A SUPPLEMENT TO THE FINAL IMPORT RISK ANALYSIS ON THE IMPORTATION OF FRESH DURIAN FRUIT (*Durio zibethinus* Murray) FROM THE KINGDOM OF THAILAND

AQIS

Protecting our way of life!

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INTRODUCTION

On 17 November 1999, AQIS released the Final Import Risk Analysis (IRA) paper for the importation of fresh durian fruit from Thailand. The Final IRA presented the determination by the Executive Director of the Australian Quarantine and Inspection Service (AQIS) that imports of fresh durian from Thailand would be permitted subject to the application of appropriate phytosanitary requirements. The release initiated a 30-day period for appeals against the IRA. As stated in *The AQIS Import Risk Analysis Handbook*, any stakeholder of the opinion that the process outlined in the Handbook had not been properly followed, including that the risk analysis failed to consider a significant body of relevant scientific or technical information may appeal to the Director of Animal and Plant Quarantine. The appeal period closed on 31 December 1999 following granting of an extension to the durian industry. A total of 47 appeals were received.

Forty-five appeals were considered by the Import Risk Analysis Appeal Panel (IRAAP); two appeals did not raise substantive issues. The members of the IRAAP were Professor Malcolm Nairn as Chair (Chairman of Quarantine and Exports Advisory Council (QEAC)), Dr Jim Cullen (member of QEAC) and Dr Mike Cole (Assistant Chief Plant Quarantine Officer, National Offices, AFFA). The IRAAP's recommendations were delivered on 24 February 2000. Attachment 1 provides a copy of the IRAAP's findings.

The IRAAP found no evidence that AQIS had ignored a significant body of relevant technical or scientific information and concluded that AQIS had handled the process consistent with Government policy, in harmony with international standards and had met the consultation process requirements of the Handbook. The IRAAP was of the belief that certain aspects of the IRA appeared not to have been conducted in a fully transparent manner. The IRAAP considered that the basis on which decisions or judgements that had been taken should be fully documented to ensure that all stakeholders are fully informed. In particular, insufficient information had been supplied to draw the reader to the same conclusion as that in the Final IRA with respect to the following four issues:

1. the economic and environmental impact analyses in the event of an incursion;
2. the adoption of the systems approach with integrated pest management (IPM) as the basis for reducing the risk of infestation in harvested fruit;
3. consideration of variation in strains of *Phytophthora palmivora* species; and
4. the treatment/disinfestation of fruit proposal.

Further, the IRAAP recommended the following course of action:

1 Within 90 days of the announcement of this decision, AQIS will consult with relevant parties, including appropriate technical expertise and representatives of the industries concerned and resolve the four issues outlined above. AQIS will then advise the IRAAP in writing of the outcome of this consultation.

2. The IRAAP once satisfied that these outstanding issues have been resolved, will consider that the appeal has been finalised and the durian IRA concluded.

The list of appellants who raised these issues is presented in Attachment 2.

This supplementary paper comprises four sections, addressing the issues identified by the IRAAP and provides details of processes and information used by AQIS to arrive at its decisions and recommendations. The paper incorporates information arising from further consultation with experts in Thailand, United States, New Zealand and Australia and references from relevant technical experts and published literature.

1. THE ECONOMIC AND ENVIRONMENTAL IMPACT ANALYSES IN THE EVENT OF AN INCURSION

1.1 Issues raised by appellants

Appellant 12. – *Failed to assess the potential of the economic importance of the introduction of DSB [durian seed borer] into Australia……type of damage, crop losses, loss of export markets, increase in control costs, effects on ongoing IPM programs, environmental damage and perceived social costs (unemployment).*

Appellant 13. – *AQIS has not considered the impact on the organic industry.*

Appellant 14. – *…social and economic impact of pests and diseases entering and establishing in Australia have not been considered.*

Appellant 18, 21, 22, 23 & 24. – *AQIS has not conducted any economic analysis on the event that a pest should breached the Australian quarantine barrier.*

Appellant 25. – *…the IRA does not appear to have considered the potential threat to other Australian horticultural industries.*

1.2 Response to issues raised

AQIS addressed the concerns relating to the economic and environmental impacts resulting from durian importation in the draft IRA paper and Issues 1, 2 and 3 on page 21 and Issue 9 on page 23 in the Final IRA paper.

In conducting the IRA, AQIS considered the potential economic and environmental impact of pests of quarantine concern in the event that they were introduced through fresh durian fruit imports from Thailand. The assessment method adopted by AQIS is in accord with the *International Standards for Phytosanitary Measures – Guidelines for Pest Risk Analysis, ISPM No. 2* (FAO, 1996) and *The AQIS Import Risk Analysis Process Handbook* (AQIS, 1998). A similar method is used by the Animal and Plant Health Inspection Service (APHIS) of the United States. Information on pest biology, distribution, life history and economic significance collated from published and official sources and presented in the pest data sheets was used in this assessment.

1.3 Results of economic and environmental impact analysis

For pests to have an economic or environmental impact in Australia, they must gain entry, become established and subsequently spread. The AQIS assessment of the consequence of introduction is based on a qualitative assessment of eight risk elements that govern the severity of negative impacts that might result from the uncontrolled introduction of the quarantine pests identified. These eight risk elements used in the IRA are described in Appendix 1.

In the IRA process, based on these eight determinants, AQIS evaluated the consequences of introduction of the quarantine pests that were identified to species level according to ratings of high, medium or low. The potential risk rating (last column in Table 1) for each quarantine pest represents the cumulative overall rating for all the elements assessed. AQIS adopts a conservative approach to the evaluation of risk associated with pests that have not been identified to species level (denoted by u in Table 1) and considers them to be of quarantine concern until such time as information on their biology and potential impact clearly indicates that they should be accorded a different status.

Table 1 provides a summary of the risk elements used in assessing the economic and environmental impact of quarantine pests on durians from Thailand as a consequence of introduction and establishment. Two species, the durian seed borer (DSB; *Mudaria luteileprosa*) and the coffee mealybug (*Planococcus lilacinus*) are rated to have comparatively higher potential risks in terms of economic and environmental impacts. As such, the following discussion will focus on these two pests.

Without any risk mitigation measures and safeguards, the likelihood of not detecting DSB at the border is high as the infestation is internal and may be difficult to discern because of the tiny oviposition hole. In contrast, the likelihood of not detecting the coffee mealybug at the border is low as the pest is very visible on the fruit.

Both DSB and the coffee mealybug are rated medium for climate/host interaction. DSB can be a threat to durian growing in the monsoonal tropics (around Darwin) and wet tropics (Tully to Cooktown in Queensland) while the mealybug can infest a wider range of crops in the tropics and sub-tropics.

Table 1. Risk elements used in assessing the economic and environmental impact of quarantine pests on durians from Thailand as a consequence of introduction without risk mitigation measures

Insect pest	Common name	Risk of not being detected at border	Climate /host interaction	Host range	Dispers. potential	Reproduct. potential	Econ. impact	Environ. impact	Vector relations	Potent. risk
Coccus sp.	scale insect	low	u*	u	low	medium	u	u	u	#
Icerya sp	stem scale insect	low	u	u	low	medium	u	u	u	#
Hemicentrus attenuatus	horned tree hopper	low	low	low	medium	low	low	low	low	low
Mudaria luteileprosa	durian seed borer	high	medium	low	medium	low	high	medium	low	medium
Planococcus lilacinus	coffee mealybug	low	medium	high	low	medium	high	medium	medium	medium
Pseudococcus sp.	mealybug	low	u	u	low	u	medium	u	u	#
Remelana jangala ravata	fruit eating moth	low	low	low	low	low	low	low	low	low
Saissetia sp.	scale insect	low	u	u	low	medium	u	u	u	#

u = unknown as the species has not been identified to the species level.
# = lack of information to conclude assessment - conservative management measures applied.

DSB has a very narrow host range - on durian and perhaps several other *Durio* spp. while the coffee mealybug has a very wide host range across several botanical families (Ben-Dov, 1994; CABI, 1999). DSB thus is assessed as low for the host range element while the mealybug is assessed as high.

DSB has an innate ability to fly from one orchard to another and is rated as medium for its dispersal potential while the coffee mealybug is rated as low as it is passively dispersed by ants and humans.

For reproductive potential, DSB with its long generation time (Buara, 1996; Sirisingh *et al*., 1991) is rated low while mealybug is rated high as it is highly fecund and exhibits a short generation time and parthenogenesis (Ben-Dov, 1994; CABI, 1999).

For economic impact both DSB and the coffee mealybug are rated high as they can result in a decline in marketable yield and an increase in field control cost in durian (for both pests) and other tropical crops such as custard apples, coconut, coffee, cocoa and citrus for the coffee mealybug (Ben-Dov, 1994; CABI, 1999). As an example, assuming there is a close correlation between field infestation of DSB and yield loss, AQIS estimates that the expected loss that could occur in durian orchards in Australia could range from 1-20%. This figure is based on field infestation data of DSB in durian orchards in the Eastern regions of Thailand. Based on the current value of the Australian durian production of $717,500 for the year 2000 (Y. Diczbalis, 1999, personal communication), the economic loss at 10-20% would range from $71,750 to $143,500.

The level of DSB infestation of fruit was determined to vary from 1 to 30% in surveys carried out from 1991-1994 (Buara, 1996). Both pests are rated medium for environmental impact as they can infect other economic plants including *Durio* spp. besides durian and infestation may necessitate the use of toxic chemicals that can pollute the environment and nullify the organic status of some fruit industries.

DSB is not known to be a vector of any plant diseases. Species closely related to *Planococcus lilacinus* within the same family, Pseudococcidae eg. *Planococcus citri*, have been reported to vector viral diseases (Bigger and Kumar, 1975; Phillips *et al*., 1999). Thus, DSB is rated low and the coffee mealybug rated medium for vector relationships.

The potential risk of DSB and the mealybug in having an economic and environmental impact if introduced without any risk mitigation measures is assessed as medium. Consequently, AQIS has specified phytosanitary management measures for the medium risk pests to reduce the risk to negligible levels before imports are permitted. These same measures would also appropriately manage risk for those other pests (Table 1) for which the absence of full information has prevented an overall assessment of potential risk.

The above analysis deals specifically with the economic and environmental impact that would result from the introduction of quarantine pests. The potential economic impact of competition from prospective imports on domestic industries is not within the scope of the IRA and cannot be a consideration in the determination of appropriate quarantine controls.

The Department of Agriculture, Fisheries and Forestry – Australia undertakes, in parallel with the AQIS IRA, an assessment of the potential economic impact on Australian agricultural industries if imports are permitted. This study provides advice to the government on any structural adjustment assistance that may be warranted in the event that imports have a significant effect on Australian primary producers.

1.4 Conclusion

The economic and environmental impact analysis as detailed above indicates that of the eight arthropod pests of quarantine concern, the durian seed borer (DSB), *Mudaria luteileprosa,* and the coffee mealybug, *Planococcus lilacinus* have been determined to have a medium potential to be destructive if they are introduced via fresh durian imports and subsequently establish in Australia. The results further indicate the need for a range of mitigation measures to reduce the risk of their introduction to an acceptably low level that is in accord with Australia's appropriate level of protection.

1.5 References

1. AQIS (Australian Quarantine and Inspection Service) (1998). *The AQIS Import Risk Analysis Process Handbook*. Australian Quarantine and Inspection Service, GPO Box 858, Canberra, ACT 2601.

2. Bigger, M. and Kumar, R. (ed.). (1975). Recent work on the mealybug vectors on cocoa swollen shoot virus. *Proc. 4th Conference of West African Cocoa Entomologists*, Zoology Department, University of Ghana, Legon, Ghana, 9-13 December 1974, pp. 62-66.

3. Ben-Dov, Y. (1994). *A Systematic Catalogue of the Mealybugs of the World (Insecta: Homoptera: Coccoidea: Pseudococcidae and Putoidae) with Data on Geographical Distribution, Host Plants, Biology and Economic Importance*. Andover: Intercept Ltd, UK, 686 pp.

4. Buara, P. (1996). Controlling durian seed borer. pp. 248-251 In *Proceedings of the International Conference on Tropical Fruits* Volume II, Kuala Lumpur, 23–26 July, 1996, MARDI, Kuala Lumpur.

5. CABI (1999). *Crop Protection Compendium Global Module*. 1999 edition. Wallingford: CAB International, UK.

6. Diczbalis, Y. (1999). South Johnstone Research Station, Queensland Department of Primary Industry, Personal communication.

7. FAO (Food and Agriculture Organization) (1996). Part 1 - *Import Regulations, Guidelines for Pest Risk Analysis*. International Standards for Phytosanitary Measures Publication No. 2, Rome.

8. Phillips, S., Briddon, R.W., Brunt, A.A. and Hull, R. (1999). The partial characterisation of a badnavirus infecting the greater asiatic or water yam (*Dioscorea alata*). *Journal of Phytopathology* 147(5): 265-269.

9. Sirisingh, S., Namrungsri, W. and Sirisingh, S. (1991). Study of the biology and infestation of seed borer, *Plagidecta magniplaga* (Walker) in durian. *Annual Report 1991. Fruit Trees and Other Horticultural Entomology Research Group*. Entomology and Zoology Division. Department of Agriculture. (In Thai).

2. THE ADOPTION OF THE SYSTEMS APPROACH WITH INTEGRATED PEST MANAGEMENT AS THE BASIS FOR REDUCING THE RISK OF INFESTATION IN HARVESTED FRUIT

2.1 Issues raised by appellants

Appellant 10. – *No information is provided on the actual working IPM program…… where is the evidence for efficacy for black blue light traps for DSB.*

Appellant 12. – *…IPM model to be tested and applied to other regions where the environment is different, poor adoption of IPM by Thai growers.*

Appellant 17. – *Need more information on growing methods, chemicals used and proof of success of IPM programs in durian cultivation.*

Appellant 18. – *…how effective would the IPM program be in avoiding infestation of fruit pests such as DSB.*

Appellant 26. – *…security is reliant on effective in-country monitoring, an IPM program and fruit bagging, which is to be confirmed by fruit cutting.*

Appellant 27. – *IPM program is undefined, there are no known chemicals known to be effective against DSB, pest monitoring program in Thailand requires a level of sophistication in pest identification not readily available on farm, bagging may not be effective if done five weeks after fruit set.*

2.2 Response to issues raised

Concerns relating to IPM and the systems approach were covered collectively in Issues 18 and 19 on page 25, in Issues 32-38 on pages 28-29, in Issues 40-57 on pages 30-34, and the concerns were covered in Section 6, Phytosanitary Import Requirements of the Final IRA paper. In the final IRA, AQIS indicated that fresh durian exports from Thailand would only be allowed during the months of April to September, this confines the exports to registered orchards in the Eastern region and precludes durian to be sourced from other regions. AQIS recommended IPM as an element of a systems approach for mitigation of risks of quarantine pests; in particular, AQIS deemed it to be mandatory for DSB in durian in registered orchards. IPM is used to reduce the incidence of pests in the crop and limit economic damage to a crop, while simultaneously minimising adverse effects on non-target organisms (such as beneficial species) in the crop, the surrounding environment and consumers (Gullan and Cranston, 1994). While IPM generally incorporates chemical usage at a lower level, its main focus is the use of a variety of other methods of controlling insect pests (Gullan and Cranston, 1994).

2.3 Introduction to a systems approach

A "systems approach" to phytosanitary risk management uses a set of safeguards and risk management measures that collectively reduce the risk of entry of a quarantine pest to an acceptable level. No single measure is relied upon to manage risk. Importantly, the components of a systems approach include measures that act independently and provide a degree of redundancy so that risk is effectively managed even if one or more mitigating measures fail or their efficacy is reduced.

A systems approach to risk management is developed with consideration of all stages of the commodity production and export chain and addresses pest risks identified in a pest risk analysis. It may include: verification of freedom from a pest in a production site, area or region; registration of growers; monitoring of pests; integrated pest management (IPM); one or more disinfestation treatments; pre-harvest control; post-harvest treatment; pre-export and on arrival inspections; and certification.

Safeguards and pest mitigation measures can be applied at any stage from the field to the consumer and may include practices that reduce pest incidence in the production area, at the packing shed, during shipment and during distribution of the commodity.

A systems approach can provide an entirely satisfactorily alternative to traditional methods of ensuring phytosanitary security such as chemical disinfestation. For the latter kind of treatment, probit 9 mortality has become a *de facto* benchmark for determining phytosanitary security. Several appellants raised this issue in their appeals against AQIS importation decision. The concept of "probit 9" efficacy indicates the achievement of a 99.997 % level of treatment efficacy (32 survivors in a treated population of one million). Where treatments are not proven or cannot be relied upon to achieve probit 9 a combination of alternative measures can provide an appropriate level of protection.

Probit 9 must be seen in a proper technical perspective so as not to be misused as a standard. For example, it is not feasible to require that inspections meet probit 9 efficacy since inspection aims to verify pest absence based on sampling. By contrast, efficacy of chemical treatments can be measured against pest mortality with a relatively higher degree of confidence.

2.4 Examples of applications of the systems approach

Systems approaches are increasingly being used by national quarantine authorities as appropriate means of managing quarantine risk, as the following examples illustrate.

- Pome fruit from Australia to Taiwan

  Australian apples and pears are exported to Taiwan under a systems approach for the management of the internal feeding pest, codling moth. As an alternative to methyl bromide fumigation:
  - orchards are trapped to detect adult moths using pheromone lures;
  - chemical control is initiated when a threshold level of pests is reached;

- AQIS inspects fruit after grading and packing to ensure that no damaged fruit is in export lots; and
- a phytosanitary certificate is endorsed.

There has been no detection of the pest in pome fruit exported to Taiwan since exports commenced in 1996.

- Unshu oranges to the USA from Japan

The USA prohibits the entry of citrus from areas where citrus canker exists. However, for the last twenty years, Unshu mandarin oranges have been permitted entry into the USA under a systems approach. This requires:

- an established orchard of resistant varieties and surrounding buffer zone to be surveyed and verified as free from the bacterial disease;
- fruit to be surface treated post-harvest with a chlorine solution;
- inspection for verification of freedom from visual symptoms; and
- limited distribution of fruit in the US.

- Bell peppers to USA from Israel

The USA prohibits the entry of fresh peppers into the USA from areas where Mediterranean fruit fly (Medfly) occurs. Medfly is endemic in Israel but peppers are allowed entry under a systems approach:

- crops must be grown within a fly-proof glasshouse in areas where the pest is absent or rare;
- absence of fruit flies is verified by trapping of the environs; and
- fruit is packed in fly-proof packaging.

Components of a systems approach in these examples include area freedom arrangements, inspection, treatment, packaging, growing conditions, traps, *etc.* Each of these measures has the purpose of reducing the incidence of the pest such that the importation pathway represents negligible risk. The failure of any one measure does not result in failure of the entire system.

This concept of the systems approach was used in considering fresh durian importation from Thailand and is consistent with practices widely adopted in international trade.

2.5 The AQIS systems approach for durian

AQIS requires the following elements of a systems approach to mitigate the risks of introduction of quarantine pests on fresh durian fruit from Thailand.

1. Designation of export/import season

As stated on pages 10 and 11 of the Final IRA paper, *"All consignments must be shipped directly from one port or city in the country of origin to a destination port or* *city in Australia. No land bridging of consignments is allowed. Exports will be allowed during the main fruiting season in Thailand ie. from April to September*."

This, in practice, limits exports to fruit from orchards in the Chanthaburi, Trad and Rayong provinces of the eastern region of Thailand. These orchards have more advanced agronomic management than those in other durian producing areas. The period April to September coincides with conditions in Australia that are unfavourable, in particular, for the survival and establishment of DSB, *Mudaria luteileprosa*.

Of itself this measure would reduce the risk of DSB establishing in Australia via imports of fruit to a very low level. Moreover, direct air or sea links from Thailand to Australia predominantly occur through Sydney and Melbourne. No commercial passenger airlines will carry fresh durian because of the odour of the fruit. Hence, most if not all durian imports will be by sea transport, which takes 18-21 days. This transit time further reduces the likelihood of survival of DSB in fruit because DSB would be likely to emerge to pupate during transit or immediately on arrival and be detected by inspection on arrival because of the presence of the conspicuous exit hole, frass produced and the emerging larva itself. Being a truly tropical species, DSB has negligible chance of surviving as a pupa in the soil through the winter months in the southern states of Australia, where in any event, suitable host plants are not present to enable adult insects to establish. It is highly unlikely that any significant quantity of imported fresh durian will be consumed in the vicinity of potential host plants in Australia.

2. Registration of grower orchards and submission of information

As stated on page 11 of the Final IRA paper, "*Durian fruit for export to Australia must be sourced from the Thailand Department of Agriculture Extension (DOAE) registered export orchards. Registered growers must keep records of control measures for auditing purposes and be given registration numbers. These registration numbers must be labelled on boxes of fruit destined for export to enable trace-back in the case of non-compliance.*"

The aims of the orchard registration and associated auditing requirements are:

- sourcing of fruit from orchards with an approved IPM program;
- auditing to ensure the IPM program is adhered to properly; and
- provision of a trace-back ability, allowing orchard de-registration in the instance of detecting failures in the IPM program (ie. quarantine pests).

3. Integrated pest management (IPM) and monitoring programs

As stated on page 11 of the Final IRA paper, "*Growers proposing to export fresh durian fruit to Australia must be registered with DOAE. They must have an orchard control program incorporating a pest monitoring system and conduct appropriate surveys under an IPM program developed by DOAE. This IPM program is mandatory for DSB. The details for such an agreed program are detailed below.*

The IPM program must include:

(a) *monitoring of DSB population and application of an economic threshold level (ETL) to trigger the implementation of control measures particularly chemical application. Monitoring and inspection for DSB should be undertaken using black-blue light traps at frequencies of 2-3 times a week from February to June. The ETL will be set at one adult DSB trapped. Trapped insects must be identified and recorded before being destroyed. Details of pest infestation levels, number of trapped insects and their identities should be supplied to AQIS staff or AQIS appointed entomologist for auditing purposes.*
(b) *some or all of fruit bagging, field sanitation, biological, chemical and cultural control. Bagging of fruits with translucent bags to reduce infestation by DSB must start at five weeks after fruit set. Field sanitation must be practised with all fallen fruits to be cut open to kill the insect inside infested fruits. Chemical control using appropriate and effective IPM compatible insecticides should be applied and should adhere to recommended withholding periods. Cultural control methods such as fruit thinning, adequate fertilisation, weed control and effective irrigation practices would also assist in improving the environment for beneficial natural enemies.*

Growers must keep records of spray programs and IPM procedures for frequent auditing by DOAE. Thailand Plant Quarantine (TPQ) must arrange for an AQIS officer or an AQIS appointed entomologist to make visits to registered IPM "export" orchards during the critical times to monitor and audit these activities."

Various methods of insect pest control that could be employed in IPM programs include, but are not limited to, chemical control (such as insecticides), biological control, host-plant resistance, mechanical and physical control, cultural control, pheromones and other insect attractants and genetic manipulation of insect pests. The IPM approach is a mandatory condition for DSB, and AQIS will ensure that the IPM program adopted by registered export orchards includes the following components: monitoring/trapping, chemical control and bagging. AQIS will seek assurance from TPQ on the compliance of the adoption of this IPM program by registered durian growers. Thai growers also employ IPM to reduce infestations of mealybugs and scale insects in durian orchards.

Durian seed borer (*DSB*)

Durian seed borer is a moth species that is truly tropical and occurs in major durian producing areas of Malaysia, Indonesia, Thailand and Vietnam. There are several species of DSB but only *Mudaria luteileprosa* is reported to occur in Thailand. The life history of the moth is intimately associated with that of the durian host, on which it is host specific. As a tropical pest, it could not establish in southern areas of Australia even if hosts were present.

Based on surveys of 4000 acres of durian plantations in Eastern Thailand between 1991 and 1994, the level of DSB infestation on fruit was determined to vary from 1-30% (Buara, 1996). From a high of 30% in 1991, the levels of infestation declined to less than 10% in 1992-94.

The adult moth lays eggs on the surface of 4-7 week old fruit at the base of a spine. The incubation period of the egg may last 5 days (Buara, 1996; Sirisingh *et al.*, 1991).

On hatching, the larva bores through the fruit to the seed and begins to feed. The larva spends between 24-30 days in the fruit in order to develop sufficiently to pupate. It burrows out through the fruit, causing significant damage in doing so and falls to the ground where it burrows into soil to pupate. The pupation period to moth emergence varies from 21 days to 10 months. After moth emergence, adults mate and the female seeks out young durian fruit on which to lay her eggs.

The DOAE IPM program for durians requires monitoring, chemical control (application of an insecticide), trapping, field sanitation, biological and cultural control.

The following specific measures are known to reduce the incidence of DSB infestation in fresh Thai durian to a very low level.

- Monitoring and physical control

Monitoring is to be carried out from February through to June (Disthaporn *et al*., 1994). Monitoring comprises the use of blue-black light traps, known to be an attractant to DSB moths, and inspection of traps at prescribed frequencies during the growing and fruiting season (Disthaporn *et al*., 1994). AQIS will adopt the trapping frequencies recommended by DOAE:

. February, 2-3 times per week, to initially reduce natural populations of DSB moths;
. March and April, every day, during fruit set which is the DSB moth's preferred stage of laying eggs in fruit (ie. DSB moths prefer to lay eggs in young fruit);
. May and June, 2-3 times per week, to assist with on-going reduction of populations of DSB and potential infestations.

Chemical control is to be applied following the detection of one adult in a light trap. The destruction of trapped adults impacts on pest populations and subsequent fruit infestation.

Buara (1996) reported that less than 10% of fruit was damaged by the seed borer in areas using blue-black light traps and insecticide sprays, suggesting that all orchards should carry light traps as this can help to decrease the moth population.

- Chemical control

The following insecticides are applied after the detection of DSB moths in light traps:

. Phosalone 22.5% EC + Cypermethrin 6.25% EC (sold as mixed Parzon) at a rate of 40 ml/20 L water; or
. Endosulfan at a rate of 40 ml/20 L water.

These are alternated with neem insecticide that is prepared fresh from crushed neem seeds. Alternatively, Carbaryl 85% WP at 4-50 g /20 L is also effective in decreasing infestation.

In an insecticide study reported by Buara in 1996, infestation in Phosalone and cypermethrin treated fruit was only 1.7% compared with 7% infestation in the untreated control.

- Cultural control

Fruit bagging is an important element of the cultural control measures and AQIS will require this as a mandatory element in the IPM program. Research has shown that bagging with translucent plastic bags at 6 weeks after fruit set prevented fruit infestation by DSB in 100% of fruit (Sudhi-aromna and Jumroenma, 1998). This was compared with 2.86% damage of fruit when bagged at 8 weeks after fruit set and 17.4% damage in unbagged fruits. This research also indicated that infestation by DSB is likely to occur from the 6^{th} week after fruit set.

Cultural control measures also include keeping orchards clean, destroying infested fruit, and thinning excessive fruit set. Fallen fruit must be collected immediately and opened to kill the insect inside.

In addition, the import protocol specifies that registered orchards will be randomly inspected and audited by an AQIS officer for compliance with field pest control measures during the growing season from February to April prior to export commencement.

Mealybugs

In Eastern Thailand mealybug infestation occurs from after fruit set in early March to late May on maturing fruit. The pest is dispersed by ants. The mealybug sucks sap from twigs, the inflorescence, and young and mature fruit and promotes heavy sooty mould growth on affected parts through the deposition of honeydew. Mealybugs attack only the rind and have no effect on internal fruit quality. However, rind damage does affect the cosmetic appearance of the fruit and lowers its marketability. Fruit badly infested with mealybug and sooty mould are generally sold on the local market. The Thailand Department of Agriculture has developed a very comprehensive IPM program for durian mealybugs that encompasses monitoring, chemical, biological and cultural control measures (Disthaporn *et al*., 1994). IPM for mealybugs is practised by Thai durian growers, as described below, and can be expected to reduce the incidence of mealybugs in registered orchards to a low level.

- Monitoring

Monitoring involves a survey of 10% of all trees once a week during March-May with 5 fruit per tree checked for the presence of mealybugs and natural enemies. The economic threshold for pest control has been set at 20% infested fruits after the third fruit thinning.

- Chemical control

Control is achieved by spraying with water or water with white oil. Indirect control consists of fastening cloth soaked in insecticide or petroleum oil around the trunk or branch, or spraying Carbaryl 85% WP on the ground around the tree. This prevents access by the ants that spread the pest. Mealybugs are washed off from the fruit skin by water jet spray in the orchard field.

- Biological control

Biological control methods include conservation of natural enemies of mealybugs such as parasitoids; Coccinellids including *Menochilus sexmaculatus; Rodalia* sp.; *Scymus* sp.; *Harmonia octomaculata*; *Micraspis* sp.; Chrysopids including *Chrysopa* sp.; *Ankyropteryx octopunctata*; *Hemerobius* sp.; Vespids including *Polytes* sp. Other natural enemies recently reported include larvae of *Spalgis epius epius* Westwood Lepidoptera: Lycaenidae – predator and parasite *Allotropa* sp. (Hymenoptera: Platygastridae) (B. Laosinchai, 1998, personal communication).

Small plants and grasses including *Crassocephalum crepidioides*, *Aegeratum conyzoides*, *Cyperus kyllingia*, *Gomphrena celossioides*, *Eleusine indica*, *Ipomeeaspes tigridis*, *Vernonia* sp. and *Tridan procumbens* are maintained in orchards to provide pollen and nectar as a food source and ongoing ecological niches for parasites and predators. Some of these are common weeds in durian orchards.

Moisture during the dry season is increased to enhance the survival of natural enemies. Selective and "soft" pesticides that are safe to natural enemies may be used as spot sprays for localised mealybug infestations.

- Cultural control

Cultural methods include thinning, removal and burning of infested fruits. It is recommended that interplanting durian trees with alternate host plants of mealybugs like custard apple, coffee, bamboo and hibiscus should be avoided to prevent severe infestation. Flowers and fruit are thinned to allow only the required number to remain for good quality fruit. Water and fertiliser management should be well managed to keep trees healthy and vigorous.

4. Pre-sorting and cleaning at the growers' orchards

As stated on pages 11 and 12 of the Final IRA paper, *"Durian fruit for export to Australia must be cleaned of adhering debris, sorted and tagged with the orchard registration number according to instructions from DOAE officers. Only clean fruits should be sent to registered packing houses/export centres*."

Consequent to this requirement fruit that has insect or fungi encrustation, is damaged with insect holes or is dirty will be culled. This practice also assists in reducing the risk of DSB infestation in export fruit as suspected DSB infested fruit can be excluded by this process. Hiranpradit *et al*. (1992) established some quality grade standards for the 3 major cultivars according to target market requirements. The standards are based on external parameters such as shape, size, blemishes, disease and insect infestation, although internal qualities such as wet core, browning and flesh colour are also important. Fruit for export are designated as Extra, I and II classes which require that the fruit should all be free from disease, insects, with slight superficial defects not markedly visible and with no wet core or internal browning.

5. Registration and auditing of packing houses/export centres

As stated on page 12 of the Final IRA paper, "*Packing houses/export centres intending to export durian fruit to Australia must be registered with DOAE and audited by AQIS to ensure compliance with AQIS requirements. The packing houses/export centres must incorporate in their packing line, facilities and procedures for further selection, culling, treatment and inspection of fruit for DSB and the other pests. Managers of these facilities must provide details of fruit processing/treatment procedures and allow inspection by an AQIS officer before exports will be permitted.*

DOAE officials must ensure the following:

- *registered export centres facilities are maintained in a condition that will enable compliance with fruit treatment requirements*
- *all areas are hygienically maintained (cleaned daily of infested, damaged and blemished fruit)*
- *premises are maintained to exclude the entry of pests from outside and contamination between treated and untreated lots of fruit*
- *all equipment is regularly calibrated and records retained for verification*
- *the movement of lots of fruit from the time of arrival at the registered premise through to the time of export is recorded*
- *the security of fruit on the premises is maintained at all times.*

Non-compliance with any of the above requirements will result in suspension of the facility by DOAE until corrective action has been completed and AQIS agreement has been obtained for reinstatement."

AQIS will periodically audit the system. The system employed by the Export Centre for Fruit and Vegetable Product III Chantaburi (a large, modern packing and export plant for fruit that was built by the Government and operated by the Extension Services of the Ministry of Agriculture) provides an excellent model for such a plant.

Accreditation and auditing of packing houses/export centres provide important safeguards in the systems approach. The aims of the packing houses/export centres registration and auditing requirements are:

- to ensure, through supervision and auditing, that AQIS import requirements are met and allowing trace-back of non-complying packing houses/export centres and de-registration in instances of non-compliance with AQIS requirements (ie. non-compliance with fruit treatments, incorrect certifications, poor hygiene standards);
- to allow trace-back of orchards not complying with IPM or grading standards, and potential de-registration of orchards.

6. Air-brushing and insecticide treatment

As stated on page 12 of the Final IRA paper, "*On arrival at the packing house/export centre, the fruits must be airbrushed under high pressure to remove mealybugs and scale insects and then washed. The washed fruit must then be treated by dipping in suspension containing an insecticidal soap or a light paraffinic oil with high solvency* *property at rates of 2-3% (v/v) for 30 seconds. The fruits may have further treatment with a registered fungicide to control post harvest rots.*"

These phytosanitary measures provide important risk mitigation of external arthropod feeders, such as mealybugs and scale insects and can be expected to be very effective in removing mealybugs and other surface pests of durian from the fruit importation pathway. Brushing and "soft" insecticide disinfestation treatment are used by numerous countries as phytosanitary measures for mealybugs and scales. The United States Department of Agriculture stipulates these requirements for durian imports in treatment schedule T102 (c) of the Treatment Manual Volume I (See Section 4 of this paper). High-pressure air or water jets are used as commercial post-harvest treatment for the removal of many external insect contaminants on horticultural commodities (See Section 4 of this paper). These measures will be verified as part of the accreditation and auditing of packing houses/export centres by DOAE.

7. Pre-export inspection at packing house/export centre

As stated on pages 12 and 13 of the Final IRA paper, *"AQIS requires 95% confidence that not more than 0.5% of units (for durian a unit is one fruit) in the lot are infested with visually detectable quarantine pests. To achieve this AQIS requires that a 450 unit random sample from lots of less than 1000 fruits or a 600 unit random sample from lots of more than 1000 fruits be inspected by fruit cutting in order to detect DSB. Culled fruits can be included in the random sample.*

This sampling regime will also be applicable for standard inspection for other quarantine pests but the random sample must not include culled fruits. Standard inspection should be undertaken after fruit cutting for DSB. Inspection for quarantine pests will be done by TPQ.

All fruits packed for export to Australia at a particular packing house/export centre on a particular day will constitute an inspection lot unless otherwise agreed by AQIS and TPQ. It is desirable to have fruits from one registered orchard as a 'lot' for trace-back purposes. However, since the quantities of fruit to be exported are unknown, fruits from several registered orchards may be combined to form a 'lot' large enough to provide the agreed sample size provided registered grower numbers are retained for trace-back purposes. If an inspection 'lot' is rejected, remaining fruits from that registered grower must be withdrawn from further inspection for that consignment. A consignment is the quantity of fresh durian fruit covered by one phytosanitary certificate that arrives at one port in one shipment. All consignments must be shipped directly from one port or city in the country of origin to a destination port or city in Australia. No land bridging of consignments is allowed.

A registered orchard from which fruit is rejected will be permitted to resubmit further 'lots' for the current export season, but if a second 'lot' is rejected the registered grower will be suspended for the remainder of the season."

Pre-export inspection is an important element in the systems approach and is considered herein as a verification assessment of the efficiency of the other risk mitigating measures.

Inspection is a practical phytosanitary measure for pests which are visible, or which produce visible symptoms, on plants and plant products. AQIS carries out phytosanitary inspections for such pests at rates based on the AQIS National Sampling Plan. This plan is consistent with internationally accepted scientific procedures and applies to imports as well exports when importing countries ask Australia for an assurance that our exports are free from certain quarantine pests. The sampling protocol is designed to detect the presence of any quarantine pest in the sample. Using statistical models the results of inspection of the sample are used to determine the phytosanitary status of the lot from which it was drawn.

The sampling protocol requires inspection for quarantine pests in random samples of 600 units (one unit is a durian fruit) per lot. If no pests are detected by the inspection, this size sample achieves a confidence level of 95% that not more than 0.5% of the units in the lot are infested. The level of confidence depends on each piece of fruit in the lot having about the same likelihood of being affected by a quarantine pest and the inspection technique being able to reliably detect all quarantine pests in the sample.

A higher level of inspection is unjustified by quarantine considerations and unduly trade-restrictive. Other quarantine agencies like those in New Zealand and the United States of America also require inspections to detect the same infestation levels at the same confidence level.

One common misconception is that the chance of detecting infested fruit in a large consignment would be reduced with a fixed sample size (because of the relative decrease in the proportion of fruit sampled in the consignment). If the consignment is infested at a rate of 0.5%, then the number of infested fruit in a consignment would increase as the consignment size is increased. This increase of infested fruit counteracts the decrease in the proportion of fruit tested using a fixed size sample. The overall result is that there is no loss of confidence in the sampling scheme for detecting pests in large consignments. In fact, using a fixed sampling rate does not provide sufficient confidence of detecting a given infestation in small consignments (for example sampling at a rate of 2% would not give the desired confidence of detecting a 0.5% prevalence if the consignment was less than 30,000).

This measure of itself makes it highly unlikely that a significant proportion of imported fruit could be infested with DSB. It also serves as an additional check on the effectiveness of measures applied prior to the inspection stage.

8. Packing and labelling

As stated on page 13 of the Final IRA paper, "*Inspected and treated fruits are to be packed immediately in cardboard cartons. New cartons must be used for packing. Packing material must be synthetic or processed if of plant origin. No unprocessed packing material of plant origin such as straw is permitted.*

All cartons containing treated fruit which has been certified free from quarantine pests, must bear a TPQ seal or sticker, and must be labelled with the packing house/export centre and grower registration numbers. The date of packing should appear on the carton, which should be marked "For Australia". For palletised *"integral" consignments that have been strapped and secured the information marked on the cartons must be provided in a pallet card*."

Packing and labelling requirements provide additional safeguards in the systems approach.

9. Phytosanitary certification

As stated on page 13 of the Final IRA paper, "*All consignments must have a phytosanitary certificate issued by TPQ for DSB and other quarantine pests.*"

Phytosanitary certification provides another important safeguard in the systems approach by ensuring consignments have been treated and sourced following AQIS requirements.

10. Fruit security

As stated on page 13 of the Final IRA paper, "*All certified fruit must not be mixed or come in contact with fruit for the domestic market or other fruit, which are not eligible for export to Australia. This could be achieved through segregation of fruit for export to Australia, netting or shrink-wrapping pallets in plastic, or by placing cartons in low temperature cold storage before loading into a shipping container. Alternatively, packed fruit can be directly transferred at the packing house into a shipping container, which must be sealed with a TPQ seal and not opened until the container reaches Australia*."

The requirement for fruit security provides another safeguard in the systems approach by ensuring that cross contamination with other fruit, which have not been treated or inspected and which may contain quarantine pests, do not occur. It also ensures that pests, which have been removed from the fruit importation pathway, do not reinfest the consignment.

11. Verification of consignment for documentation errors

As stated on page 13 of the Final IRA paper, "*AQIS will examine relevant certification, documents and seals at the port of arrival in Australia. Any consignment with incomplete or defective documentation, or with certification which does not conform to specifications, or where seals of the containers in a consignment are damaged or missing, will be refused entry with the options of re-export or destruction of contents by freezing. The AQIS approved phytosanitary freezing treatment requires maintenance of product at –18^{o}C for a minimum of seven days. Cost incurred by this freezing treatment will have to be borne by importers in Australia. AQIS will notify TPQ immediately of any action to be taken*."

This measure provides another safeguard in the systems approach as it ensures that any consignment not conforming to AQIS requirements will be re-exported, destroyed or treated.

12. On-arrival inspection

As stated on page 14 of the Final IRA paper, "*On arrival, each consignment will be inspected by AQIS. Six hundred fruit from each consignment will be randomly sampled for inspection using a 10 X hand lens or a magnifying glass. Fruit showing surface damage or punctures will be cut for internal examination for DSB.*

If any live quarantine pest including DSB is found in the sample, containers in a consignment will be re-exported or destroyed by freezing as described in Item 10. The reasons for failure must be established and appropriate remedial action agreed upon between TPQ and AQIS before trade is permitted to recommence. AQIS undertakes to provide details of such finding including identification of the pest."

AQIS will complete an on-arrival inspection of a sample of fruit consistent with the AQIS National Sampling Plan. On-arrival inspection, as with pre-export inspection, is an important element in the systems approach and is considered herein as a verification assessment of the efficiency of the other risk mitigating measures. This measure ensures that the entire systems approach used has been effective in preventing and removing the quarantine pests of concern from the fruit importation pathway. This also serves as a *de facto* audit by AQIS of the efficacy of the entire process.

13. Review of protocol

As stated on page 14 of the Final IRA paper, "*The protocol for each of the items outlined above will be reviewed at the end of the first season of export*."

2.6 Conclusion

AQIS has proposed a systems approach to reduce the risks associated with this importation pathway. Each step in this approach either seeks to remove the pests from the pathway (such as an IPM program or cleaning) or audit/verify the validity of each step (such as pre-export inspection and inspection on-arrival). AQIS is confident that a systems approach, using the combination of these consecutive and independent steps, will result in negligible risk to Australia.

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3. CONSIDERATION OF VARIATION IN STRAINS OF *PHYTOPHTHORA PALMIVORA* SPECIES

3.1 Issues raised by appellants

Appellant 10. – *No work has been done to ascertain different and reputedly more virulent strains of Phytophthora said to exist in Thailand.*

Appellant 12 – *…serious concerns on the possible entry of different strains of this major fungal disease have been dismissed by AQIS.*

Appellant 13. – *AQIS ignoring issue that strains in Thailand are more virulent…*

Appellant 15. – *…AQIS has not addressed concerns on possible new fungi entering the country on fresh fruit.*

Appellant 19. – *…Asia has worse forms of Phytophthora than we have.*

Appellant 20. – *The possible devastation to durian and other horticultural industries if Phytophthora strains not yet present in Australia gain access.*

3.2 Response to issues raised

Phytophthora palmivora is present in all durian-producing countries, including Australia and Thailand. It is an economically significant pest of durian and many other agricultural plant species. It attacks all parts of durian plants from young seedlings to bearing trees. It causes root rot, patch canker on the trunk and stem, ultimately leading to tree mortality; leaf blight; twig die-back; and pre- and post-harvest fruit rots (Lim, 1990).

Stakeholder concerns regarding *P. palmivora* were covered in the Final IRA paper (Issues 29-31 on pages 26-27). *Phytophthora palmivora* is already present in Australia on durian and is not under official control in any state or territory. Accordingly, following the International Plant Protection Convention (IPPC) definition of a quarantine pest (FAO, 1997), it was determined not to be a quarantine pest. The IPPC definition of a pest also covers strains of a pest.

AQIS considered the possibility of introduction of more pathogenic (aggressive/virulent) strains of *P. palmivora* with imports of durian fruit from Thailand. However, AQIS did not find any sound evidence that durian isolates of *P. palmivora* from Thailand are more pathogenic than those already present in Australia.

Dr S. Sangchote has advised AQIS that he is not aware of any reports on the testing of *Phytophthora* on durian in Thailand (personal communication, February 2000). He has indicated that they would be conducting research on this topic in an on-going research project on *Phytophthora*. Australian scientists have suggested the likelihood of pathogenic variation between Australian isolates of *P. palmivora* from durian (Weinert *et al*., 1999) but presented no sound evidence. There is an indication that the

P. palmivora population in Australia comprise isolates varying in pathogenicity on different host plant species (Weinert *et al*., 1999).

Isolates of *P. palmivora* from durian are highly pathogenic to durian, moderately pathogenic to papaya and non-pathogenic to seedlings of cocoa, jackfruit, mandarin, passionfruit, pulasan, rambutan and tangelo (Chan and Lim, 1987; Tai, 1971). Isolates of *P. palmivora* from durian in Malaysia and Thailand do not infect cocoa (Lim and Chan, 1986a).

AQIS has no justification for restricting entry of durian fruit based on the assertion that Thailand has strains of *P. palmivora* that are more pathogenic than their Australian counterparts. AQIS's position on this matter is consistent with its obligations under the World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS agreement) and the IPPC guidelines for pest risk analysis.

AQIS currently permits imports of numerous plants and plant-products that could potentially carry *P. palmivora*, eg. nursery stock, particularly orchids, and papaya fruit. *Phytophthora palmivora* is not treated as a quarantine pest for these imports.

AQIS is not aware of any major agricultural country imposing specific restrictions for *P. palmivora* on imports of fresh fruits from other countries where this pest is known to occur. Thailand exports durian fruit to many countries.

Even though *P. palmivora* cannot be considered as a quarantine pest and hence no specific risk management measures are in place to reduce its incidence, imported fruit will be sourced from orchards where intensive pest management practices will be followed. Therefore, imported fruit will be of high quality and as such essentially free from *P. palmivora* rot. As a further measure, the fruit will also be subject to pre-export and on-arrival inspection for freedom from quarantine pests. In this process, AQIS will require fruit showing *P. palmivora* and other fruit rot symptoms to be removed in order to ensure that inspection for other pests is not impeded.

3.3 Conclusion

To date, no scientific information exists that more pathogenic strains of *P. palmivora* exist in Thailand as compared with Australia. Hence, there is no justification for restricting entry of durian fruit from Thailand on this basis. Under the terms of its WTO obligations, Australia cannot impose phytosanitary barriers to trade unless such barriers are justified based on scientific principles and sufficient scientific evidence. Australia is obliged either to have phytosanitary restrictions on imports on a relevant international standard or to have its restrictive measures on a risk assessment appropriate to the circumstances. Phytosanitary restrictions are not to be maintained without sufficient scientific evidence. In cases where relevant scientific evidence is insufficient we may provisionally adopt phytosanitary measures on the basis of available pertinent information, including that from the relevant international organisations as well as from phytosanitary measures applied by other WTO members.

In light of all the above, it is appropriate to permit entry of fresh durian fruit without any specific *P. palmivora*-related restrictions.

AQIS notes that some research work on strain difference has been foreshadowed (Weinert *et al*., 1999; personal communication with Dr David Guest, April 2000; personal communication with Dr S. Sangchote, February 2000). Consistent with its practice of keeping quarantine import conditions under review, AQIS will monitor scientific developments and take any relevant new information into account.

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4. THE TREATMENT AND DISINFESTATION OF FRUIT PROPOSAL

4.1 Issues raised by appellants

Appellant 7. – *….It mentions airbrushing under high pressure followed by light paraffinic oils followed by fungicide treatment. Not all types of scale insects can be removed by air brushing, this leaves the oil treatment as the only line of defence… the fungicide solution may well dilute or wash off the paraffin, reducing its efficacy…*

Appellant 9. – *Post-harvest treatments have been changed to include untested chemicals and methods.*

Appellant 10. – *No scientific testing has been done using Natrasoap or fine oils for mealy-bug and Sassettia scale.*

Appellant 12. – *…No scientific basis for AQIS to transfer the results from citrus research in South Australia to durian fruit in Thailand.*

Appellant 26. – *…AQIS have assumed that the treatment would work without any research to confirm the efficacy when used on durian.*

Appellant 27. – *Measures to control scales have not been tested…*

Appellant 28. – *There is no reference to any scientific work done on the efficacy of this method of treatment for these insects.*

4.2 Response to issues raised

Concerns related to post-harvest treatment and disinfestation were addressed in Issues 18 and 19 on page 25, and in Issues 50-52 on pages 32-33 in the Final IRA paper. Post-harvest treatment and disinfestation are mandatory for the mealybug (*Planococcus lilacinus*) and will also mitigate the risk of pests assessed to be of low quarantine risk such as *Pseudococcus* sp. and scale insects (*Coccus* sp., *Icerya* sp. and *Saissetia* sp.).

Brushing and "soft" insecticide disinfestation treatment are used by numerous countries as phytosanitary measures for mealybugs and scales. The United States Department of Agriculture's requirements for durian imports in treatment schedule T102 (c) of the Treatment Manual Volume I, prescribe the use of warm, soapy water and brushing for external feeders. Under these requirements the fruit is to be immersed in warm detergent water for a minute, brushed to remove any insects, rinsed using a pressure shower and inspected, paying particular attention to mealybugs and scales.

In the measures specified by AQIS for the importation of fresh durian the use of post-harvest fruit treatment and disinfestation for mealybug management builds upon the control achieved by the IPM program practised by durian growers in Thailand as discussed in Section 2 of this paper. The information provided below supports the recommendation made in the IRA in specifying the use of airbrushing and petroleum oil/natural soap (detergent) for the control of mealybugs on durian.

4.3 The import conditions to address mealybugs

Prior to transport to the packing house/export centre, durian fruit will have to be pre-selected, cleaned by brushing and sorted in the orchards of registered growers according to instructions from DOAE officers. Only clean fruit free of DSB and other quarantine pests including mealybugs and scales should be sent to registered exporting/packing sheds.

As stated on page 12 of the Final IRA paper, *"On arrival at the packing house/export centre, the fruits must be airbrushed under high pressure to remove mealybugs and scale insects and then washed. The washed fruit must then be treated by dipping in suspension containing an insecticidal soap or a light paraffinic oil with high solvency property at rates of 2-3% (v/v) for 30 seconds. The fruits may have further treatment with a registered fungicide to control post harvest rots."* Subsequently, fruits must be visually inspected to confirm freedom from mealybugs, scales and other quarantine pests before packing into cartons (Section 6 "Phytosanitary Import Requirements", Item 6 on page 12 in the Final IRA paper). Visual inspection is used as a further safeguard to ensure the efficacy of the airbrushing and dipping treatments.

4.4 Efficacy of high pressure air/water treatment

Airbrushing and water jet treatments work on the same principle, that is, using high pressure to physically (or mechanically) remove external pest infestations from the commodity. The mode of action and overall effect of the high pressure treatment (ie. mechanical removal of the pest) is the same regardless of the type of treatment used (air or water). High-pressure air or water jets are used as a commercial post-harvest treatment for the removal of many external insect contaminants on horticultural commodities. Whiting *et al*. (1998a) found that high-pressure jets were very effective for the removal of springtails, mites and thrips on kiwifruit and that this technology may be more effective following mineral oil sprays and biocontrol agents used for armoured scale control.

High-pressure jets are used commercially overseas to dislodge red scales (*Aonidiella aurantii*) from citrus (Honiball *et al*., 1979; Walker *et al*., 1996; Walker *et al*., 1999). Walker *et al*. (1996) found significant removal of armoured scales by standard pack-house processing and the addition of a washing treatment (high pressure of 325-525 psi) for 15-21 seconds enhanced pack-house removal by 73.5-99.7%. Commercial South African and Israeli descaling systems use comparatively lower water pressures for shorter exposure times of 2-10 seconds (Du Toit Pleser, 1993).

Pack-house processing significantly reduced the load of obscure mealybug (*Pseudococcus viburni*) and lightbrown apple moth (*Epiphyas postvittana*) from harvested Royal Gala apples (Moffitt, 1990). Whiting *et al*. (1998b) reported that adding a high pressure apple washing treatment to the pack-house procedure reduced the pest load more than just brushing and movement along the packing line, and produced relatively consistent insect removal of surface pest contaminants. However, internal larvae and all insects located beneath the sepals of apples with a closed-calyx cavity would evade high-pressure apple washing treatment (Whiting *et al*., 1998b).

Jamieson *et al*. (2000) reported that high-pressure water blasts removed green-headed and brown-headed leafroller egg rafts from avocado surfaces at an efficacy of 96-99.9% at 800 and 1000 psi. They also reported that natural infestations of thrips, mites and leafroller larvae were completely removed using water-blasting pressures of 400-1000 psi. The quality of water-blasted fruit was equal to, or better than, current standard industry practices in relation to pest contamination levels.

4.5 Efficacy of insecticidal soaps and paraffinic oils

Based on current research into the use of paraffinic oils as a post-harvest treatment, it is apparent that paraffinic oils are effective against mites, scales, mealybugs and the lightbrown apple moth (*Epiphyas postvittana*). Based on the mode of action of these oils on mites, scales, mealybugs and certain moth species, it can be predicted that paraffinic oils would also be effective against a similar range of pests on durian.

Insecticidal soap and paraffinic oils are used to remove insect contaminants on the surface of fruits. Hata *et al*. (1992) reported that a systems approach consisting of an insecticidal application before harvest and use of an insecticidal dip (combination of fluvalinate and insecticidal soap) after harvest with inspection provided quarantine security against aphids, thrips and several mealybug species on red ginger. The addition of a detergent (insecticidal soap) increases the effectiveness of washing by dissolving the waxy epicuticle of insect pests causing rapid drowning (Hata *et al*., 1992; Waller, 1990).

In addition, AQIS received information from Peter Taverner (South Australia Research and Development Institute) which mentioned that insecticidal soaps or lighter, paraffinic oils with higher solvency are very effective against mealybugs, scales and mites. They are used as a post-harvest dip to control these insects in citrus. They kill mealybugs and scales by suffocation, dissolution of the waxy epicuticular layers, desiccation and drowning (Hata *et al*., 1992; Waller, 1990).

The use of petroleum based oils, specifically paraffinic oils (which are defined as alkane hydrocarbons), have been reported to reduce the fertility of adult red scales (*Aonidiella aurantii*) (Ebeling, 1936; Riehl and Carman, 1953), and the fertility and fecundity of codling moth (*Cydia pomonella*) (Riedl *et al*., 1995).

Paraffinic oils such as C23 Ampol DC-Tron NR have been reported to be sufficiently non-volatile to be an effective ovicide against eggs of tortricid moths (Fiori *et al*., 1963; Riedl *et al*., 1995; Smith and Pearce, 1948; Taverner *et al*., 1999). The use of paraffinic oils has also been found to be effective against the adults and eggs of mites, scale and mealybugs and eggs and larvae of the lightbrown apple moth (*Epiphyas postvittana*) (Bailey *et al*., 1999; Riehl and Carman, 1953; Taverner and Bailey, 1995a; Taverner and Bailey, 1995b; Taverner *et al*., 1999).

Taverner and Bailey (1995a) found that the addition of post-harvest oils to commercial bulk dipping tanks produced a high mortality of surface dwelling pests such as mites and mealybugs in citrus. Furthermore, paraffinic oils such as the Ampol Citrus Post Harvest Dip® have been recommended as a post-harvest disinfestation treatment for citrus for the removal of surface pests such as mites, mealybugs and the lightbrown apple moth (Bailey *et al*., 1999; Taverner and Bailey, 1995a; Taverner and Bailey, 1995b; Taverner *et al*., 1999).

Taverner *et al*. (1999) also reported that the homogenous C15 alkane petroleum oil, C15 Ampol CPD, was more efficacious when applied in dips than the other petroleum spray oil, C23 Ampol DC Tron NR, applied in the same manner.

AQIS has found no technical evidence to say that the effect of insecticidal soaps or paraffinic oils on arthropod pests would be any different from citrus and other horticultural commodities. In addition, no stakeholder has advanced any reason or evidence why there might be such a difference.

4.6 Conclusion

Based on the above information AQIS is confident that the use of airbrushing and insecticidal soap or light paraffinic oils in combination with a routine IPM program and pre-export and on-arrival inspections will mitigate the risks of mealybugs and scale insects from being introduced via fresh durian fruit imports. The efficacy of the airbrushing and insecticidal soap/paraffinic oil treatments will be verified by the pre-export inspection in Thailand and on-arrival inspection in Australia.

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ATTACHMENT 1

IMPORT RISK ANALYSIS APPEAL PANEL DECISION - IMPORT RISK ANALYSIS ON THE IMPORTATION OF FRESH DURIAN FROM THAILAND

Dear

As previously advised on 11 February, the Import Risk Analysis Appeal Panel (IRAAP) convened on 21 February 2000 to finalise its consideration of appeals against the Import Risk Analysis on the Importation of Fresh Durian Fruit from Thailand (the Durian IRA).

<u>Background</u>

On 17 November 1999 AQIS released the final Durian IRA paper for the importation of fresh durian from Thailand. The Durian IRA was conducted using the routine process described in the AQIS Import Risk Analysis Process Handbook (the Handbook). Stakeholders were advised that, if in their opinion, the process outlined in the Handbook has not been properly followed they could appeal, in writing, to the Director of Animal and Plant Quarantine by COB 16 December 1999.

Subsequent to the release of the final Durian IRA, the acting Director of Animal and Plant Quarantine granted an extension to the appeal period to one stakeholder until 31 December 1999.

The IRAAP first convened on 21 January 2000 to discuss a number of issues that related to the establishment of guidelines under which the IRAAP would conduct the appeal process. These guidelines (at Attachment A) were developed with the assistance of legal advice from the office of the Australian Government Solicitor. Appellants will note that the Director of Animal and Plant Quarantine excused himself from this IRAAP on the grounds that he had commented on the draft Durian IRA in his previous role.

The IRAAP was to report to appellants within 45 days of the appeal period closing, but given the necessity to establish guidelines for the conduct of the IRAAP and the time required to assess the volume of appeals, that period was extended to 21 February 2000.

The IRAAP considered 45 appeals against the criteria outlined in section 4.5 of the Handbook that states “any stakeholder of the opinion that the process outlined in the Handbook has not been properly followed, including that the risk analysis failed to consider a significant body of relevant scientific or technical information, may appeal to the Director” (of Animal and Plant Quarantine).

In reaching its recommendations, the IRAAP considered each appeal in detail, the final draft Durian IRA and written briefing supplied by AQIS.

Recommendations

The IRAAP has considered the issues that formed the basis of appeals and has formulated its recommendations under two broad headings. With respect to the other principles outlined in the IRA Handbook, the IRAAP was presented with no evidence that a significant body of relevant scientific or technical information had not been considered in the Durian IRA, nor was there any evidence presented that the Durian IRA was inconsistent with Government policy or lacked harmonisation with international standards. As such, appeals under these principles have been dismissed.

Consultation

The IRAAP considered the issues highlighted by appellants regarding consultation and concluded that the IRA was conducted as required by the AQIS IRA Handbook on routine IRAs. As such, appeals under this category have been dismissed by the IRAAP.

However, the IRAAP would like to note that whilst the IRA was conducted using the routine process in accordance with the provisions of the Handbook, this process does not provide the opportunity for a level of industry and scientific consultation that would necessarily address stakeholder concerns. The IRAAP also noted that although it is not a requirement to release the Pest Risk Analysis or the details of the team conducting the IRA, it would recommend that it would be good practice to do so.

The IRAAP recommends that its comments regarding consultation be referred to the Quarantine and Export Advisory Council Policy Group that is currently reviewing the guidelines for the conduct of Import Risk Analyses, for action.

Transparency

The IRAAP is of the belief that certain aspects of the IRA appear not to have been conducted in a fully transparent manner. The IRAAP is of the view that there appears to be a lack of clear reasoning, with reference to relevant evidence on some issues to support decisions or judgements that have been taken.

The IRAAP considers that the basis on which decisions or judgements that have been taken should be fully documented to ensure that all stakeholders are fully informed. In particular, in the following four issues insufficient information has been supplied to draw the reader to the same conclusion as that in the IRA:

1. the economic and environmental impact analyses in the event of an incursion;
2. the adoption of the systems approach with integrated pest management as the basis for reducing the risk of infestation in harvested fruit;
3. consideration of variation in strains of Phytophthora palmivora species; and
4. the treatment/disinfestation of fruit proposal.

Under these circumstances, the IRAAP has upheld the appeal.

The IRAAP recommends the following course of action:

1. Within 90 days of the announcement of this decision, AQIS will consult with relevant parties, including appropriate technical expertise and representatives of the industries concerned and resolve the four issues outlined above. AQIS will then advise the IRAAP in writing of the outcome of this consultation.

2. The IRAAP, once satisfied that these outstanding issues have been resolved, will consider that the appeal has been finalised and the Durian IRA concluded.

Any further comments that you wish to make on the process conducted by the IRAAP may be directed to me at the address on the first page of this letter.

Yours sincerely

Professor Malcolm Nairn
Chair of the IRAAP for the Importation of Durian

24 February 2000

ATTACHMENT A

IMPORT RISK ANALYSIS APPEAL PANEL GUIDELINES

An Import Risk Analysis Appeal Panel is convened to consider appeals made by stakeholders in accordance with the provisions of the IRA Handbook. The sections of the IRA Handbook that relate to convening an IRAAP are 4.5, 4.6 and 4.7.

IRAAP - Chair and Members

The IRAAP as described in section 4.6 of the IRA Handbook, routinely comprises the Chair of the Quarantine and Exports Advisory Council as the Chair; the Director of Animal and Plant Quarantine, either the Chief Plant Protection Officer or the Chief Veterinary Officer as appropriate to the appeal and one other member of QEAC. The IRAAP membership will, in most cases, be balanced between scientific expertise and other fields of expertise such as economics, business management and communication.

If, when a person is approached to become the Chair or a Member of an IRAAP they believe that there may be a conflict of interest or perception of bias, that person shall declare those interests to the Chair or other Members as appropriate. In all cases, if the Chair or Member should decide to withdraw from the IRAAP, then a replacement is required.

Notification to appellants of the Chair and Members of the IRAAP will be undertaken by the IRAAP Secretariat.

IRAAP Meetings

The IRAAP must meet at least once during the course of the appeal process, in person. Follow up meetings may be in person if this is convenient or by way of teleconference.

Administrative arrangements

All papers associated with the appeal, including all correspondence with appellants, will be coordinated by the IRAAP Secretariat located in the Executive Secretariat of AFFA.

Conduct of Chair and Members

In considering an appeal, the Chair and Members of the IRAAP, wherever possible, should not make judgements on scientific issues that are within the scope of the actual appeal(s). The IRAAP's primary role is to review the process and will consider issues on a case by case basis.

The Chair of the IRAAP is the sole point of contact for appellants, or other parties. Any queries regarding the conduct of the IRAAP or deliberations or decisions made by the IRAAP, must be directed to the Chair of the IRAAP, in writing, via the IRAAP Secretariat.

Dismissal of an appeal

Dismissal of an appeal requires majority support of the IRAAP. The Chairman will not exercise a casting vote.

Oral submissions to the IRAAP

The IRAAP will not consider oral submissions from any applicant unless the applicant can demonstrate to the IRAAP that they cannot present their case adequately by way of written submission.

45 Day period to hear appeals

The IRAAP will endeavour to consider appeals within the 45 day time period outlined in the IRA Handbook. Should circumstances arise where this may not be possible, eg volume of appeals received, then the Chairman of the IRAAP will write to appellants advising them of the delay and where possible, the date the IRAAP will conclude its deliberations and release its recommendations.

Consideration of appeals

The IRAAP will consider in detail the appeals provided, the final draft IRA and any written factual briefing from AQIS that may be requested by the IRAAP.

Announcement of decision

The IRA Handbook advises that if the appeal is upheld, the IRAAP refers its conclusion to the AQIS team or Risk Analysis Panel (in the case of non-routine IRAs) for rectification of the deficiency in the process. If the appeal is dismissed the policy is adopted.

The IRAAP Chair should formally notify the appellants, AQIS and the Minister and any other relevant interested parties of the IRAAP decision within 3 working days of the final decision being taken.

As mentioned previously, the Chair of the IRAAP is the sole point of contact for appellants, or other parties regarding the decision(s) of the IRAAP.

Action arising from a decision to uphold an appeal

Within a specified period of time of the announcement of the decision to uphold an appeal, AQIS is to advise the Chair of the IRAAP, in writing, of the action taken to remedy the issues raised.

ATTACHMENT 2

No.	Issue	Appellant Number	Total Number of Appeals
1	Economic and environmental impact analysis	12, 13, 14, 18, 21, 22, 23, 24, 25	9
2	Adoption of systems approach with IPM	10, 12, 17, 18, 26, 27	6
3	Consideration of variation in strains of *Phytophthora palmivora* species	10, 12, 13, 15, 19, 20	6
4	Treatment and disinfestation of fruit proposal	7, 9, 10, 12, 26, 27, 28	7

Appellants and their addresses:

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Appealed issue no. 4

9 – Peter Uechtritz
PO Box 104
Mena Creek QLD 4871
Appealed issue no. 4

10 – Kerry McAvoy
PO Box 31
Japoonvale QLD 4856
Appealed issue no. 2, 3, 4

12 – Zappala Tropicals Pty Ltd (Alan Zappala)
CMB No 2
Bellenden Ker QLD 4871
Appealed issue no. 1, 2, 3, 4

13 – Organic Producers Association of Queensland (Andre Leu)
PO Box 800
Mossman QLD 4873
Appealed issue no. 1, 3

14 – Queensland Fruit & Vegetable Growers (Chairman: Rod Dalton)
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Appealed issue no. 1, 4

15 – David K. Chandlee
‘Treefarm’
El Arish QLD 4855
Appealed issue no. 3

17 – Tropical Organic Produce (Tom Meredith)
PO Box 228
Innisfail QLD 4860
Appealed issue no. 2

18 – Tropical Primary Products (Tian Mok Siah)
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Appealed issue no. 1, 2

19 – Peter Mansfield
PO Box 73
Mossman QLD 4873
Appealed issue no. 3

20 – Steven Scopelliti
PO Box 32
Silkwood QLD 4856
Appealed issue no. 3

21 – Myandra Tropical Produce (Michael Poffley)
PO Box 935
Humpty Doo NT 0836
Appealed issue no. 1

22 – King Durian (Richard Sadowski)
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Humpty Doo NT 0836
Appealed issue no. 1

23 – Beratan Produce (Barry Lemcke)
PO Box 27
Humpty Doo NT 0836
Appealed issue no. 1

24 – Jamal Tropical Fruits (Bert Jaminon)
PO Box 145
Howard Springs NT 0835
Appealed issue no. 1

25 – Australian Banana Growers Council (DR Boyle)
GPO Box 414
Brisbane QLD 4001
Appealed issue no. 1

26 – NSW Agriculture Department of Plant Industries (KP Sheridan)
Locked Bag 21
Orange NSW 2800
Appealed issue no. 2, 4

27 – Northern Territory Horticultural Association (Ian Baker)
PO Box 2207
Palmerston NT 0831
Appealed issue no. 2, 4

28 – Zappala Farming (Joseph Zappala)
PO Box 51
Mena Creek QLD 4871
Appealed issue no. 4

NB: Appellants 21, 22, 23 and 24 sent "form letters" which raised the same issues.

APPENDIX 1

Risk element 1 – risk of not being detected on commodity at the border

To cause economic and environmental damage a pest has to gain entry at the border. The risk or likelihood of the pest not being detected on the commodity during inspection were rated as follows:

- high: internal infestation with indiscernible external symptoms
- medium: external infestation hidden beneath calyx or adult pest or its stages discernible with the aid of magnifying devices, and internal infestation with discernible external symptoms
- low: external infestation/infection with symptoms readily discernible with the naked eye.

Risk element 2 – climate-host interaction

When introduced to new areas, pests can be expected to behave as they do in their native area if host plants are available and the climate is similar. AQIS considers different ecological zones and the interaction between the geographic distribution of the pest and host. Australia is categorised into monsoonal tropic, wet tropics, semi-arid, Mediterranean, sub-tropical and temperate production areas. Where there are both suitable host plants and suitable climate, a pest may have the potential to establish a breeding colony. Qualitative ratings were assigned as follows:

- high: pest can establish in four or more types of production areas
- medium: pest can establish in two or three types of production areas
- low: pest can establish in one type of production area.

Risk element 3 – host range

The risk posed by a plant pest depends on both its ability to establish a viable reproductive population and its capacity to cause plant damage. For arthropods, risk is assumed to be correlated positively with host range. Qualitative ratings were assigned as follows:

- high: pest attacks multiple species within multiple plant families
- medium: pest attacks multiple species within a single plant family
- low: pest attacks a single species or multiple species within a single genus.

Risk element 4 – dispersal potential

The dispersal potential of a pest may be innate or assisted. Innate dispersal capability of the pest includes natural factors (wind, water, mobility (eg. wings)) that facilitate dispersal. Assisted dispersal may be through carriage of infested commodity to an ecologically suitable habitat. Qualitative ratings were assigned as follows:

- high: evidence (eg. scientific literature) reveals the pest is capable of rapid movement (eg. 5 km per year) under its own power, human assisted, or by natural mechanisms
- medium: moderate capacity for dispersal, eg. the species is motile
- low: relatively immobile.

Risk element 5 – reproductive potential

The risk posed by a pest depends on its ability to establish a viable reproductive population. Significant reproductive potential depends on the pest reproductive patterns (eg. fecundity, fertility, reproductive output, voltinism, parthenogenesis). Qualitative ratings were assigned as follows:

- high: pest has high reproductive potential (eg. many generations per year, many offspring per reproductive individual, high innate capacity for population increase (r-selected species – opportunistic pest that increases rapidly as a suitable opportunity arises))
- medium: pest has moderate reproductive potential
- low: pest has low reproductive potential eg. long generation time.

Risk element 6 – economic impact

Economic consequences of pest introduction and establishment taken into account include:

- a lowering of yield of crop or other crops of economic importance (actual yield reductions, plant mortality);
- a lowering of crop value or return due to increases in the cost of production, lower market price through reduced quality or a combination of the two; and
- a loss of markets (foreign or domestic) due to presence of a new quarantine pest.

Qualitative ratings were assigned as follows:

- high: pest causes any two of the consequences

- medium: pest causes any one consequence

- low: pest causes damage to the host but does not result in any one of the above consequences to a significant extent.

Risk element 7 – environmental impact

The introduction and establishment of a pest is expected to:

- cause significant, direct environmental impacts eg. ecological disruptions, reduced biodiversity;

- have a direct impact on species listed as endangered, threatened or candidate (eg. by feeding on listed plant species);

- have an indirect impact on species listed as endangered, threatened or candidate (eg. by disruption of sensitive critical habitat(s));

- have a direct impact on other plants of economic importance; and

- necessitate control program(s) including the use of toxic chemicals.

Qualitative ratings were assigned as follows:

- high: three or more consequences

- medium: any two consequences

- low: any one consequence.

Risk element 8 – vector relationships

Many pests can act as vectors of disease-causing agents such as nematodes, protozoa, fungi, bacteria, phytoplasmas, spiroplasmas, viruses and viroids that can be detrimental to plant or animal health. Qualitative ratings were assigned as follows:

- high: species reported to act as vectors

- medium: related species within the same family or group have been reported to act as vectors

- low: species not reported to act as vectors.