources stressed that there is no such thing as a zero-risk quarantine policy, and it believed that Australia's approach should be better described as '*scientific evaluation of acceptable risk*'. In 1988, the Lindsay review of Australian quarantine concluded that '*a no risk policy is untenable and undesirable and should be formally rejected*'. In 1996, the Senate Rural and Regional Affairs and Transport Committee was of the view that a zero-risk approach was unrealistic and untenable, and that its currency only demonstrated that the concepts of risk assessment and risk management were widely misunderstood. These themes were repeated in the AQRC report. In its 1997 response to that report, the Government confirmed a managed risk approach.

Import risk analysis provides the basis for considering import applications for the importation of animals and animal-derived products, and plants and plant-derived products. In keeping with the scope of the *Quarantine Act* and Australia's international obligations, only factors relevant to the evaluation of quarantine risk (i.e. the risk associated with the entry, establishment and spread of unwanted pests and diseases) are considered in the import risk analysis. The potential competitive economic impact of prospective imports is not within the scope of the import risk analysis process, and any discussion on industry support mechanisms would need to remain quite separate from the import risk analysis.

WTO AND IMPORT RISK ANALYSIS

One of the principal objectives in developing the administrative framework for import risk analysis was to ensure that it complied with Australia's international rights and obligations.

These derive principally from the *SPS Agreement*, although other WTO Agreements (including the *Agreement on Technical Barriers to Trade* — the TBT Agreement) may be relevant in certain circumstances. Specific international guidelines on risk analysis developed under IPPC and by OIE are also relevant.

The *SPS Agreement* applies to measures designed to protect human, animal and plant life and health from pests and diseases, or a country from pests, and which may directly or indirectly affect international trade. It also recognises the right of WTO Member countries to determine the level of protection they deem appropriate and to take the necessary measures to achieve that protection. Sanitary (human and animal health) and phytosanitary (plant health) measures apply to trade in or movement of animal and plant based products within or between countries.

In the *SPS Agreement*, SPS measures are defined as any measures applied:

- *to protect animal or plant life or health within the territory of the Member from risks arising from the entry, establishment or spread of pests, diseases, disease-carrying organisms or disease-causing organisms*
- *to protect human or animal life or health within the territory of the Member from risks arising from additives, contaminants, toxins or disease-causing organisms in foods, beverages or feedstuffs*
- *to protect human life or health within the territory of the Member from risks arising from diseases carried by animals, plants or products thereof, or from the entry, establishment or spread of pests*
- *to prevent or limit other damage within the territory of the Member from the entry, establishment or spread of pests*.

The key provisions of the *SPS Agreement* are as follows:

- An importing country has the sovereign right to adopt measures to achieve the level of protection it deems appropriate (its appropriate level of protection, or ALOP) to protect human or animal life or health within its territory, but such a level of protection must be consistently applied in different situations.
- An SPS measure must be based on scientific principles and not be maintained without sufficient evidence.
- In applying SPS measures, an importing country must avoid arbitrary or unjustifiable distinctions in levels of protection, if such distinctions result in discrimination or a disguised restriction on international trade.
- An SPS measure must not be more trade restrictive than necessary to achieve an importing country's ALOP, taking into account technical and economic feasibility.
- An SPS measure should be based on an international standard, guideline or recommendation, where these exist, except to the extent that there is scientific justification for a more stringent measure which is necessary to achieve an importing country’s ALOP.
- An SPS measure conforming to an international standard, guideline or recommendation is presumed to be necessary protect human, animal or plant life or health, and to be consistent with the *SPS Agreement*.
- Where an international standard, guideline or recommendation does not exist or where, in order to meet an importing country’s ALOP, a measure needs to provide a higher level of protection than accorded by the relevant international standard, such a measure must be based on a risk assessment; the risk assessment must take into account available scientific evidence and relevant economic factors.

- When there is insufficient scientific evidence to complete a risk assessment, an importing country may adopt a provisional measure(s) by taking into account available pertinent information; additional information must be sought to allow a more objective assessment and the measure(s) reviewed within a reasonable period.
- An importing country must recognise the measures of other countries as equivalent, if it is objectively demonstrated that the measures meet the importing country's ALOP.

The rights and obligations in the *SPS Agreement* must be read as a whole. The articles must be interpreted in relation to each other. That is, the articles do not stand alone.

In many instances, the biosecurity policies Biosecurity Australia develops are based on the relevant international standards, guidelines and recommendations. In certain instances and in conformity with rights under the *SPS Agreement*, Australia has not adopted such international norms because to do so would result in an unacceptably high level of risk of disease or pest entry and establishment. Instead, the policies are based on a risk analysis.

The text of the *SPS Agreement* can be found at the WTO Internet site.[1]

The following issues are discussed in greater detail below:

- notification obligations
- use of international standards
- equivalence
- risk assessment
- appropriate level of protection (ALOP)
- consistency in risk management.

Notification obligations

The WTO SPS Committee has been established to oversee the implementation of the *SPS Agreement*, and to provide a forum for the discussion of any trade issues related to biosecurity policies. Like other WTO committees, all WTO Members have the right to participate in the work and decision making of the SPS Committee; decisions are taken by consensus. The SPS Committee has accepted, as observers, the Codex Alimentarius Commission (Codex), OIE and IPPC, as well as other international and regional intergovernmental organisations with activities in food safety, animal health and plant protection to maximise knowledge of and participation in its work.

The SPS Committee normally meets three times a year at the WTO headquarters in Geneva, Switzerland.

In addition to considering any specific trade concerns raised by governments, the *SPS Agreement* has set specific tasks for the Committee. One of these is to monitor the extent to which governments are using internationally developed standards as the basis for their requirements for imported products. Countries identify cases where the non-use, or non-existence, of an appropriate international standard is causing difficulties for international trade. After consideration by the SPS Committee, these concerns may be brought to the attention of the relevant standard-setting organisations.

Under the *SPS Agreement*, Members are required to notify WTO of new sanitary or phytosanitary regulations or modifications to existing regulations that are not substantially the same as the

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[1] Available at http://www.wto.org/english/docs_e/docs_e.htm

content of an international standard and that may have a significant effect on international trade. Australia notifies new measures and comments on draft policies proposed by other countries through the SPS Notification Point in AFFA.

Use of international standards

The *SPS Agreement* has conferred new responsibilities on three international organisations by requiring WTO Members to harmonise their sanitary and phytosanitary measures on the standards, guidelines and recommendations produced by those organisations unless there is scientific justification for a more stringent measure.

The three international organisations are referenced in Annex A of the *SPS Agreement* as follows:

- *for food safety, the standards, guidelines and recommendations established by the Codex Alimentarius Commission relating to food additives, veterinary drug and pesticide residues, contaminants, methods of analysis and sampling, and codes and guidelines of hygienic practice*
- *for animal health and zoonoses, the standards, guidelines and recommendations developed under the auspices of the International Office of Epizootics*
- *for plant health, the international standards, guidelines and recommendations developed under the auspices of the Secretariat of the International Plant Protection Convention in cooperation with regional organizations operating within the framework of the International Plant Protection Convention.*

International Plant Protection Convention

IPPC is a multilateral treaty deposited with the Director-General of the Food and Agriculture Organization of the United Nations. IPPC provides a framework and forum for international cooperation, standards harmonisation and information exchange on plant health in collaboration with regional and national plant protection organisations (RPPOs and NPPOs). Its prime purpose is to secure common and effective action to prevent the spread and introduction of pests of plants and plant products and to promote measures for their control.

Currently, 117 governments are contracting parties to IPPC.

The New Revised Text of IPPC provides for the establishment of a Commission on Phytosanitary Measures to serve as IPPC's new governing body. Membership in the Commission is open to all contracting parties of IPPC. The Commission meets annually to establish priorities for standard-setting and harmonisation of phytosanitary measures in coordination with the IPPC Secretariat.

The functions of the Commission are to provide direction to the work program of the IPPC Secretariat and promote the full implementation of the objectives of the Convention and, in particular, to:

- review the state of plant protection in the world and the need for action to control the international spread of pests and control their introduction into endangered areas
- establish and keep under review the necessary institutional arrangements and procedures for the development and adoption of international standards, and to adopt international standards
- establish rules and procedures for the resolution of disputes
- cooperate with other relevant international organisations.

The new IPPC and ISPM 11(*Pest Risk Analysis for Quarantine Pests*) adopt a similar approach to that of OIE and note the importance of documenting all steps in the risk analysis process.

Equivalence

Article 4 of the *SPS Agreement* states that:

> *Members shall accept the sanitary or phytosanitary measures of other Members as equivalent, even if these measures differ from their own or from those used by other Members trading in the same product, if the exporting Member objectively demonstrates to the importing Member that its measures achieve the importing Member's appropriate level of sanitary or phytosanitary protection.*

Members must accept the SPS measures of other Members as equivalent to their own if the latter can demonstrate objectively that their measures provide the level of protection required by the importing country. Often there are several alternative measures that may either singly or in combination achieve ALOP (e.g. treatment, increased inspection). In choosing among such alternatives, a Member should put in place measures that are no more trade-restrictive than required to achieve its health protection objectives, provided those measures are technically and economically feasible. In doing so, the importing country must remain open to approaches from exporting countries with regard to alternative measures that may meet its ALOP.

Risk assessment

Articles 5.1 to 5.3 of the *SPS Agreement* outline the requirements that Members should follow when carrying out a risk assessment.

Article 5.1 provides a basic statement of the obligation:

> *Members shall ensure that their sanitary or phytosanitary measures are based on an assessment, as appropriate to the circumstances, of the risks to human, animal or plant life or health, taking into account risk assessment techniques developed by the relevant international organisations.*

Annex A of the *SPS Agreement* contains two definitions of risk assessment; the following is the definition applicable to biosecurity assessments:

> *The evaluation of the likelihood of entry, establishment or spread of a pest or disease within the territory of an importing Member according to the sanitary or phytosanitary measures which might be applied, and of the associated potential biological and economic consequences.*

On the basis of this definition, the Appellate Body examining Australia’s appeal against the dispute settlement panel’s finding on Australia’s prohibition of imports of Canadian salmon considered that a risk assessment within the meaning of Article 5.1 must:

- identify the hazards whose entry, establishment or spread within its territory a Member wants to prevent, as well as the associated potential biological and economic consequences
- evaluate the likelihood of entry, establishment or spread of these hazards, as well as the associated potential biological and economic consequences
- evaluate the likelihood of entry, establishment or spread of these hazards according to the SPS measures that might be applied; measures which might be applied are those which reduce the risks to the appropriate level, with the aim of being least trade restrictive.

The Appellate Body believed that, for a risk assessment to fall within the meaning of Article 5.1 and the first definition in paragraph 4 of Annex A of the Agreement, it is not sufficient that it conclude that there is a 'possibility' of entry, establishment or spread of pests and their associated biological and economic consequences. That is, an assessment must evaluate the 'likelihood' (the 'probability') of entry, establishment or spread of pests and their associated biological and economic consequences. Furthermore, likelihood should be evaluated without and then with any SPS measures that might be required.

Article 5.2 outlines factors that should be considered when assessing the risks associated with a proposed importation. Specifically, it states that:

> *In the assessment of risks Members shall take into account available scientific evidence; relevant processes and production methods; relevant inspection, sampling and testing methods; prevalence of specific diseases or pests; existence of pest- or disease-free areas; relevant ecological or environmental conditions; and quarantine or other treatment*

This paragraph emphasises the need to consider a wide range of factors in both the importing and exporting country.

Article 5.3 describes the need to include a consequence assessment in a risk assessment, and lists dimensions that should be considered when assessing 'potential damage' arising from a disease or pest incursion. Specifically, it states that:

> *Members shall take into account as relevant economic factors; the potential damage in terms of loss of production or sales in the event of the entry, establishment or spread of a pest or disease; the cost of control or eradication in the territory of the importing Member*

This list of 'relevant economic factors' may be viewed as the bare minimum that must be considered if an analysis is to comply with the terms of the *SPS Agreement*. In addition, both the *OIE Code* and IPPC standards for risk analysis have outlined factors that should be considered when assessing consequences. These two standards also stress the need to consider the 'likely magnitude' of consequences — that is, to base an assessment of consequences on the likelihood of various levels of damage in the importing country. Finally, Article 5.3 states that Members should consider '*... the relative cost-effectiveness of alternative approaches to limiting risks ...*'. This is an issue that should be explored during risk management. Among factors that may not be taken into account are those relating to import competition.

The environmental and ecological consequences of pest or disease introduction are legitimate considerations in a risk assessment. The *SPS Agreement* provides a basic right to take measures to protect animal or plant life or health (Article 2). In Annex A, 'animal' is defined to include fish and wild fauna; and 'plant' to include forests and wild flora.

Additional to the economic factors identified in Article 5.3, the definition of risk assessment in Annex A, paragraph 4 ('*... evaluation of the likelihood of entry, establishment or spread of a pest or disease … and of the associated potential biological and economic consequences ...*') provides for general consideration of the biological consequences, including those for the environment. The environment is included in paragraph 1(d), which states that an SPS measure is one that is applied to '*... prevent or limit other damage to a country from the entry, establishment or spread of pests ...*'.

Article 5.7 provides for the use of precaution when information is insufficient. This paragraph states that:

In cases where relevant scientific evidence is insufficient, a Member may provisionally adopt sanitary or phytosanitary measures on the basis of available pertinent information, including that from the relevant international organizations as well as from sanitary or phytosanitary measures applied by other Members. In such circumstances, Members shall seek to obtain the additional information necessary for a more objective assessment of risk and review the sanitary or phytosanitary measure accordingly within a reasonable period of time.

Members, in adopting provisional measures, must demonstrate that there is insufficient information for an objective assessment of the risk. The provisional measures must be based on available information including international standards and the approaches of other countries. Countries adopting provisional measures are obliged to identify the additional information required for a more objective assessment and to seek that information in a timely manner. The provisional measure must be reviewed within a reasonable period because such measures are assumed to be trade limiting and contrary to the interests of WTO agreements.

Appropriate level of protection

The *SPS Agreement* defines *'appropriate level of sanitary or phytosanitary protection'* as the level of protection deemed appropriate by the Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory. The *SPS Agreement* notes that many Members also refer to this concept as the *'acceptable level of risk'*. In setting their ALOP, Members are to take into account the objective of minimising negative trade effects (Article 5.4).

Determination of Australia's ALOP is an issue for government in consultation with the community — it is not a prerogative of WTO. ALOP reflects government policy that is affected by community expectations; it is a societal value judgement to which AFFA contributes by providing technical information and advice. It is important to note that the *SPS Agreement* does not require a Member to have a scientific basis for its ALOP determination.

ALOP can be illustrated using a *risk estimation matrix* (Table 1). The cells of this matrix describe the product of likelihood and consequences — termed 'risk'.

When interpreting the risk estimation matrix it should be remembered that although the descriptors for each axis are similar ('low', 'moderate', 'high', etc.), the vertical axis refers to *likelihood* and the horizontal axis refers to *consequences*.

One implication of this is that a 'negligible' probability combined with 'extreme' consequences, is not the same as an 'extreme' probability combined with 'negligible' consequences — that is, that the matrix is *not symmetrical.* Another implication is that 'risk' is expressed in the same units as are used to estimate consequences — that is, risk is *not* a likelihood.

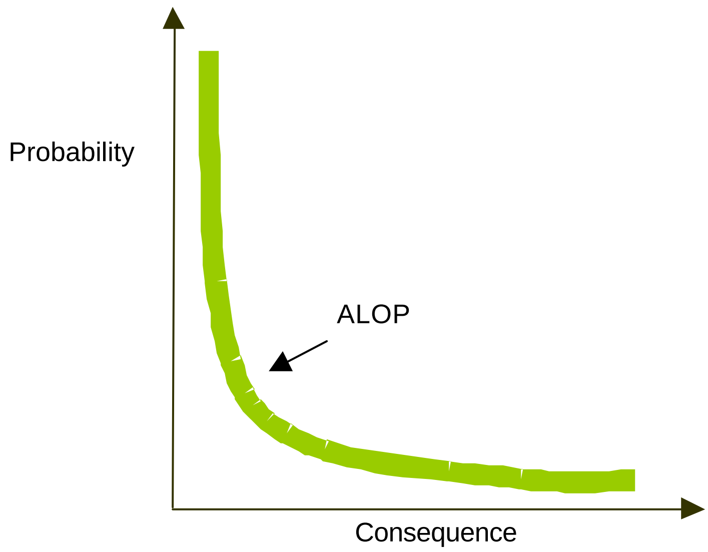
Table 1 Risk estimation matrix

Likelihood of entry, establishment and spread						
High likelihood	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
Moderate	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
Low	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk	High risk
Very low	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk
Extremely low	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk
Negligible likelihood	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk
	Negligible impact	*Very low*	*Low*	*Moderate*	*High*	*Extreme impact*

Consequences of entry, establishment and spread

The band of cells in Table 1 marked ‘very low risk’ represents Australia's ALOP, or tolerance of loss. This band of cells represents an approximation of a continuous ‘iso-risk curve’ — a curve that will be asymptotic at the minimum level of consequences considered to be ‘acceptable’ (which, in Australia's case, is ‘very low’) and at a likelihood that tends toward zero. The principle of an iso-risk curve is illustrated in Figure 1.

Figure 1 Theoretical iso-risk curve



Consistency in risk management

Article 5.5 states:

> *With the objective of achieving consistency in the application of the concept of appropriate level of sanitary or phytosanitary protection against risks to human life or health, or to animal and plant life or health, each Member shall avoid arbitrary or unjustifiable distinctions in the levels it considers to be appropriate in different situations, if such distinctions result in discrimination or a disguised restriction on international trade*

Members are obliged to avoid arbitrary or unjustifiable distinctions in the levels of protection applied in different situations, if such distinctions result in discrimination or a disguised restriction on international trade. This obligation reflects the objective of consistency in applying the concept of ALOP against risks to human, animal and plant life or health — that is, consistency in risk management. In other words, it is not open to a Member to arbitrarily vary its attitude to the acceptance of risk from one situation to another.

Consistency in risk management is achieved in Biosecurity Australia's IRA process by using the risk estimation matrix (Table 1).

The technical component of an IRA for plants or plant products is termed a 'pest risk analysis', or PRA. In accordance with the ISPM *Pest Risk Analysis for Quarantine Pests*[2], a PRA comprises three discrete stages:

- Stage 1: initiation of the PRA
- Stage 2: risk assessment
  - pest categorisation
  - entry potential
  - establishment potential
  - spread potential
- Stage 3: risk management.

The *initiation* of a risk analysis involves the identification of pest(s) and pathways of concern that should be considered for analysis. *Risk assessment* comprises pest categorisation, assessment of the probability of introduction and spread, and assessment of the potential economic consequences (including environmental impacts). *Risk management* describes the evaluation and selection of options to reduce the risk of introduction and spread of a pest. The key objective of this draft IRA is to document the approach and results of these three stages and propose quarantine conditions.

STAGE 1: INITIATION OF THE PRA

According to the IPPC, the aim of the initiation stage is to identify the objectives of the PRA – in particular, to define the initiation point and the PRA area. The 'initiation point' describes the purpose or context in which the PRA was initiated. The 'PRA area' is the area in relation to which a PRA is conducted (officially defined country, part of a country or all or part of several countries).

Typical initiation points for the PRA process include:

- the identification of a pathway that presents a potential pest hazard
- the identification of a pathway that may require regulation
- the review of revision of phytosanitary policies and priorities.

From Biosecurity Australia's perspective, the identification of a new pathway will be the most common and important means by which a PRA is initiated.

This PRA was initiated because of the prospect of imports of fresh pineapple fruit from various new points of origin. The Philippines, Solomon Islands, Sri Lanka and Thailand have sought access for their pineapples to the Australian market. International standards to address quarantine concerns associated with imports of pineapples are not available, nor has Australia completed an IRA of this commodity.

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[2] PRA is used throughout this document as an abbreviation of Pest Risk Analysis. AFFA uses the term PRA to describe the technical component of an import risk analysis.

STAGE 2: METHOD FOR RISK ASSESSMENT

Risk assessment describes the process of identifying pests of quarantine (or biosecurity) concern and estimating the risk (the probability of introduction and spread and the magnitude of the likely consequences) associated with each.

In accordance with the IPPC, this risk assessment was carried out and reported in the following steps:

- pest categorisation
- assessment of probability of entry[3], establishment[4] and spread[5]
- assessment of potential consequences[6] (including environmental impacts).

Method for pest categorisation

Pest categorisation is a classification phase to group pests identified in Stage 1 (Initiation of the PRA) as either 'quarantine pests', or not. The objective of pest categorisation is to screen efficiently a 'complete' list of potential quarantine pests, to identify those that require in-depth examination in the ensuing risk assessments.

According to the IPPC, a 'quarantine pest' is a pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled. An 'endangered area' is an area where ecological factors favour the establishment of a pest whose presence in the area will result in economically important loss.

On the basis of these definitions, the process of pest categorisation is summarised by IPPC in the five criteria outlined below:

- *Identity of the pest*. The identity of the pest should be clearly defined to ensure that the assessment is being performed on a distinct organism, and that biological and other information used in the assessment is relevant to the organism in question. If this is not possible because the causal agent of particular symptoms has not yet been fully identified, then it should have been shown to produce consistent symptoms and to be transmissible.

  The taxonomic unit for the pest is generally species. The use of a higher or lower taxonomic level should be supported by scientifically sound rationale. For levels below the species, this should include evidence demonstrating that factors such as differences in virulence, host range or vector relationships are significant enough to affect phytosanitary status.

[3] 'Entry' describes the movement of a pest into an area where it is not yet present or present but not widely distributed and being officially controlled. This phase of risk assessment will be carried out on quarantine pests, so it follows that an area denotes a category of suitable host.

[4] 'Establishment' describes the perpetuation, for the near future, of a pest within an area after entry.

[5] 'Spread' describes the expansion of a geographical distribution of a pest within an area.

[6] IPPC ISPM No 2 and ISPM No 11 (*Pest Risk Analysis for Quarantine Pests*) use the term 'economic consequences'. Except in the situation where either economic impact or economic viability is specifically of interest, the word 'economic' has been deleted from all headings, text and definitions. This action has been taken because it was believed that the impact of a pest would often be accrued in areas that cannot practically be evaluated through a traditional 'economics' approach. In particular, this would include the impact of a pest on the environment, on ecosystems, on biodiversity, etc.

Where a vector is involved, the vector may also be considered a pest to the extent that it is associated with the causal organism and is required for transmission of the pest.

- *Presence or absence in the endangered area*. The pest should be absent from all or part of the endangered area.
- *Regulatory status*. If the pest is present but not widely distributed in the PRA area, it should be under official control or be expected to be under official control in the near future.
- *Potential for establishment and spread in the PRA area*. Evidence should be available to support the conclusion that the pest could become established or spread in the PRA area. The PRA area should have ecological/climatic conditions including those in protected conditions suitable for the establishment and spread of the pest where relevant, host species (or near relatives), alternate hosts and vectors should be present in the PRA area.
- *Potential for economic consequences in the endangered area*. There should be clear indication that the pest is likely to have an unacceptable economic impact (including environmental impact) in the PRA area.

For administrative purposes, pest categorisation was carried out in two stages.

In the Issues Paper released in August 2001 (*Issues Paper: Import Risk Analysis (IRA) for the importation of fresh pineapple fruit*) a list of pests of pineapples was categorised according to the presence or absence of each pest in Australia, and the association of each pest with pineapple fruit. Where there was any doubt or contention regarding the occurrence of a pest or its association with pineapple fruit, that pest was retained on the list of potential quarantine pests.

The second stage of pest categorisation is documented in this *Draft IRA Report*. This stage was based on the categorisation of each pest absent from Australia and associated with pineapple fruit according to (a) its potential to become established in Australia, and, (b) the potential for economic consequences. Categorisation of establishment potential and potential for economic consequences was dichotomous, and expressed using the terms 'feasible' / 'not feasible', and 'significant' / 'not significant', respectively[7]. Additional description of the pest categorisation stage is provided in 'Pest Categorisation' section of this document.

The result of pest categorisation was a list of quarantine pests for which individual in depth assessments were required.

Method for evaluating the probability of entry, establishment and spread

The probability of *entry* was obtained by considering the 'importation' and 'distribution' pathway(s) for the commodity (Figure 2) and the likelihood that a given pest will remain viable and undetected as each of the component steps in this pathway is completed. The probability of *establishment* and the probability of *spread* are obtained by examining biological and other factors in the endangered area that may influence a pest's ability to become established and subsequently spread to other areas.

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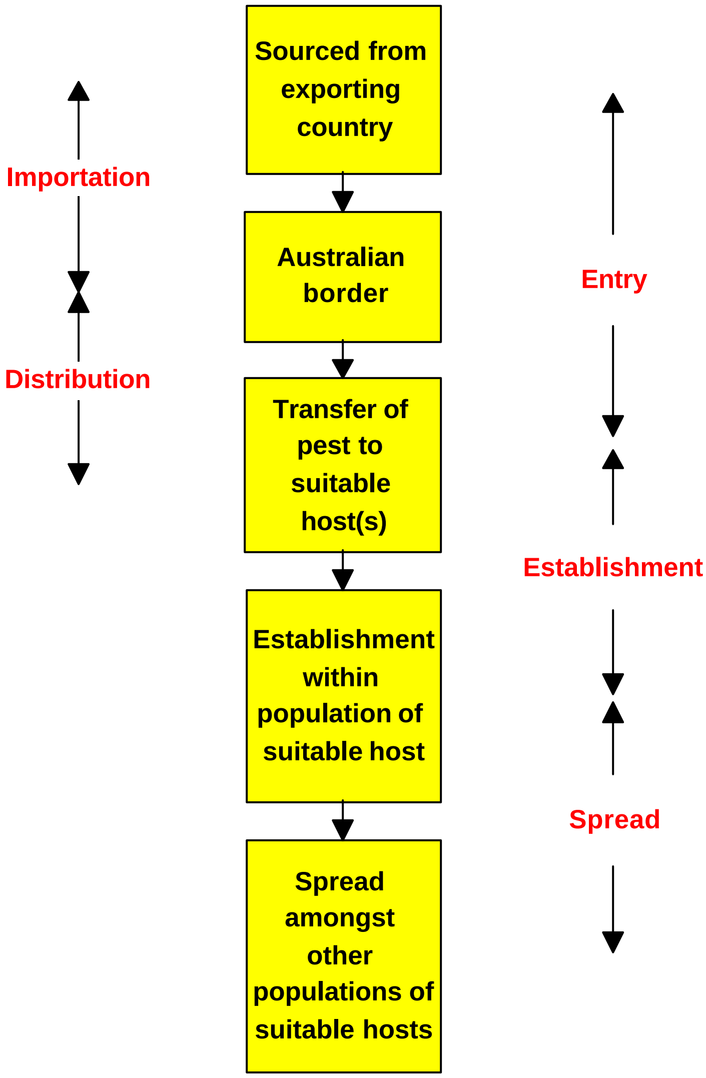
[7] Categorisation should not be confused with the more detailed assessments of establishment and spread potential and of economic consequences that were carried out for each quarantine pest.

Figure 2 Stages in the entry, establishment and spread of a pest



Evaluating and reporting likelihood

Evaluation and reporting of likelihoods can be done qualitatively, semi-quantitatively or quantitatively. For qualitative evaluation, likelihoods assigned to steps in the scenarios (and/or to the overall result for a scenario) are categorised according to an ordinal descriptive scale – eg 'low', 'moderate', 'high' etc – and where no attempt has been made to equate descriptors with numeric values or scores. For semi-quantitative evaluation, likelihoods are given numeric 'scores' (eg. 1, 2, 3), or probabilities and/or probability intervals (eg. 0–0.0001, 0.0001–0.001, 0.001-0.01, 0.01-1). For quantitative evaluation, likelihoods are described in purely numeric terms – whether as 'deterministic' point estimates or as 'stochastic' probability distributions.

Each of these three approaches to likelihood evaluation has its advantages and constraints and the choice of approach depends on both technical and practical considerations.

For the purposes of this IRA, likelihood was evaluated and reported qualitatively using the terms described in Table 2.

Table 2 Nomenclature for qualitative likelihoods

Likelihood	Descriptive definition
High	The event would be very likely to occur
Moderate	The event would occur with an even probability
Low	The event would be unlikely to occur
Very low	The event would be very unlikely to occur
Extremely low	The event would be extremely unlikely to occur
Negligible	The event would almost certainly not occur

Qualitative likelihoods can be assigned to individual steps in scenarios, or to the probability that the entire scenario will occur.

If qualitative likelihoods have been assigned to individual steps in a scenario, then some form of 'combination rule' is needed for calculating the probability that the entire scenario will occur. For the purposes of this IRA the likelihoods were combined using a two-by-two tabular matrix, as shown in Table 3.

Table 3 A matrix of 'rules' for combining descriptive likelihoods

	High	**Moderate**	**Low**	**V. low**	**E. low**	**Negligible**
High	High	Moderate	Low	V. Low	E. Low	Negligible
Moderate		Low	Low	V. Low	E. Low	Negligible
Low			V. low	V. Low	E. Low	Negligible
V. low				E. Low	E. Low	Negligible
E. low					Negligible	Negligible
Negligible						Negligible

The *advantage* of this matrix-based qualitative approach is that an importation scenario can be broken into its component steps and a descriptive likelihood assigned to each. This provides a simple means by which to improve the transparency of an assessment. The principal *disadvantage* is that the assessment will often lead to a conservative overestimate of the likelihood that would have been obtained had the scenario been evaluated using a quantitative or semi-quantitative approach. This is because the repeated application of any one of the rules in the matrix (Table 3) will lead to the same likelihood. For example, if two steps in a scenario were considered to have a 'low' likelihood of occurrence, then the product of these, as determined using the matrix, would be 'very low'. Unfortunately, the same result would be obtained if there were three, four, five, etc., steps with a 'low' likelihood, and yet clearly the overall likelihood should be progressively lower in each case.

Biosecurity Australia considered that a qualitative approach was the most appropriate approach for this IRA due to the limited amount of technical information that was available and the relatively simple import and distribution scenarios that were identified. As described in ISPM No 11 (*Pest Risk Analysis for Quarantine Pests*), the overall probability of introduction should be expressed in terms most suitable for the data. This ISPM also notes that “this may be quantitative or qualitative, since either output is in any case the result of a combination of both quantitative and qualitative information”.

Due to the limited amount of available technical information, evaluation of likelihoods required the use of expert opinion and extrapolation of information that was available on similar related pests. Thorough documentation of the evaluation of likelihoods and referencing to available information allowed this to be a structured and transparent process. As described later in this document, this qualitative approach supported the estimation of ‘risk’ using a combination of likelihood and consequence.

The procedure can be illustrated using the hypothetical example of imported fruit (Figure 3). In this example, each of the four steps has been assigned a likelihood. These likelihoods have subsequently been combined using the ‘rules’ provided in Table 3.

Figure 3 A scenario diagram for the importation of fruit

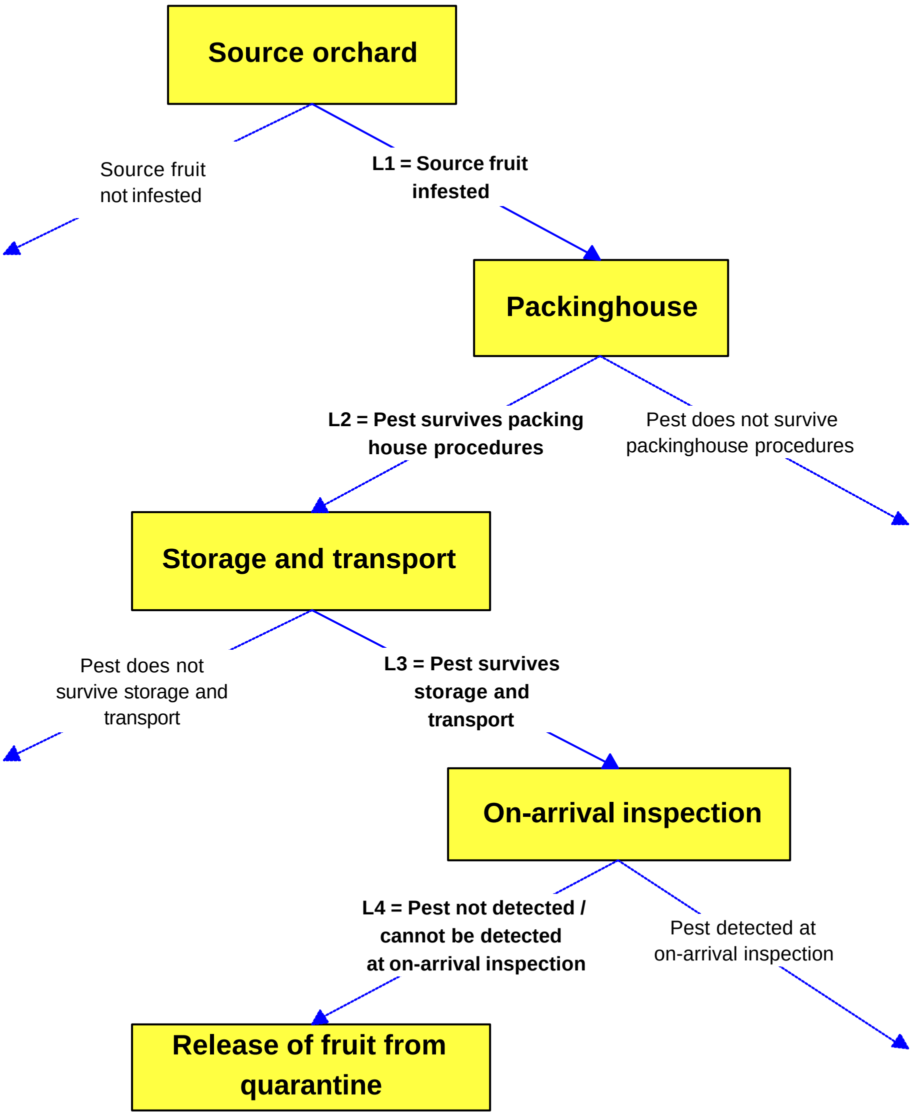


Table 4 Qualitative evaluation of the imported fruit scenario

Step	Qualitative descriptor	Product of likelihoods
L_1: Source fruit infested	Low	
L_2: Pest is not detected / survives packinghouse procedures	Moderate .... ➔	Low
L_3: Pest survives storage and transport	High .... ➔	Low
L_4: Pest not detected during routine AQIS on-arrival inspection	V. Low .... ➔	V. Low

The result of the procedure is an estimate of the probability that the complete chain of events will occur — that is, 'the probability that imported fruit will be infested on arrival'. In this hypothetical example, the probability that imported fruit is infested is estimated to be 'very low'. Alternatively, it could be stated that it is 'very unlikely' that imported fruit will be infested. The calculation of this probability would conclude a qualitative assessment of the probability of importation.

Probability of entry

The probability of entry describes the likelihood that a quarantine pest will enter Australia as a result of trade in pineapple fruit, and be distributed in a viable state to the endangered area. This phase of risk assessment did not include consideration of risk management other than that considered normal practice in sourcing and importing pineapple fruit. The probability of entry may be divided into the following components:

- *probability of importation*: the probability that a pest will arrive in Australia[8] with the importation of pineapple fruit
- *probability of distribution*: the probability that the pest will be distributed as a result of the processing, sale or disposal of pineapple fruit, to the endangered area.

It is important to note that in breaking down the probability of entry into these two components, its formal IPPC definition was preserved. The two components were identified and separated solely to enable their pathways to be described and assessed individually.

Probability of importation

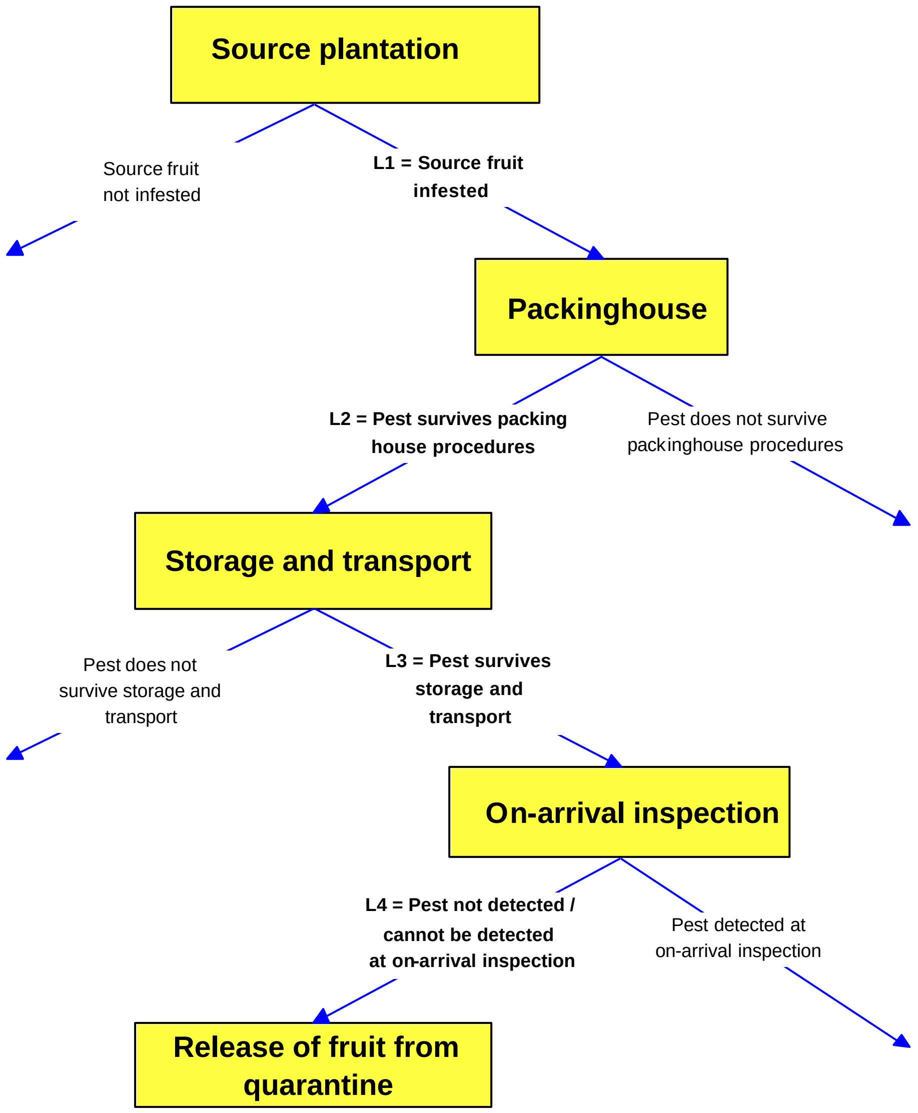
The 'biological pathway', or ordered sequence of steps undertaken in sourcing, processing and exporting pineapple fruit, is termed its 'importation scenario'. The initiating step in the importation scenario was the source plantation – the end-point was the release of infected or infested fruit from quarantine in Australia.

A conceptual representation of the importation scenario for pineapple fruit is presented in Figure 4. The individual steps are defined in summary form below.

[8] In this context, 'arrival in Australia' is taken to imply the arrival of infested or contaminated commodity at the point of entry — whether this is an airport, a shipping port or an Australian quarantine station.

- Step 1 *Association of the pest with the pathway at its origin*. An evaluation of the prevalence of the pest in the source area; the occurrence of the pest in a life stage associated with the commodity, containers or conveyances; seasonal timing of movements; pest management; cultural or commercial procedures applied at the point of origin (eg application of plant protection products, handling, culling, roguing, grading). Likelihood noted as L1 in the importation scenario for pineapples (Figure 4).
- Step 2 *Survival of the pest through the packinghouse process*. An evaluation of standard cleaning and hygiene practices applied to pineapple fruit. L2
- Step 3 *Survival of the pest during transport or storage*. The speed and conditions of transport and duration of the life cycle of the pest in relation to time in transport and storage; vulnerability of the life-stages during transport or storage; prevalence of pest likely to be associated with a consignment; commercial procedures (e.g. refrigeration) applied to consignments in the country of origin, country of destination, or in transport or storage. L3
- Step 4 *Non-detection of the pest during routine AQIS on-arrival inspection*. The probability that the pest will go undetected during inspection or survive other existing phytosanitary procedures should be estimated. L4.

Figure 4 Importation scenario for pineapple



Probability of distribution

The 'biological pathway', or ordered sequence of steps describing the distribution of a pest from its point of entry into Australia to a susceptible host is termed a distribution scenario. In the context of this assessment:

- The *initiation point* for a distribution scenario was the release of contaminated pineapple fruit from quarantine in Australia
- The *endpoint* for a distribution scenario was the exposure of a susceptible host in Australia to a viable example of the pest of concern.

The probability of distribution is the probability that a pest that has entered Australia with the importation of a given commodity will be distributed (as a result of the processing, sale or disposal or the commodity) to the endangered area, and subsequently be transferred to a suitable host. The assessment of distribution potential for this draft IRA is based on a single distribution pathway leading to a single endpoint – as described in the importation pathway. Likelihoods were assigned based on the following generalised distribution scenario: :

- storage and distribution of imported fruit
- occurrence of infected/infested fruit waste
- distribution of infected/infested fruit waste to the environment
- transfer to a susceptible host in an endangered area.

Estimation of the probability of entry

Estimates for the probability of importation and distribution were combined to give the probability of entry. This is the overall likelihood that a quarantine pest will enter Australia as a result of trade in pineapple fruit, and be distributed in a viable state to the endangered area.

Probability of establishment

The probability of establishment was derived from a comparative assessment of factors in the source and destination areas considered pertinent to the ability of a pest to survive and propagate. These factors included:

- *The availability, quantity and distribution of hosts in the PRA area*. Whether hosts (or suitable near relatives) occur in sufficient numbers and geographical proximity to allow the pest to complete its life cycle, whether known vectors (or suitable alternate species) are present or likely to be introduced.
- *The environmental suitability of the PRA area*. Whether environmental factors (climate, soil conditions, pest and host competition, etc) are suitable for the pest and any identified hosts or vectors. Environmental factors in protected environment (glasshouses, etc) were considered.
- *The potential for adaptation of the pest*. Whether the species is polymorphic, and the degree to which it has demonstrated an ability to adapt to conditions as present in the PRA area. Genetic adaptability is considered an indication of a pest's ability to withstand environmental fluctuations, to adapt to a wide range of habitats, to develop pesticide resistance and to overcome host resistance.
- *The reproductive strategy of the pest*. Characteristics that enable the pest to reproduce effectively in the new environment. Examples include pathogenesis, self-crossing, duration of life cycle, number of generations per year, the presence of a resting stage, etc.
- *The method of pest survival*. Whether a minimum population is needed for survival.
- *Cultural practices and control measures*. Whether these differ between the source area and the PRA area. Pest-control programs and natural enemies of the pest were considered. It was noted that pests for which there is no feasible control should be considered a greater threat than those that are subject to control in the source area.

Technical information to support the probability of establishment was derived from the data-sheet for each quarantine pest (Appendix 4), and from an assessment of the relevant factors in the area of origin and Australia.

It can be seen that in contrast to the probability of entry, the 'probability of establishment' does not result from a structured scenario of events, or 'pathway'. That is, the probability of establishment reflects an expert opinion derived from a single comparative evaluation of the factors described above.

Probability of spread

The probability of spread was derived from a comparative assessment of those factors in the area of origin and Australia considered pertinent to the expansion of the geographical distribution of the pest. As for the probability of establishment, the probability of spread was not based on a pathway but, rather, reflected expert opinion on a comparative evaluation of the biological factors described below.

Factors that were considered included:

- the suitability of the natural and/or managed environment for natural spread
- movement of the pest with the commodity or with conveyances
- the intended use of the commodity
- potential vectors for the pest in the PRA area
- potential natural enemies of the pest in the PRA area

Conclusions: entry, establishment and spread potential

Estimates for the probability of entry, the probability of establishment and the probability of spread were combined to give an overall estimate for 'entry, establishment and spread potential'. This is the overall likelihood that a quarantine pest will enter Australia as a result of trade in a pineapple fruit, be distributed in a viable state to a suitable host, establish in that area and subsequently spread within Australia.

Method for assessing consequences

Criteria for assessing the consequences associated with a pest or disease are outlined in the relevant acts and agreements, and in the standards prepared by the relevant international organisations.

In particular:

- the *Quarantine Act* requires decision-makers to take into account the likelihood of harm being caused (to humans, animals, plants, other aspects of the environment, or economic activities) and the probable extent of the harm (Section 5D)
- the *SPS Agreement* states that:

  Members shall take into account as relevant economic factors; the potential damage in terms of loss of production or sales in the event of entry, establishment or spread of a pest or disease; the costs of control or eradication in the territory of the importing Member; and the relative cost-effectiveness of alternative approaches to limiting risks
- IPPC expand the 'relevant economic factors' described in the *SPS Agreement* to differentiate between the 'direct' and 'indirect' effects of a pest, and to provide examples of factors that will typically be relevant to an import risk analysis.

In each case, consequence assessments do not extend to considering the benefits or otherwise of trade in a given commodity, nor to the impact of import competition on industries or consumers in the importing country.

The direct and indirect consequences considered in this IRA are shown below.

Direct consequences

These describe direct harm to:

- animal or plant life, health or welfare (whether native or introduced species), including animal and plant production losses
- human life, health or welfare
- any other aspects of the environment not covered above (e.g. the physical environment or other life forms — microorganisms, etc.).

Indirect consequences

Indirect consequences are the costs resulting from natural or human processes associated with the incursion of a pest. These include:

- new or modified eradication, control, surveillance/monitoring and compensation strategies/programs
- domestic trade or industry effects, including changes in consumer demand and effects on other industries supplying inputs to, or utilising outputs from, directly affected industries
- international trade effects, including loss of markets, meeting new technical requirements to enter/maintain markets and changes in international consumer demand
- indirect effects on the environment (see below), including biodiversity, endangered species, the integrity of ecosystems, reduced tourism, reduced rural and regional economic viability and loss of social amenity, and any 'side effects' of control measures.

A range of factors is relevant to the consideration of harm to the environment. This includes harm arising from the impact of the pest, as well as from any treatments or procedures used to control it. The extent of harm was evaluated taking into account the circumstances of the particular pest, and using the factors outlined below:

- all on-site and off-site impacts
- the geographical scope and magnitude of the impact
- the frequency and duration of the action causing the harm
- the total impact which can be attributed to that action over the entire geographic area affected, and over time (i.e. cumulative impact)
- any synergistic effect of hazards on impact
- reversibility of the impact
- the sensitivity of the receiving environment (recognised environmental features of high sensitivity)
- the degree of confidence with which the impacts of the action are known and understood.

The direct and indirect consequences described above collectively cover the *economic*, *environmental* and *social* effects of a pest. Given this, the consequences are also mutually exclusive — that is, an effect was not be assessed more than once. In particular, the direct effects of a pest on a native or wild species were assessed under the criterion describing the '*animal or* *plant life and health, including animal and plant production losses*', whereas the indirect or 'flow-on' effects on the environment were assessed under the last indirect criterion.

Describing direct and indirect pest effects

Each direct and indirect consequence was estimated at four levels — local, district, regional and national — and the values derived subsequently translated into a single qualitative score (A–F). In this context, the terms 'local', 'district', 'regional' and 'national' were defined as follows.

Local: an aggregate of households or enterprises — e.g. a rural community, a town or a local government area

District: a geographically or geopolitically associated collection of aggregates — generally a recognised section of a state, such as the 'North West Slopes and Plains' or 'Far North Queensland'

Region: a geographically or geopolitically associated collection of districts — generally a state, although there may be exceptions with larger states such as Western Australia

National: Australia-wide

At each level, the quantum of impact was described as 'unlikely to be discernible', of 'minor significance', 'significant' or 'highly significant':

- an '*unlikely to be discernible*' impact is not usually distinguishable from normal day-to-day variation in the criterion
- an impact of '*minor significance*' is not expected to threaten economic viability, but would lead to a minor increase in mortality/morbidity or a minor decrease in production. For non-commercial factors, the impact is not expected to threaten the intrinsic 'value' of the criterion — though the value of the criterion would be considered as 'disturbed'. Effects would generally be reversible
- a '*significant*' impact would threaten economic viability through a moderate increase in mortality/morbidity, or a moderate decrease in production. For non-commercial factors, the intrinsic 'value' of the criterion would be considered as significantly diminished or threatened. Effects may not be reversible
- a '*highly significant*' impact would threaten economic viability through a large increase in mortality/morbidity, or a large decrease in production. For non-commercial factors, the intrinsic 'value' of the criterion would be considered as severely or irreversibly damaged.

When assessing the local, district, regional and national consequences, the frame of reference was the impact of each pest on the community as a whole. This often differed markedly from the effect of the pest on the local, district, regional or national population of directly affected parties.

A related consideration is the *persistence* of an effect. In general, where the effect was prolonged, as was the case if it was thought to persist for several production cycles or if regeneration would take several generations, the consequences were considered greater. If an effect was not prolonged, then consequences were likely to be less serious. In either case, it was at times necessary to place a pest in the next higher or lower category for that consequence criterion.

Estimates of the consequences of the introduction, establishment and spread at the local, district, regional and national level were subsequently translated to an overall score (A–F) using the schema outlined in Table 5.

Table 5 The assessment of local, district, regional and national consequences

Impact score	Local	District	Regional	National
F	-	-	-	Highly significant
E	-	-	Highly significant	Significant
D	-	Highly significant	Significant	Minor
C	Highly significant	Significant	Minor	Unlikely to be discernible
B	Significant	Minor	Unlikely to be discernible	Unlikely to be discernible
A	Minor	Unlikely to be discernible	Unlikely to be discernible	Unlikely to be discernible

Level

Approach to the consequence assessment for fresh pineapple

The approach to consequence assessment for this draft IRA was based on consideration of the following direct and indirect consequences

- plant health or loss
- direct effects on the environment
- control and eradication
- domestic trade
- international trade
- indirect effects on the environment.

An impact score (A-F) was estimated for each of the above consequences and then combined using the decision rules below to give the overall expected consequence for each pest.

This was achieved by following the decision rules below. These rules are mutually exclusive, and were addressed in the order that they appeared in the list — for example, if the first set of conditions did not apply, the second set were considered. If the second set did not apply, the third set were considered ..., and so forth until one of the rules applied:

1. Where the consequences of a pest with respect to any direct or indirect criterion is ‘F’, the overall consequences are considered to be ‘extreme’.
2. Where the consequences of a pest with respect to more than one criterion is ‘E’, the overall consequences are considered to be ‘extreme’.
3. Where the consequences of a pest with respect to a single criterion is ‘E’ and the consequences of a pest with respect to each remaining criterion is ‘D’, the overall consequences are considered to be ‘extreme’.
4. Where the consequences of a pest with respect to a single criterion is ‘E’ and the consequences of a pest with respect to remaining criteria is not unanimously ‘D’, the overall consequences are considered to be ‘high’.
5. Where the consequences of a pest with respect to all criteria is ‘D’, the overall consequences are considered to be ‘high’.

6. Where the consequences of a pest with respect to one or more criteria is ‘D’, the overall consequences are considered to be ‘moderate’.
7. Where the consequences of a pest with respect to all criteria is ‘C’, the overall consequences are considered to be ‘moderate’.
8. Where the consequences of a pest with respect to one or more criteria is considered ‘C’, the overall consequences are considered to be ‘low’.
9. Where the consequences of a pest with respect to all criteria is ‘B’, the overall consequences are considered to be ‘low’.
10. Where the consequences of a pest with respect to one or more criteria is considered ‘B’, the overall consequences are considered to be ‘very low’.
11. Where the consequences of a pest with respect to all criteria is ‘A’, the overall consequences are considered to be ‘negligible’.

Conclusions (risk estimation)

The unrestricted risk estimate for each pest was determined by combining the overall estimate for ‘entry, establishment and spread potential’ with the overall expected consequence using a risk estimate matrix (Table 1).

STAGE 3: METHOD FOR RISK MANAGEMENT

The requirement for risk management was determined by comparing the unrestricted risk estimate with Australia’s ALOP using the risk estimation matrix (Table 1). Australia’s ALOP is represented in this matrix by the row of cells marked ‘very low risk’. Where the estimate of unrestricted risk did not exceed Australia’s ALOP, risk management was not required. Where the unrestricted risk estimate exceeded Australia’s ALOP, risk management measures were required to reduce the risk to an acceptable level. Using this risk estimation matrix, risk management measures are required when the unrestricted risk estimate is low, moderate, high or extreme. Risk management measures are not required when the unrestricted risk estimate is very low or negligible.

BACKGROUND

Over the past several years a number of countries, the Philippines, Solomon Islands, Sri Lanka and Thailand have sought access for their pineapples to the Australian market. An Issues Paper for this IRA was released in August 2001 (*Issues Paper: Import Risk Analysis (IRA) for the importation of fresh pineapple fruit*) describing background information on the risk analysis and documenting the approach to and preliminary results of the pest categorisation.

This draft IRA document summarises the information provided in the Issues Paper and also includes the full pest risk assessment (including the final stage of pest categorisation), the risk management stage and the proposed quarantine conditions. Stakeholder comments were received to the Issues Paper and these were considered in the preparation of this draft IRA.

The Philippines

The Philippines Bureau of Plant Industry (BPI) has been seeking market access for exports of pineapples from the Philippines to Australia since 1995 as part of a general request for access for exports of bananas, mangoes and pineapples. In June 1996, BPI and AQIS mutually resolved that mango was the top priority for the Philippines, and accordingly that IRAs for bananas and pineapples would be progressed in due course.

At a meeting of the Philippines-Australia Joint Commission in Canberra in May 1999, the Philippines' authorities indicated that their next market access priority was bananas, following the imminent completion of market access negotiations for exports of Philippine mangoes to Australia. In May 2000, BPI provided Biosecurity Australia with a pest list for Philippines bananas and pineapples, and requested that IRAs for these commodities be conducted simultaneously.

Solomon Islands

In early 1991, AQIS received an application from the Solomon Islands Ministry of Agriculture and Lands to export fresh fruit and vegetables, including pineapples, to Australia. In March 1991, pest lists were received from the Solomon Islands. Because several years have since elapsed, Biosecurity Australia has endeavoured to obtain an updated pest list for pineapples from the Solomon Islands.

Sri Lanka

In 1999, an Australian importer requested permission to import pineapples from Sri Lanka. Biosecurity Australia has requested a pest list from Sri Lanka.

Thailand

At the 5th Thailand-Australia Joint Technical Working Group meeting held in Canberra in February 2001, the Thai authorities requested access to the Australian market for pineapples exported from

Thailand. Biosecurity Australia subsequently requested a pineapple pest list from Thailand. The pest list was received in November 2001.

Because several countries have submitted access requests and because the major quarantine pests of pineapples are similar in most pineapple producing countries, it is considered most efficient to conduct the IRA as a generic IRA. The rationale for using the generic IRA approach was given in Plant Biosecurity Policy Memorandum 2000/20 (issued on 17 October 2000).

SCOPE

This IRA considers quarantine risks that may be associated with the import from any country into Australia of fresh pineapple fruit for human consumption. The IRA is considered to be 'generic', in that it is not based upon particular exporting countries. The occurrence of pests and other country-specific factors are, however, considered in the specification of risk management measures.

As described in the Issues Paper, fresh pineapple is defined as "…fresh pineapple with crowns (leaf) from all countries for human consumption."

CURRENT IMPORT CONDITIONS FOR FRESH PINEAPPLE INTO AUSTRALIA FOR CONSUMPTION

International policy

Currently, fresh pineapple for human consumption is permitted into Australia from the USA, New Zealand, European and Pacific Island nations. Imports of pineapple from these countries are subject to compliance with specific import conditions. The general conditions include freedom from soil, removal of crowns and a phytosanitary certificate endorsed that "fruit fumigated with methyl bromide at the rate of $32 g/m^3$ for 6 hours at 21^oC or above" (Anon., 2001).

Domestic arrangements

The Commonwealth Government is responsible for regulating the movement of plants and their products into and out of Australia, but the State and Territory Governments are responsible for plant health controls within Australia. Legislation relating to resource management or plant health may be used by State and Territory Government agencies to control interstate movement of plants and their products.

METHOD USED FOR PEST CATEGORISATION

For this IRA, pest categorisation was conducted using the method described in the 'Method for pest categorisation' section of this document. The Issues Paper for this IRA contained the preliminary results of the pest categorisation and the full results are presented in this draft IRA. The tables presented in the Issues Paper listed the presence/absence in Australia of pests of pineapples and whether they were on the pathway under consideration in this IRA.

In October 2001, Biosecurity Australia received interception records from the National Plant Protection Organisation (NPPO) of a third country currently importing pineapples from the Philippines. The NPPO also provided Biosecurity Australia with their import conditions for pineapples from Thailand, which contained 17 arthropod pests and eight weed pests not covered in the Issues Paper. The Thai Ministry of Agriculture provided a list of pests on pineapples in Thailand in November of 2001. This list highlighted additional pineapple pests, of which two weeds were not included in the Issues Paper. The Western Australian Department of Agriculture provided a list of eight additional pests that were not considered in the Issues Paper.

These additional pests have been included in the pest list being considered in this draft IRA. Detailed results of the pest categorisation for the weed pests are provided in Appendix 2 in Part B. The additional pests received by BA since the publication of the Issues Paper are denoted by an *.

Table 6 provides a numerical summary of the total number of weed pests known to be associated with pineapples worldwide as well as the number present in Australia.

RESULTS OF PEST CATEGORISATION FOR WEED PESTS

Table 6 Number of potential pineapple weed pests worldwide and in Australia

Associated with pineapple	Present in Australia	Present in Australia but under official control	Not present in Australia
187	116	0	71

Of the 187 weed pests associated with pineapples worldwide, 116 occur in Australia. It was considered that all of the 71 that do not occur in Australia had a feasible 'potential for establishment and spread in the PRA area' (as opposed to not feasible) and significant 'potential for economic consequences' (as opposed to not significant).

The interception report provided to Biosecurity Australia on weed seeds found on pineapples from the Philippines is evidence that weeds can be introduced to Australia on this pathway.

Weeds pose a high socio-economic and environmental cost to Australia. The socio-economic cost of the weeds through yield loss and agricultural weed control is estimated at between $2.75 billion and $3.3 billion per annum. Also, many other costs such as contamination of produce and stockfeed, crop disease carriers and the human health impacts are yet to be quantified. Weeds are also very harmful to the environment, causing reduced conservation, biodiversity, aesthetic and recreational values. Weeds threaten endangered native species and contribute to the overall degradation of natural resources.

Methodology for risk assessment is described in the previous 'Stage 2: Method for Risk Assessment' section. As described in that section, the method is in accordance with the IPPC. All stages of this method were used for the non weed pests identified in this IRA whereas only the pest categorisation stage from this method was used for the weed pests. For the purposes of this IRA, the risk assessment stage for weed pests is based on the Weed Risk Assessment (WRA) process. A full description of the WRA system is available on the AFFA website.

Considerations for this assessment included whether the species was categorised by CSIRO as a weed (Lazarides *et al.* 1997), listed in World's Worst Weeds List 1977 (Holm *et al.* 1977), whether the seed was likely to be associated with pineapple fruit (Delta Database 2001; Holm *et al.* 1997), whether the species was a declared noxious weed (National Weeds Strategy Noxious Weeds Database; Parson and Cuthbertson 2001), and whether the species was currently prohibited entry into Australia or not.

Of the weed pests considered in the risk assessment stage, approximately 20% are categorised as weeds by CSIRO, approximately 15% are included in the World's Worst Weeds List, seed of approximately 60% are likely to be associated with the pineapple crown, approximately 30% are prohibited entry into Australia and approximately 15% are not listed in the AQIS ICON database (and therefore by default are prohibited entry).

As noted in the pest categorisation section, the potentially devastating consequences of weed pests are well established.

Refer to Appendix 2 in Part B for details of the weed risk assessment.

Holm, L., Doll, J., Holm, E., Pancho, J. and Herberger, J. (1997). World Weeds – Natural Histories and Distribution. John Wiley and Sons.

Lazarides, M., Cowley, K. and Hohnen, P. (1997). CSIRO Handbook of Australian weeds. CSIRO Publishing.

National Weeds Strategy Noxious Weeds Database: www.weeds.org.au/noxious.htm

Parson, W.T. and Cuthbertson, E.G. (2001). Noxious Weeds of Australia (2nd Ed.). CSIRO Publishing.

Risk management measures are applied to reduce the likelihood that the importation of a commodity will lead to the introduction and spread of exotic pests in Australia. Measures can be applied at all stages of the importation and distribution scenarios for a commodity and can be considered in two groups:

- Reducing the likelihood that exotic pests will *enter Australia* in imported commodities by imposing conditions on one or more of the steps in the importation scenario — i.e. 'pre-import measures'; and
- Reducing the likelihood that *suitable hosts in Australia would be exposed* to an imported commodity, or to other products or waste derived from that commodity, by imposing conditions on one or more of the steps in the distribution scenario(s) — i.e. 'post-import measures'

The risk management measures for the importation of fresh pineapples will be presented in the final IRA document. This draft IRA presents risk management options for consideration. Biosecurity Australia will develop the risk management measures based on these options and consideration of comments received on them from stakeholders.

The proposed risk management options relevant to the risks associated with weed pests are presented below. These risk management options are proposed for comment and BA will consider any other measures suggested by stakeholders that provide equivalence. Equivalence (see Article 4.1 of the SPS Agreement) provides for acceptance of measures that are not identical, but have the same effect.

The proposed risk management options are targeted at the pre-import stage rather than the post-export stage. This is in accordance with the recommendation of the AQRC Report that notes that implementing measures off-shore is an effective method for managing quarantine risk. The generalised distribution scenario is provided in Table 8 for clarity but no specific post-import risk management options are proposed. AQIS has the capacity to order consignments into quarantine and to undergo required treatments in the event of the detection of pests of quarantine concern post-import but this authority applies to all imports of fruit and vegetables and is therefore not described as part of this draft IRA.

Pre-import options

Steps in the importation scenario that may affect the probability of importation were outlined in the 'Method for Risk Assessment' section. These steps are reiterated in Table 7. Risk management options that may be suitable for the weed pests have been identified and are proposed in this draft IRA.

Table 7 Managing the probability of importation

Step in the importation scenario	Risk management option(s) – weeds
Source plantation	De-crowning to remove the receptacle for many pests of concern [A]
Packinghouse	Standard cleaning and hygiene practices [2]
Storage and transport	-
On-arrival inspection	Phytosanitary inspection (pre-export and on-arrival) and treatment if required [4]

Note: The numbers in square brackets refer to the risk management options described within the text. Details of the options for the Packinghouses and On-arrival inspection steps are provided in the 'Risk management – non weed pests' section under options 2 and 4 respectively.

Post-import options

Steps in the distribution scenarios that may affect the probability of distribution were identified in *Method for Risk Assessment*. These steps are reiterated in Table 8. Risk management options are not proposed for the post-import stage.

Table 8 Managing the probability of distribution

Step in the distribution scenario	Risk management option
Storage and distribution of imported fruit	-
Occurrence of infected/infested fruit waste	-
Distribution of infected/infested fruit waste to the environment	-
Transfer to a susceptible host in an endangered area	-

Risk management – weeds

Risk management options for weeds are proposed for the source plantation, packinghouse and on-arrival inspection stages of the importation scenario. Adoption of the proposed options is considered to reduce the risk associated with this group of pests to an acceptable level. These risk management options are proposed for all countries. Risk management option A is described below and Risk management options 2 and 4 are described in the 'Risk management – non weeds' section.

Risk management option A. De-crowning of pineapples

All fruit to be de-crowned at the source plantation or packinghouse during or prior to standard cleaning and hygiene activities.

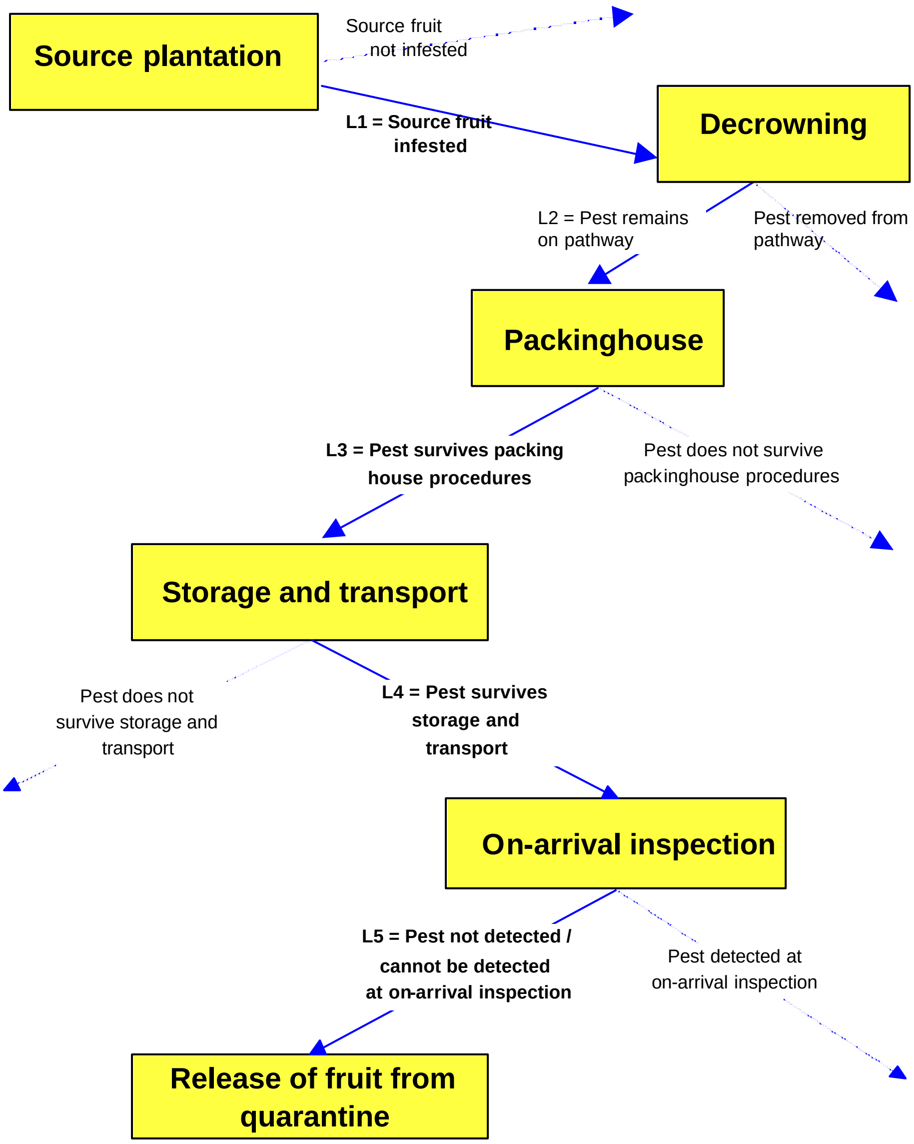
Revised importation scenario

The importation scenario for pineapples was described earlier (Figure 4, ‘Probability of importation’ section). Incorporating the proposed risk management measures for the risks associated with weeds adds an additional step to this scenario. The summary of steps in the importation scenario can now be defined as:

- Step 1 *Association of the pest with the pathway at its origin*. An evaluation of the prevalence of the pest in the source area; the occurrence of the pest in a life stage associated with the commodity, containers or conveyances; seasonal timing of movements; pest management; cultural or commercial procedures applied at the point of origin (eg application of plant protection products, handling, culling, roguing, grading). Likelihood noted as L1 in the importation scenario for pineapples (Figure 4).
- Step 2 *Association of the pest with the pathway following decrowning*. Association of the pest with the crown and/or other parts of the pineapple fruit. The likelihood that the pest will remain on the pathway following decrowning. L2
- Step 3 *Survival of the pest through the packinghouse process*. An evaluation of standard cleaning and hygiene practices applied to pineapple fruit. L3
- Step 4 *Survival of the pest during transport or storage*. The speed and conditions of transport and duration of the life cycle of the pest in relation to time in transport and storage; vulnerability of the life-stages during transport or storage; prevalence of pest likely to be associated with a consignment; commercial procedures (e.g. refrigeration) applied to consignments in the country of origin, country of destination, or in transport or storage. L4
- Step 5 *Non-detection of the pest during routine AQIS on-arrival inspection*. The probability that the pest will go undetected during inspection or survive other existing phytosanitary procedures should be estimated. L5.

This revised importation scenario represented in the diagram below. Note that step 1 is the same as described earlier and the original steps 2, 3, 4 have been re-numbered to steps 3, 4 and 5 respectively.

Figure 5 Revised importation scenario for pineapple following the risk management stage for weed pests



METHOD USED FOR PEST CATEGORISATION

As described in the 'Pest categorisation – weeds' section, the Issues Paper for this IRA contained the preliminary results of the pest categorisation, and the complete results for the pest categorisation are presented in this document. The additional non weed pests that were identified by stakeholders following the release of the Issues Paper have been included in the pest list being considered in this draft IRA.

Detailed results of the pest categorisation are provided in Part B. Categorisation of the presence or absence in Australia (or present but under official control) and association with the pathway is presented in Appendix 1. The additional pests received by BA since the publication of the Issues Paper are denoted by an *. Categorisation of the 'potential for establishment and spread in the PRA area' and 'potential for economic consequences' is presented in Appendix 3.

Summaries of the information presented in Appendix 1 and 3 are given in the sections below. Table 9 provides a numerical summary of the total number of pests known to be associated with pineapple plants worldwide as well as the number of each pest type present in Australia. Table 10 summarises the number of potential pests associated with de-crowned pineapple fruit and therefore under consideration in this stage of the pest categorisation. Table 11 lists the quarantine pests that are considered further in the risk assessment stage of this IRA.

RESULTS OF PEST CATEGORISATION

Table 9 Number of potential pineapple pests worldwide and in Australia

Pest type	Associated with pineapple	Present in Australia	Present in Australia, but under official control, or different strain)	Not present in Australia
Arthropods	210	94	1	115
Gastropods	3	1	0	2
Nematodes	94	32	0	62
Fungi	134	68	1	65
Bacteria	22	14	0	8
Viruses	4	3	0	1
Weeds	*187*	*116*	*0*	*71*
Total	**654**	**328**	**2**	**324**

Note: weeds are included in this table so the 'total' can be included.

Table 10 summaries the number of potential pests of pineapple of the various categories that are associated with de-crowned pineapple fruit. The number of potential pests on the revised importation scenario (de-crowned pineapple fruit) has been greatly reduced for two reasons. Firstly, many of the pests of pineapple only affect the leaves and are therefore not associated with the import scenario now under consideration in this IRA. Secondly, many pests are not considered to be of economic significance and therefore do not meet the definition of a quarantine pest.

Table 10 Number of pineapple pests of potential concern to Australia

Pest type	Number of potential pests (on crown-intact pineapples)	Number of potential pests (on de-crown pineapples)
Arthropods	116	28
Gastropods	2	0
Nematodes	62	0
Fungi	66	1
Bacteria	8	0
Viruses	1	0
Weeds	*71*	*0*
Total	**326**	**29**

Note: weeds are included in this table so the 'total' can be included.

Table 11 lists the number of non weed pests on the pathway that were categorised as having a feasible 'potential for establishment and spread in the PRA area' (as opposed to not feasible) and significant 'potential for economic consequences' (as opposed to not significant). The names of these pests are given in Table 12. The pests listed in Table 12 were considered further in the risk assessment stage of this IRA, which is presented in the following section.

Arthropods

Of the 210 arthropod species known on pineapples worldwide, 94 occur in Australia. Of the 94 species that occur in Australia, only one species (Mediterranean fruit fly, *Ceratitis capitata*) is under official control, and only in some areas of some States. Note that commercial pineapples of 50 per cent or more Smooth Cayenne genotype are now recognised as not being a host for *Ceratitis capitata*. Of the 116 arthropod species, 28 may be associated with the de-crowned pineapple fruit pathway, and will be considered further in this analysis.

Gastropods

Of the three gastropod species known on pineapples worldwide, one occurs in Australia. The other two species not found in Australia are not considered to occur on the pathway and are not considered further in the risk analysis.

Nematodes

Of the 94 nematode species known on pineapples worldwide, 32 occur in Australia. Of the 62 species that do not occur in Australia, none are considered further in the risk analysis because they do not occur on the pathway.

Fungi

Of the 134 fungal species known on pineapples worldwide, 68 occur in Australia. One species, *Fusarium subglutinans*, has been reported to have different strains in Brazil and is included for further consideration despite its presence in Australia. Of the remaining 66 species that do not occur in Australia, many are saprophytes or occur in the pineapple rhizosphere or are considered cosmopolitan post-harvest pests and are not considered for further analysis. Only one species, *F. subglutinans*, is considered to have significant potential for economic consequences and is considered further in the risk analysis.

Bacteria

Of the 22 bacteria known on pineapples worldwide, 14 occur in Australia. Of the 8 species that do not occur in Australia, none are considered further in the risk analysis because they are not considered to occur on the pathway.

Viruses

Of the 4 viruses reported on pineapples worldwide, 3 occur in Australia. None are considered further in the risk analysis because they are not considered to occur on the pathway.

Table 11 Number of quarantine non weed pests of pineapple

Pest type	Number of potential pests on pathway	Number of quarantine pests
Arthropods	32	16
Gastropods	0	0
Nematodes	0	0
Fungi	1	1
Bacteria	0	0
Viruses	0	0
Total	**33**	**17**

Table 12 List of quarantine non weed pests on de-crowned pineapple

Scientific Name	Common Name
Arthropods	
Baris sp. [Coleoptera: Curculionidae]	Weevil
Cholus spinipes (Fabricius) [Coleoptera: Curculionidae]	Weevil
Cholus vaurieae O'Brien [Coleoptera:Curculionidae]	Weevil
Cholus zonatus (Swederus) [Coleoptera: Curculionidae]	Weevil
Cotinis mutablis (Gory & Percheron) [Coleoptera: Scarabaeidae]	Beetle
Cryptophlebia leucotreta (Meyrick) [Lepidoptera: Tortricidae]	False codling moth
Dysmicoccus grassii (Leornadi) [Hemiptera: Pseudococcidae]	Mealybug
Dysmicoccus neobrevipes Beardsley [Hemiptera: Pseudococcidae]	Pineapple mealybug
Melanaspis bromeliae (Leonardi) [Hemiptera: Diaspididae]	Brown pineapple scale; armoured scale
Melanoloma canopilosum Hendel [Diptera: Richardiidae]	Pineapple fruit fly
Melanoloma viatrix Hendel [Diptera:Richardiidae]	Fly
Paracoccus marginatus Williams & Granar de Willink [Hemiptera: Pseudococcidae]	Papaya mealybug
Phenacoccus hargreavesi Laing [Hemiptera: Pseudococcidae]	Mealybug
Planococcoides njalensis (Laing) [Hemiptera: Pseudococcidae]	West African cocoa mealybug
Pseudococcus jackbeardsleyi Gimpel & Miller [Hemiptera: Pseudococcidae]	Jack Beardsley mealybug
Strymon megarus (Godart) Syn. *Thecla basilides* Geyer *Tmolus echion* (L.) [Lepidoptera: Lycaenidae]	Pineapple caterpillar; fruit boring caterpillar
Fungi	
Fusarium subglutinans (Wollenweb. And Reinking) P.E. Nelson, T.A. Tousson and Marasas [Brazilian Strain]	Pineapple eye rot; fruitlet core rot; fusariosis; gummosis

RISK ASSESSMENT FOR QUARANTINE PESTS – NON WEEDS

Risk assessments were conducted individually for all non weed pests identified in the pest categorisation stage as requiring formal risk assessment and are detailed in Appendix 5 in Part B of this draft IRA. Because of similarities in pest biology, the risk assessments for many of the pests are similar, so the description below is based on groupings of the pests. Risk management measures have also been developed based on these groups. The groups are mealy bugs (6 species), lepidopterans (2 species), beetle (1 species), fungal disease (1 species), weevils (4 species) and miscellaneous species (3 species). For all references relating to the risk assessment for quarantine pests, refer to the data sheets in Appendix 4.

MEALY BUGS

(*Dysmicoccus grassii*, *Dysmicoccus neobrevipes* [pineapple mealybug], *Paracococcus marginatus* [papaya mealybug], *Phenacoccus hargreavesi*, *Planococcoides njalensis* [West African cocoa mealybug], *Pseudococcus jackbeardsleyi* [Jack Beardsley mealybug])

Introduction and spread potential

Probability of importation

Low. Mealy bugs feed on fruit but standard practices of sorting/grading are likely to remove them. Adults and crawlers may occur in cracks of the fruit and reduce the likelihood of detection during inspection. The potential presence of secondary fungal infections (sooty moulds) increases the likelihood of detection of infested fruit during inspection.

Probability of distribution

Low. Adults and crawlers may survive storage and transport but the likelihood of being associated with infested waste and subsequent transfer to a susceptible host is low.

Probability of entry

Very low. The overall probability of entry is determined by combining the probabilities of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Qualitative evaluation of entry of mealy bugs on pineapples

Step	**Qualitative descriptor**	**Product of likelihoods**
Entry – importation	Low	
Entry – distribution	Low	Very low
Overall likelihood of entry of mealy bugs		**Very low**

Note: The likelihood of 'entry – importation' for one of the six species of mealy bugs (*Dysmicoccus neobrevipes*) is considered to be very low because populations are known to decline as pineapple fruit mature.

Probability of establishment

Low. Mealy bugs can potentially infest a wide range of plant hosts. Standard crop management practices for other mealy bug pests (e.g. *Dysmicoccus brevipes*, pineapple mealy bug) would reduce the likelihood of establishment.

Probability of spread

Very low. Males can fly but females remain wingless throughout their life. Crawlers can be spread by wind or as contaminants on humans or other mammals. The intended use of the pineapples (human consumption) reduces the likelihood of exposure to the environment.

Probability of entry, establishment and spread

Extremely low. The probability of entry, establishment and spread is determined by combining the probabilities of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Qualitative evaluation of entry, establishment and spread of mealy bugs on pineapples

Step	Qualitative descriptor	Product of likelihoods
Entry	Very low	
Establishment	Low	Very low
Spread	Very low	Extremely low
Overall likelihood of entry, establishment and spread of mealy bugs		**Extremely low**

Consequences

Extreme. Mealy bugs have been reported as disease vectors and also as having reduced fruit quality as a result of the presence of secondary sooty mould.

Unrestricted risk estimate

Low. The unrestricted risk estimate is determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1).

LEPIDOPTERANS

(*Cryptophlebia leucotreta* [false codling moth]& *Strymon megarus* [pineapple fruit borer])

Introduction and spread potential

Probability of importation

Low. Lepidopteran larvae are conspicuous and likely to be detected during inspection. The likelihood of detecting eggs is lower. Secondary fungal/bacterial infections increase the likelihood of detecting infested fruit during inspection.

Probability of distribution

Low. Larvae may survive storage and distribution but the likelihood of being associated with infested waste and subsequent transfer to a susceptible host is low.

Probability of entry

Very low. The overall probability of entry is determined by combining the probabilities of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Qualitative evaluation of entry of Lepidopterans on pineapples

Step	Qualitative descriptor	Product of likelihoods
Entry – importation	Low	
Entry – distribution	Low	Very low
Overall likelihood of entry of Lepidopterans		**Very low**

Note: The entry – importation and entry – distribution for one of the two species (*Cryptophlebia leucotreta*) are very low, so the overall likelihood of entry is extremely low.

Probability of establishment

Low. Lepidopterans can potentially attack a wide range of hosts, and females can produce large numbers of eggs. Standard crop management practices would reduce the likelihood of establishment.

Probability of spread

Very low. Adults can fly but the intended use of the pineapples (human consumption) reduces the likelihood of exposure to the environment.

Probability of entry, establishment and spread

Extremely low. The probability of entry, establishment and spread is determined by combining the probabilities of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Qualitative evaluation of entry, establishment and spread of Lepidopterans on pineapples

Step	Qualitative descriptor	Product of likelihoods
Entry	Very low	
Establishment	Low	Very low
Spread	Very low	Extremely low
Overall likelihood of entry, establishment and spread of Lepidopterans		**Extremely low**

Note: The likelihood of entry of one of the two species (*Cryptophlebia leucotreta*) is extremely low.

Consequences

Extreme. Lepidopterans have been reported as serious pests of several horticultural crops in other countries.

Unrestricted risk estimate

Low. The unrestricted risk estimate is determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1).

BEETLE

(*Cotinus mutabilis* [fig beetle])

Introduction and spread potential

Probability of importation

Low. Adults feed on fruit but are conspicuous, and standard practices of sorting/grading are likely to remove them. Any remaining individuals are likely to be detected during inspection.

Probability of distribution

Low. Adults may survive storage and transport but the likelihood of being associated with infested waste and subsequent transfer to a susceptible host is low.

Probability of entry

Very low. The overall probability of entry is determined by combining the probabilities of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Qualitative evaluation of entry of fig beetle on pineapples

Step	Qualitative descriptor	Product of likelihoods
Entry – importation	Low	
Entry – distribution	Low	Very low
Overall likelihood of entry of fig beetle		**Very low**

Probability of establishment

Very low. This species has a limited host range.

Probability of spread

Very low. The intended use of the pineapples (human consumption) reduces the likelihood of exposure to the environment.

Probability of entry, establishment and spread

Extremely low. The probability of entry, establishment and spread is determined by combining the probabilities of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Qualitative evaluation of entry, establishment and spread of fig beetle on pineapples

Step	Qualitative descriptor	Product of likelihoods
Entry	Very low	
Establishment	Very low	Extremely low
Spread	Very low	Extremely low
Overall likelihood of entry, establishment and spread of fig beetle		**Extremely low**

Consequences

Extreme. Reported as a destructive pest of several horticultural crops in California.

Unrestricted risk estimate

Low. The unrestricted risk estimate is determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1).

FUNGAL DISEASE

(*Fusarium subglutinans* [fusariosis, fruitlet core rot])

Introduction and spread potential

Probability of importation

High. Symptoms can be an internal blemish which is not detectable during harvesting, packing or during inspection.

Probability of distribution

High. Infected fruit is more likely to be discarded than consumed. This species can infect various hosts and can survive in the soil.

Probability of entry

High. The overall probability of entry is determined by combining the probabilities of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Qualitative evaluation of entry of fruitlet core rot on pineapples

Step	**Qualitative descriptor**	**Product of likelihoods**
Entry – importation	High	
Entry – distribution	High	High
Overall likelihood of entry of fruitlet core rot		**High**

Probability of establishment

Moderate. This species can infect various hosts, only requires a single propagule to establish, can adapt and broaden its host range and can survive in soil.

Probability of spread

Low. Movement of soil is not considered an important means of spread for this pest, and the intended use of the pineapples (human consumption) reduces the likelihood of exposure to the environment.

Probability of entry, establishment and spread

Low. The probability of entry, establishment and spread is determined by combining the probabilities of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Qualitative evaluation of entry, establishment and spread of fruitlet core rot on pineapples

Step	Qualitative descriptor	Product of likelihoods
Entry	High	
Establishment	Moderate	Moderate
Spread	Low	Low
Overall likelihood of entry, establishment and spread of fruitlet core rot		**Low**

Consequences

High. A disease caused by this species (fusariosis) is considered to be the most serious disease of pineapples in Brazil.

Unrestricted risk estimate

Moderate. The unrestricted risk estimate is determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1).

WEEVILS

(*Baris* sp., *Cholus spinipes*, *Cholus vaurieae*, *Cholus zonatus*)

Introduction and spread potential

Probability of importation

Very low. Adults feed on fruit but are conspicuous, and standard practices of sorting/grading are likely to remove them. Any remaining individuals are likely to be detected during inspection, especially because of the presence of gummosis on the fruit.

Probability of distribution

Low. Adults may survive storage and transport but the likelihood of being associated with infested waste and subsequent transfer to a susceptible host is low.

Probability of entry

Very low. The overall probability of entry is determined by combining the probabilities of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Qualitative evaluation of entry of weevils on pineapples

Step	Qualitative descriptor	Product of likelihoods
Entry – importation	Very low	
Entry – distribution	Low	Very low
Overall likelihood of entry of weevils		**Very low**

Probability of establishment

Low. Suitable environments and hosts occur but standard crop management practices would reduce the likelihood of establishment.

Probability of spread

Very low. The intended use of the pineapples (human consumption) reduces the likelihood of exposure to the environment. Adults can be able flyers but many have reduced wings and are flightless.

Probability of entry, establishment and spread

Extremely low. The probability of entry, establishment and spread is determined by combining the probabilities of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Qualitative evaluation of entry, establishment and spread of weevils on pineapples

Step	Qualitative descriptor	Product of likelihoods
Entry	Very low	
Establishment	Low	Very low
Spread	Very low	Extremely low
Overall likelihood of entry, establishment and spread of weevils		**Extremely low**

Note: The likelihood of establishment for two of the four species of weevils is very low because they are not reported to have a wide host range (only reported in association with pineapples).

Consequences

Moderate. Weevils are reported as a serious pest of pineapples in plantations in northern Venezuela.

Unrestricted risk estimate

Negligible. The unrestricted risk estimate is determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1).

MISCELLANEOUS SPECIES

(*Melanaspis bromeliae* [Brown pineapple scale], *Melanoloma canopilosum* [Pineapple fruit fly], *Melanoloma viatrix* [Fly])

Introduction and spread potential

Probability of importation

Very low. Larvae of *Melanoloma viatrix* can reduce fruit quality as a result of uneven ripening. This increases the likelihood of detection and removal of infested fruit during standard sorting/grading practices. Infestation by larvae of *Melanoloma canopilosum* also causes visible symptoms on fruit which increase the likelihood of detection and removal of infested fruit. Feeding by *Melanaspis bromeliae* can cause visible symptoms on fruit. Mobile individuals may be removed by standard practices of sorting/grading but females could remain under a protective cap. Adults of these species are conspicuous and detectable during inspection.

Probability of distribution

Very low. Adults and juveniles (larvae) may survive storage and transport but the likelihood of being associated with infested waste and subsequent transfer to a susceptible host (only reported as pineapple) is very low.

Probability of entry

Extremely low. The overall probability of entry is determined by combining the probabilities of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Qualitative evaluation of entry of miscellaneous species on pineapples

Step	Qualitative descriptor	Product of likelihoods
Entry – importation	Very low	
Entry – distribution	Very low	Extremely low
Overall likelihood of entry of miscellaneous species		**Extremely low**

Note: The likelihood of entry – importation for one of the three species (*Melanaspis bromeliae*) is low, so the overall likelihood of entry is very low.

Probability of establishment

Low. Pineapple is the only reported host of these species. Standard crop management practices for other Diptera (flies) and Hemiptera (e.g. scale insects) would reduce the likelihood of establishment.

Probability of spread

Very low. Adult Diptera can fly and juvenile scale insects can be spread by wind or as contaminants on humans or other mammals, but the intended use of the pineapples (human consumption) reduces the likelihood of exposure to the environment.

Probability of entry, establishment and spread

Extremely low. The probability of entry, establishment and spread is determined by combining the probabilities of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Qualitative evaluation of entry, establishment and spread of miscellaneous species on pineapples

Step	Qualitative descriptor	Product of likelihoods
Entry	Extremely low	
Establishment	Low	Extremely low
Spread	Very low	Extremely low
Overall likelihood of entry, establishment and spread of miscellaneous species		**Extremely low**

Note: the likelihood of entry for one of the three species (*Melanaspis bromeliae*) is very low.

Consequences

Moderate/High. *Melanoloma canopilosum* is reported as causing significant loss of fruit, and other species of scales are capable of causing significant damage to pineapples (e.g. *Diaspis bromeliae*, pineapple scale).

Unrestricted risk estimate

Negligible/Very low. The unrestricted risk estimate is determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1).

CONCLUSIONS: RISK ASSESSMENTS

The results of the risk assessments are summarised in Table 13. From this table, it can be seen that the unrestricted risks for some of the quarantine pests exceed ALOP. Risk management measures are required for those pests that have an unrestricted risk exceeding ALOP. The proposed measures are described in the following section.

Table 13 Results of the risk assessments

Pest scientific name	Pest common name(s)	Likelihood				Consequence	Unrestricted risk	Acceptable (Yes/No)
		Importation potential	Distribution potential	Establishment potential	Spread potential			
Mealy bugs								
Dysmicoccus grassii	Mealybug	Low	Low	Low	Very low	Extreme	Low	No
Dysmicoccus neobrevipes	Pineapple mealybug	Very low	Low	Low	Very low	Extreme	Low	No
Paracoccus marginatus	Papaya mealybug	Low	Low	Low	Very low	Extreme	Low	No
Phenacoccus hargreavesi	Mealybug	Low	Low	Low	Very low	Extreme	Low	No
Planococcoides njalensis	West African cocoa mealybug	Low	Low	Low	Very low	Extreme	Low	No
Pseudococcus jackbeardsleyi	Jack Beardsley mealybug	Low	Low	Low	Very low	Extreme	Low	No

Pest scientific name	Pest common name(s)	Likelihood				Consequence	Unrestricted risk	Acceptable (Yes/No)
		Importation potential	Distribution potential	Establishment potential	Spread potential			
Lepidopterans								
Cryptophlebia leucotreta	False codling moth	Very low	Very low	Low	Very low	Extreme	Low	No
Strymon megarus	Pineapple fruit borer	Low	Low	Low	Very low	Extreme	Low	No
Beetle								
Cotinis mutabilis	Fig beetle	Very low	Low	Very low	Very low	Extreme	Low	No
Fungal disease								
Fusarium subglutinans	Fruitlet core rot	High	High	Moderate	Low	High	Moderate	No
Weevils								
Baris sp.	Weevil	Very low	Low	Very low	Very low	Moderate	Negligible	Yes
Cholus spinipes	Weevil	Very low	Low	Very low	Very low	Moderate	Negligible	Yes
Cholus vaurieae	Weevil	Very low	Low	Low	Very low	Moderate	Negligible	Yes
Cholus zonatus	Weevil	Very low	Low	Low	Very low	Moderate	Negligible	Yes

Pest scientific name	Pest common name(s)	Likelihood				Consequence	Unrestricted risk	Acceptable (Yes/No)
		Importation potential	Distribution potential	Establishment potential	Spread potential			
Miscellaneous species								
Melanaspis bromeliae	Brown pineapple scale	Low	Very low	Low	Very low	Moderate	Negligible	Yes
Melanoloma canopilosum	Pineapple fruit fly	Very low	Very low	Low	Very low	Moderate	Negligible	Yes
Melanoloma viatrix	Fly	Very low	Very low	Low	Very low	High	Very low	Yes

As described earlier in this document ('Risk Management – weeds' section), risk management measures are applied to reduce the likelihood that the importation of a commodity will lead to the introduction and spread of exotic pests in Australia. As for the weed pests, the proposed risk management options for the non weed pests are all targeted at the pre-import stage rather than the post-export stage.

The risk management measures for the importation of fresh pineapples will be presented in the final IRA document. This draft IRA presents risk management options for consideration. Biosecurity Australia will develop the risk management measures based on these options and consideration of comments received on them from stakeholders.

Risk management options relevant to steps in the importation scenario are listed below. As for the risk management option proposed for weed pests, these risk management options are proposed for comment and BA will consider any other measures suggested by stakeholders that provide equivalence. Equivalence (see Article 4.1 of the SPS Agreement) provides for acceptance of measures that are not identical, but have the same effect.

Pre-import options

Steps in the importation scenario that may affect the probability of importation were outlined in the 'Method for Risk Assessment' section. These steps are reiterated in Table 14. Risk management options that may be suitable have been identified and are proposed in this draft IRA. The risk management measures required for each exporting country are dependent on the quarantine pests that are present in that country. Note that the decrowning step has been inserted into the importation scenario following the risk management stage for the weed pests.

Table 14 Managing the probability of importation

Step in the importation scenario	Risk management option(s)
Source plantation	Area freedom from fruitlet core rot (*Fusarium subglutinans*) [6] In-field management of arthropod pests [1] Pheromone trapping for *Cryptophlebia leucotreta* [5]
De-crowning	*Removal of receptacle for many pests of concern*
Packinghouse	Standard cleaning and hygiene practices [2] Methyl bromide fumigation for arthropod pests of concern [3]
Storage and transport	-
On-arrival inspection	Phytosanitary inspection (pre-export and on-arrival) and treatment if required [4]

Note: The numbers in square brackets refer to the risk management measures described below.

Risk management – mealy bugs

Risk management options for mealy bugs are proposed for the source plantation, packinghouse and on-arrival inspection stages of the import scenario. Adoption of the proposed options is considered to reduce the risk associated with this group of pests to an acceptable level. These risk management options are proposed for all countries. Four risk management options are proposed for the mealy bugs (numbers 1-4) and these are described below.

Risk management option 1. In-field management of arthropod pests

Registered plantations are to undertake in-field management of arthropod pests to maintain production of commercial grade pineapples.

Risk management option 2. Standard cleaning and hygiene practices

Registered plantations and packinghouses are to maintain a high level of hygiene and undertake sorting and grading activities to ensure production of commercial grade pineapples and removal of potentially infested/infected fruit.

Risk management option 3. Methyl bromide fumigation

All consignments are to be fumigated with methyl bromide pre-export at 32g/m^3 for 2 hours at 21^{o}C or above. For each 5^{o}C reduction in temperature below 21^{o}C the fumigator is to add 8g/m^3 to the fumigation dosage. Technical justification for this option is provided in the section on research conducted by Biosecurity Australia.

Risk management option 4. Phytosanitary inspection (pre-export and on-arrival) and treatment if required

All consignments are to be inspected pre-export by the NPPO of the exporting country and on-arrival by AQIS. Pre-export inspection is to be done following fumigation, and is to confirm compliance with packing and labelling requirements, and the requirements under risk management measures 3 and 6. This measure is to reduce the likelihood of importing pests.

Risk management - Lepidopterans

Risk management options for lepidopterans are proposed for the source plantation, packinghouse and on-arrival inspection stages of the import scenario. Adoption of the proposed options is considered to reduce the risk associated with this group of pests to an acceptable level. These risk management options are proposed for the countries where the two identified lepidopteran pests of concern occur (see Appendix 4 for details on geographic distribution of these pests). Four risk management options are proposed for the lepidopterans (numbers 1, 2, 4 and 5). Risk management options 1, 2 and 4 are described under the mealy bug heading above, and option number 5 is described below.

Risk management option 5. Pheromone trapping for *Cryptophlebia leucotreta*

A program for in-field monitoring and control (incorporating the use of pheromones) of *Cryptophlebia leucotreta* is to be agreed upon between AQIS and the exporting country for specific production areas (place or site of production as per ISPM No. 5). Details of the program are to be determined based on characteristics of the area (e.g. pest pressure in the area, availability of alternative hosts, existing control strategies) and are to meet the requirements for a systems approach to pest management (as per the draft ISPM). This option is to reduce the likelihood of introduction of this pest.

Risk management – *Cotinus mutabilis* (fig beetle)

Risk management options for the beetle *Cotinus mutabilis* are proposed for the source plantation, packinghouse and on-arrival inspection stages of the import scenario. Adoption of the proposed options is considered to reduce the risk associated with this pest to an acceptable level. These risk management options are proposed for the countries where this pest occurs (currently El Salvador, Mexico and the USA). Four risk management options are proposed for *Cotinus mutabilis* (numbers 1-4) and they are described under the mealy bug heading above.

Risk management – *Fusarium subglutinans* (fusariosis, fruitlet core rot)

Risk management options for *Fusarium subglutinans* (fusariosis, fruitlet core rot) are proposed for the source plantation, packinghouse and on-arrival inspection stages of the import scenario. Adoption of the proposed options is considered to reduce the risk associated with this group of pests to an acceptable level. These risk management options are proposed for the countries where the strain of quarantine concern of this pest occurs (currently Brazil and Bolivia). Three risk management options are proposed for the *Fusarium subglutinans* (numbers 2, 4 and 6). Risk management options 2 and 4 are described under the mealy bug section above and, option number 6 is described below.

Risk management option 6. Area freedom for fruitlet core rot (*Fusarium subglutinans*)

Pineapples are to be sourced from areas (place or site of production as per ISPM No. 5) established as free from fruitlet core rot (*Fusarium subglutinans*). Scientific evidence is to be provided to substantiate freedom from this disease in accordance with ISPM No. 4 and/or 10 as appropriate. This option is to reduce the likelihood of introducing this disease on the identified pathway.

SUMMARY OF RISK MANAGEMENT – NON WEEDS

Table 15 summaries the risk management options needed for fresh pineapple to be imported into Australia with an acceptable level of risk.

Table 15 Summary of risk management procedures – non weeds

Pest	Risk management measure
Mealy bugs	1 + 2 + 3 + 4
Lepidopterans	1 + 2 + 4 + 5
Cotinus mutabilis (fig beetle)	1 + 2 + 3 + 4
Fusarium subglutinans (fusariosus, fruitlet core rot)	2 + 4 + 6

The draft quarantine conditions described below are based on the conclusions from this draft IRA. The components of the draft quarantine conditions are:

a. Registration of source plantations and fumigation facilities
b. Pest free areas for *Fusarium subglutinans* (fusariosis, fruitlet core rot)
c. De-crowning
d. Methyl bromide fumigation
e. Packing and labelling compliance
f. Pre-export inspection
g. Storage
h. Phytosanitary certification
i. On-arrival inspection
j. Review of policy.

Four countries have currently applied for access for pineapples: the Philippines, Solomon Islands, Sri Lanka and Thailand. Each country will be required to provide evidence of their ability to comply with the draft import conditions before trade can commence.

Although a 'generic' IRA is being undertaken for pineapples, any other country wishing to gain access to Australia is required to provide a comprehensive pest list to Biosecurity Australia for consideration. Following consideration of the pest list, the draft quarantine conditions below may apply or additional risk management measures may be required to manage the risks associated with particular pests present in that country.

Registration of source plantations and fumigation facilities

All pineapples for export must be sourced from plantations registered with the NPPO of the exporting country. The NPPO is required to register all export plantations and fumigation facilities before exports commence to enable trace back in the event of non-conformance. Fumigation facilities are required to comply with standards of the NPPO for export grade facilities and also comply with the AQIS fumigation standard. Copies of registration records must be provided to AQIS.

Pest-free areas for *Fusarium subglutinans* (fusariosis, fruitlet core rot)

Scientific evidence is required to substantiate absence of *Fusarium subglutinans* (fusariosis, fruitlet core rot) from areas where strains of quarantine concern of this pest are known to occur. This evidence is to comply with the requirements under ISPM No. 4 and/or No. 10 as appropriate. Biosecurity Australia is to be notified immediately of any changes to the pest-free area status of any source area.

In-field control and trapping for *Cryptophlebia leucotreta* (false codling moth)

Cryptophlebia leucotreta is to be managed using an in-field monitoring and control program (incorporating the use of pheromones) agreed to between the exporting country and AQIS.

De-crowning

All pineapple fruit are to be de-crowned (i.e. fruit with crown and basal leaves removed) and only de-crowned fruit will be permitted entry. Consignments arriving with crowns intact with not be permitted entry and will be subject to re-export at the importers expense.

Methyl bromide fumigation

All consignments are to undergo mandatory fumigation with methyl bromide at $32g/m^3$ for 2 hours at 21°C or above. For each 5°C reduction in temperature below 21°C the fumigator is to add $8g/m^3$ to the fumigation dosage. This must be completed under the supervision of the NPPO or an accredited certifying official at a facility that is registered with and audited by the NPPO. Records of chamber testing must be made available to AQIS if requested.

Product is not to be fumigated if the fruit temperature is below 15.5°C. The loading ratio should not exceed 80% of the chamber volume.

Ten pallets selected at random from the lot will have a sample carton withdrawn (under NPPO supervision) for measuring product temperature. The temperature of the fruit from each sample will be measured and recorded. The lowest temperature recorded from the pallets in the lot will be the temperature that will be used to calculate the methyl bromide dosage rate.

Fumigation establishments will ensure that records identify each treatment lot and include details of the fumigation for each lot treated.

All data pertaining to the fumigation treatment will be recorded: the number and identification of pallets to be treated, the time and date of the treatment, the temperature data from each pallet as tested above, the lowest temperature recorded, the methyl bromide dose rate as calculated, and reference to the chamber capacity and the volume of product treated.

Fumigation establishments will ensure that they have systems in place to assure that treated and untreated product is identified and segregated at all times while on the premises.

Packing and labelling compliance

All consignments of pineapples are to be free of soil and other debris (e.g. twigs, leaves and other plant material) and packed in clean new packages. No unprocessed packaging material of plant origin will be permitted. All wood material used in packaging must comply with the conditions stipulated in “Cargo Containers: quarantine aspects and procedures” (AQIS, 2001) and as contained in the AQIS “ICON” database.

All boxes must be labelled with the plantation registration number and boxes/pallets with fumigation facility number. Stacking of boxes on pallets must be done in such a way as to facilitate permeation and diffusion of fumigant through the entire pallet.

Palletised product is to be identified by attaching a uniquely numbered pallet card to each pallet or part pallet to enable trace back to growers.

Pallet cards must be securely fastened to the pallet to withstand all handling. (Note: If pallet cards are not affixed or cannot be located on arrival in Australia, the pallet will not be considered to comply).

Pre-export inspection

All consignments are to be inspected by the NPPO before export. At least 600 units (pineapple fruit) are to be inspected per consignment. The cartons to be sampled for inspection are to be randomly selected from throughout the consignment.

Storage

Packed product and packaging is to be protected from pest recontamination during and after packing, storage, fumigation, inspection, and transfer to the shipment point (i.e. at all distribution points). Inspected lots must be maintained in secured conditions segregated from rejected lots, non-inspected pineapples or other fruit. If product is not transported separately an NPPO approved barrier needs to be inserted between pineapples intended for export to Australia and any other fruit.

Phytosanitary certification and documentation

An Import Permit issued by AQIS is required for all consignments. A Phytosanitary Certificate must accompany each consignment. A Quarantine Entry form must be lodged for produce from sea and airfreight by an importer or their agent for clearance of the consignment by AQIS.

The Phytosanitary Certificates are to be provided to AQIS by the NPPO with the following information:

Additional declarations

- The pineapples in this consignment have been produced in accordance with the conditions governing the entry of fresh pineapples from <*exporting country*> to Australia.
- The pineapples in this consignment have been produced in an area free from *Fusarium subglutinans* (fusariosis, fruitlet core rot).

Distinguishing marks

- This section will include the container numbers or aircraft flight number (where known) and seal numbers for sea freight shipments.

Treatments

- Details of pre-shipment methyl bromide fumigation including dosage, treatment duration, fruit temperature and date.
- The name of the fumigation treatment facility in the "additional information" section.

On-arrival inspection by AQIS

All consignments are subject to inspection by AQIS on arrival and any necessary treatment is done before release. Inspection must occur at the first port of call. No land bridging of consignments will be permitted unless the goods have cleared quarantine.

Review of policy

This policy will be reviewed after the first year of trade for each exporting country. AQIS is to be informed immediately if any new pests of pineapple that are potentially of quarantine concern to Australia are detected in the exporting country.

CONCLUSIONS

The findings of this draft IRA are based on a comprehensive analysis of relevant scientific literature and discussions with experts in the production of fresh pineapples and *Ananas comosus* (L.) Merr health and quarantine in Australia and overseas.

In the course of preparing the draft IRA, Biosecurity Australia received submissions on scientific issues raised in the Issues Paper, and conducted research into the effect of methyl bromide fumigation, crown removal, top-waxing and harvesting maturity on pineapple fruit quality. A list of submissions received in response to the Issues Paper and Biosecurity Australia's response, and a summary of the research conducted by BA is included in Part A of this draft IRA. Biosecurity Australia considered all scientific issues raised in the submissions of stakeholders and incorporated the suggestions as appropriate.

Biosecurity Australia considers that the risk management measures proposed in this draft IRA will provide an appropriate level of protection against the pests identified in the risk assessment. Various risk management measures may be suitable to manage the risks associated with pineapples, and BA will consider any other measures suggested by stakeholders that provide equivalence.

FURTHER STEPS IN THE IMPORT RISK ANALYSIS PROCESS

The IRA process requires that the following steps be followed:

- Release of the draft IRA paper for stakeholder comment
  - comments to be received within 60 days;
- Consideration of stakeholder comment on the draft IRA paper
  - stakeholders consulted further as necessary;
- Submission of recommendations to the Director of Animal and Plant Quarantine;
- Consideration of recommendations by the Director of Animal and Plant Quarantine, and final determination made;
- Preparation of the final IRA paper;
- Release of the final IRA paper;
- Consideration of any appeals;
- If no appeals, or if appeals are rejected, adoption of the quarantine policy.

Stakeholders will be advised of any significant variations to this process.

Biosecurity Australia is committed to a thorough risk analysis of the proposed importation of fresh pineapple .This analysis requires that technical information be gathered from a wide range of sources. The timely contribution of information would be much appreciated.[9]

[9] Contact details for stakeholder contributions are provided in the accompanying Plant Biosecurity Policy Memorandum (PBPM).

Regional approach for risk assessment

Stakeholder comment: that Biosecurity Australia use a regional approach for risk assessment and consideration be given to the level of risk that may exist in different parts of Australia due to differences in pest status; likelihood or entry, establishment or spread of a pest; and economic consequences of a pest.

The Commonwealth and the States and Territories recognise that regional differences in pest status and regional differences in biosecurity risks exist in Australia. The Commonwealth is committed to addressing regional differences in pest status and risk and the consequent SPS measures as part of import risk analysis. This commitment is articulated in Biosecurity Australia's Draft Administrative Framework for Import Risk Analysis and the draft Guidelines for Import Risk Analysis. The Commonwealth also recognises the importance of States/Territories' assisting the IRA process through early and comprehensive input of regional pest status and risk information. Such input will help to ensure a stronger national ownership of the IRA process and IRA determinations. This understanding was recently endorsed by the Primary Industries Standing Committee.

Official control

Stakeholder comment: that Biosecurity Australia categorise all pests that are under official control, or consideration of official control, in consultation with the respective pest free region.

Biosecurity Australia acknowledges that where a pest is under official control it can be regarded as a quarantine pest in the context of an IRA. However, there appears to be confusion in the interpretation of the term 'official control'. A definition for official control was formally agreed to by the Interim Commission of Phytosanitary Measures (ICPM) during 2001 and is:

> *The active enforcement of mandatory phytosanitary regulations and the application of mandatory phytosanitary procedures with the objective of eradication or containment of quarantine pests or for the management of regulated non-quarantine pests.*
>
> Official control includes:
>
> - eradication and/or containment in the infested area(s)
> - surveillance in danger area(s)
> - measures related to controls on movement into and within the protected areas including measures applied at import.
>
> All official control programs have elements that are mandatory. At minimum, program evaluation and pest surveillance are required in official control programs to determine the need for and effect of control to justify measures applied at import for the same purpose. Measures applied at import should be consistent with the principle of non-discrimination.

> The specific requirements of an official control program are: non-discrimination, transparency, technical justification (risk analysis), enforcement, mandatory nature, area of application, and NPPO authority and involvement.

Biosecurity Australia cannot consider a pest to be under official control without justification that the above requirements are met. For example, the fact that a species is a declared pest under State legislation does not justify official control status.

Use of a qualitative approach for risk assessment

Stakeholder comment: not supportive of the use of qualitative measures for risk assessment and that such an approach is not transparent and does not allow for an independent assessment of the conclusions reached.

Biosecurity Australia did not receive any justification for these comments and they are not consistent with the position held by relevant international organisations. In its report on *Measures Affecting the Importation of Canadian Salmon into Australia* (WT/DS18/AB/R), the Appellate Body of the World Trade Organization's (WTO) Dispute Settlement System made a ruling on the validity of quantitative and qualitative risk assessment. It held that there is no requirement in the *Agreement on the Application of Sanitary and Phytosanitary Measures* (SPS Agreement) to make a 'quantitative evaluation'; a risk assessment can be either quantitative or qualitative:

> *"…the SPS Agreement does not require the evaluation of the likelihood to be done quantitatively. The likelihood may be expressed either quantitatively or qualitatively"*
>
> (para 124).

The International Plant Protection Convention (IPPC) in its International Standards for Phytosanitary Measures (ISPM) Number 11: *Pest Risk Analysis for Quarantine Pests* states that 'the overall probability of introduction should be expressed in terms most suitable for the data, the methods used for analysis, and the intended audience. This may be quantitative or qualitative, because either output is in any case the result of both quantitative and qualitative information'.

Biosecurity Australia considers that the approach used for risk estimation in the IRA process allows for a high degree of transparency and consistency. The qualitative descriptors used to describe the likelihoods assigned to particular steps in the entry pathways correspond to broad probability ranges, allowing likelihood to be estimated consistently within this IRA for pineapples, and between it and other Biosecurity Australia documents. Consequences in this IRA are assessed qualitatively with each consequence assessment including direct and indirect effects that a particular pest may have if it entered Australia. Likelihoods and consequences are combined using the qualitative risk estimation matrix. This provides for transparency and allows the final 'risk estimate' to be broken down into its components.

Accuracy of the pest information presented in the Issues Paper

Stakeholder comment: that technical inaccuracies occurred in the information included in the Appendices of the Issues Paper (for example distribution information).

Where appropriate the tables have been updated for inclusion in the draft IRA. In particular, a significant number of weeds were added.

Consideration of *Phytophthora cinnamomi*

Stakeholder comment: that *Phytophthora cinnamomi* be considered further in the analysis due to the listing of the dieback disease caused by this fungus as a 'Key Threatening Process' under the *Environment Protection and Biodiversity Conservation Act 1999*.

Biosecurity Australia recognises that *Phytophthora cinnamomi* qualifies as a pest due to its potential to cause harm to the environment. However *P. cinnamomi* is prevalent in Australia on a wide range of hosts in the natural environment and on cultivated crops, and it is not under official control in any area of Australia. This species therefore cannot be considered as a quarantine pest in the context of an IRA.

Consideration of *Lantana camera*

Stakeholder comment: that the weed species *Lantana camera* be considered further in the analysis.

Biosecurity Australia acknowledges that there is a serious risk posed by weeds entering Australia on the pathway described in the Issues Paper (crown intact pineapple fruit). As described in detail within the draft IRA document, the scope of this IRA has been revised to de-crowned fruit to manage the risk posed by weeds.

Status of *Pantoea citrea* (causal agent of pink disease)

Stakeholder comment: that *Pantoea citrea* (causal agent of pink disease in the Philippines) is the appropriate name for *Gluconabacter oxydans* and *Acetobacter aceti*). (All three species were included in the pest list presented in the Issues Paper.)

BA concludes that recognised taxonomic changes place the causal agent of pink disease in the genus *Pantoea*, with the species potentially being either *P. ananas* or *P. citrea*. Therefore, the same causal agent for pink disease is considered to occur in the Philippines and Australia. This is reflected in the entry for *P. citrea* in the final stage of pest categorisation in the draft IRA.

Scope of consequence assessment

Stakeholder comment: queried the scope of the consequence assessment and whether effects other than those on plants were considered.

The approach used to assess the risk of a pest includes consideration of direct and indirect consequences. Direct consequences cover direct harm to animal or plant life, health or welfare (whether native or introduced species), including animal and plant production losses; human life, health or welfare; and any other aspects of the environment not otherwise covered. Indirect consequences are considered to be the costs resulting from natural or human processes associated with the incursion of a pest or disease, for example, new or modified eradication or control programs, domestic trade or industry effects, international trade effects and indirect effects on the environment.

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ISPM draft. *Integrated measures for pest risk management (systems approaches)*. International Standards for Phytosanitary Measures, Draft standard. Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations.

The following information is an extended summary of research conducted by Biosecurity Australia into the effect of methyl bromide fumigation on pineapple fruit. The full results and statistical analysis has been prepared for publication in a scientific journal and the draft paper is available on request (Lim, T.K., Cannon, R., Rossely, R., Lee, W., Rayner, K. and Fox, F. Effect of methyl bromide fumigation, crown removal, top waxing and harvesting maturity on pineapple fruit.)

Introduction

Research was conducted by Biosecurity Australia (BA) to assess the effect of methyl bromide fumigation, crown removal, top waxing and harvesting maturity on pineapple fruit. This research was conducted to assist with the development of risk management measures for the importation of pineapples from various countries. In particular, it was to investigate options for methyl bromide fumigation at dosages less than that currently required for pineapples imported into Australia, and the role of the pineapple crown as a receptacle for pests.

Fresh pineapple fruit are currently permitted into Australia for human consumption from the USA, New Zealand, European and Pacific Island. The current phytosanitary import conditions include freedom from soil, removal of crowns and a Phytosanitary Certificate endorsed: "Fruit fumigated with methyl bromide (MB) at the rate of 32 g/m^3 for 6 hours at 21ºC or above" (Anon., 2001). For each 5°C reduction below 21°C the fumigator must add $8g/m^3$ of MB to the fumigation dosage (Anon.2000).

MB fumigation has been reported to effectively control mealybugs, scales and mites on infested pineapple planting material in South Africa (Petty, 1987, Petty and Westhuizen 1991) and in Australia (Murray *et al.*, 1979, Murray 1980). However, the effect of MB fumigation on pineapple fruit has not been reported, but there are claims that it adversely affects pineapple fruit. To investigate this claim, BA conducted various fumigation studies.

Materials and Methods

Pineapple fruit (*Ananas comosus* var. Smooth Cayenne) was sourced from GO Pike & Sons in Queensland, with the assistance of Golden Circle Queensland. Methyl bromide fumigation was conducted with $48g/m^3$ at 15ºC for 0, 2 or 6 hours. Two edible waxes were used (Pinecoat ®, Sta-fresh ® FMC 7081). The pineapples were harvested with crowns at three stages of maturity; mature firm green (MG), green with a blotch of yellow (YB) and more than one third of fruit yellow to orangey (TY).

Four factors were evaluated in the main trial:

- fruit harvest maturity – mature green, yellow blotch and third yellow stages
- crown treatment – crown intact (CI), de-crowned (DC), de-crowned and the de-crowned top waxed using Pinecoat ® (DCW)
- MB fumigation time - 0 hour (OMB), 2 hours (2MB) and 6 hours (6MB)
- sampling time –3, 6, and 9 days after fumigation.

Two trials were conducted, the major one using Pinecoat ® (as described above) and a smaller trial using Sta-fresh®. For the trial with Sta-fresh® all fruit were de-crowned and top-waxed before fumigation together with the batch of fruit in the main trial. The fumigation treatment consisted of 0 hour (control), 2 hours and 6 hours at the same rate as in the main trial.

Measurements

The following measurements were made:

- total soluble solids (brix %) using a brixmeter
- firmness using a penetrometer
- colour change of skin and flesh
- taste test using a 1-5 scale Hedonic scale where 1 is poor and 5 is excellent, based on the average of three expert panels
- internal colour, discolouration, translucency, rots etc of fruit cut in half
- insect infestation at three days after fumigation (eight days after harvesting) by teasing the crown and basal leaves apart
- presence of weed seeds in the crown.

Results

The results are summarised in the table below and further discussion is provided under separate subheadings.

	Brix	Firmness	Taste	Translucency	Colour
F (0.05) = 3.055					
Fumigation	0.099ns	0.929ns	**21.147***	**10.038***	2.686ns
Crown treatment	3.218ns	2.867ns	**13.957***	**8.868***	5.110ns
Harvest maturity	**68.648***	**16.841***	**16.365***	**4.775***	**183.141***
Sample time	**10.177***	**43.181***	**11.984***	2.729ns	4.250ns
p values					
Fumigation	90.5506%	39.7292%	0.0000%	0.0080%	7.1396%
Crown treatment	4.2741%	5.9911%	0.0003%	0.0227%	0.7105%
Harvest maturity	0.0000%	0.0000%	0.0000%	0.9735%	0.0000%
Time	0.0071%	0.0000%	0.0015%	6.8486%	1.5984%

*Values significantly different from zero.

Effect of MB fumigation

The duration of MB fumigation significantly affected the eating quality (taste) and translucency of fruit but did not affect the total soluble solids (brix), fruit firmness or flesh colour. The taste of a fumigated pineapple was less than a non-fumigated pineapple. The taste was lower if the pineapple was fumigated for 6 hours rather than 2 hours. The proportion of translucent fruit increased with the duration of fumigation. Fumigation affected crown-intact and de-crowned fruit to the same extent, but affected de-crowned/top-waxed fruit to a greater extent. The detrimental effect of decrowning/waxing and fumigation was also evident from the smaller trial. Most of the fruits were rotting, had an off-aroma and off-taste, and were leaking juice at the second sampling stage, and the trial was aborted.

Effect of crown treatment

There were significant differences in taste rating and fruit translucency among de-crowned/top-waxed, de-crowned and crown-intact fruit but not in brix levels, fruit firmness and flesh colour. De-crowned/top-waxed fruit were given significantly the lowest taste rating but there was no significant difference between de-crowned and crown-intact fruit.

Although the taste score was lower for de-crowned than crown-intact for non-fumigated fruit, the taste for both crown treatments was similar (but lower) for both levels of fumigation. However, de-crowned/top-waxed fruit, which had a similar taste to de-crowned fruit if there was no fumigation, had a significantly lower taste for fumigated fruit. The duration of fumigation did not affect the taste rating.

Effect of sampling time

The time when fruit were sampled for evaluation had significant effects on brix, fruit firmness and eating quality but not on fruit flesh colour and translucency. The decrease in taste with time after fumigation was significant. Differences were observed in brix and taste rating at Day 3 but there was no significant difference for these traits between Day 6 and Day 9. Fumigation did decrease the taste for each of the times of sampling although the decrease did not depend on fumigation duration. At 9 days after fumigation that is 15 days after harvesting, the shelf-life appeared to be good especially for non-waxed fruit regardless of fumigation duration. No scorching of the leaves or fruit by fumigation was observed.

Arthropods and weed seeds on crowns

Spiders and insects collected off the crowns from the 2 and 6 hour fumigated fruit 3 days after fumigation were all dead (discoloured and shrivelled) in contrast to the live insects collected from the non-fumigated fruit. Weeds seeds were also found in the crown but the impact of methyl bromide fumigation on the viability or germination of the weed seeds was not assessed.

Discussion and justification for 2-hour fumigation and decrowning

Historically 6-hour fumigation was used as a phytosanitary treatment because of a perceived threat of fruit flies in pineapples (Anon., 2001; Anon., 1992). Pineapple entering the United States infested with internally feeding insects such as fruit flies must be fumigated with 32g/m^3 MB for 6 hours at 21.7ºC (Anon., 1992). However, commercial pineapples of 50 per cent or more Smooth Cayenne genotype are now recognised to be a non-host for tephritid fruit flies including *Ceratitis capitata* (Medfly) and *Batrocera* spp. (Armstrong *et al*., 1979; Armstrong and Vargas, 1982; Heimoana, *et al*., 1997; Seo *et al*., 1973) and a 6 hour MB fumigation for fruit flies is therefore not justified.

In addition, a six hour fumigation increases treatment costs, and could give rise to higher residues of MB in the fruit.

A 2-hour fumigation is justified for external surface feeders, and we found that it is as efficacious as a 6-hour fumigation in killing arthropods in the crowns. This is supported by research done in South Africa and in Queensland on pineapple planting material. For pineapple planting material infested with the pseudococcids *Dysmicoccus brevipes* and *Pseudococcus longispinus*, and the diaspid *Diaspis bromeliae*, fumigation with 32 or 40g/m^3 MB for 2-8 hours at approximately 23-35ºC and 20-25ºC respectively, effectively controlled these pests in South Africa (Petty, 1987). Fumigation for 2 hours eliminated the pests without killing any of the plants; fumigation for 8 hours, however, resulted in a slightly reduced growth rate. Subsequent trials in the Bathurst area of South Africa showed that fumigation of pineapple planting material with methyl bromide was more effective against insect (Pseudococcidae) and arthropod pests (Acari) than spraying young pineapple plants after establishment or pre-plant dipping of planting material (Petty and Westhuizen, 1991).

In Australia, crowns, suckers and slips of Smooth Cayenne pineapples infested with *Diaspis bromeliae* were fumigated with methyl bromide at 27-55 g/m^3 for two hours at 20^{o}C (Murray *et al*., 1979). Fumigation at 46 or 55 g/m^3 eliminated *D. bromeliae*, assessed 14 days later. No phytotoxic ity was caused on disease-free material, but suckers severely infected with *Phytophthora cinnamomi* suffered severe leaf burn at all dosage rates.

Damage to pineapples caused by *D. bromeliae* can be reduced by methyl bromide fumigation (Murray, 1980). The pest could be eliminated from planting material by fumigation with methyl bromide (46 g/m^3) at 20ºC for 2 hours. Fumigation of pineapple tops with methyl bromide at 32 and 48 g/m^3 also gave complete control of *Dolichotetranychus floridanus* without plant damage. Methyl bromide at 16 g/m^3 was unsatisfactory (Elder, 1988).

The finding that pineapple crowns act as a receptacle for weed seeds has very significant implications for quarantine. Weeds are one of the most serious threats to the Australia's natural environment and primary industry productivity. Millions of dollars are spent annually in Australia on weed control, and research, education and training in weed management (Anon., 1997). The cost resulting from control measures for agricultural weeds, yield losses caused by weeds and downgrading of grains, fodder and animal products has been estimated at between \$2.75 billion and \$3.3 billion Australian per annum (Combellack 1987; Anon., 1997). De-crowned fruit still had good shelf life of more than 15 days after harvesting. So, from a phytosanitary viewpoint, removal of pineapple crowns is scientifically justifiable.

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