Preliminary environmental audit of the Australian lychee industry

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Australian Lychee Industry: Environmental Audit Final Report



HAL Project: LY09002 Preliminary Environmental Audit of the Australian Lychee Industry

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Executive summary

The Australian Lychee industry instigated this project in order to identify the current level of environmental performance of the industry. This was to be achieved by conducting on-farm environmental audits across a sample of growers, and to verify audit results with a broader grower survey.

The industry comprises approximately 280 growers producing lychees on farms around the Atherton Tableland, Coastal Wet Tropics, Central Queensland, South east Queensland and Northern NSW. Most lychee farms are less than 10 ha in size, with few being greater than 50 ha

The "average grower" involved in the on-farm audit was over 50 and grew and packed lychees in the Coastal Wet Tropics. Their orchard was less than 10ha and their business was certified to Freshcare Food Safety. The average respondent to the e-survey was very similar; again being over 50, growing and packing lychees and being certified to Freshcare Food Safety. Their property was a little smaller, being less than 5ha in size and being in the Northern NSW / Southern Qld area.

Audits were conducted on 24 lychee growing properties selected from the industry database. Growers were randomly selected, however the numbers audited in each region reflected the proportion of national growers in that region

Following the on-farm audits, a shorter grower survey was extracted from the audit checklist, with particular attention paid to those audit questions that had yielded inconclusive results. The survey was launched online using the Survey Monkey tool, and a link sent to all lychee growers on the ALGA database. Despite a number of requests and reminders to growers, only 10 responses were received.

In total, 34 businesses or approximately 12% of the lychee industry participated in the environmental audit through the on-farm audits and the grower survey. Given the relatively small sample size the conclusions that can be drawn from this project are general in nature and should not be considered a definitive industry or regional picture. Bearing these limitations in mind, it is still possible to develop a picture of the Australian lychee industry and for this to be used as a starting point from which to measure future progress in uptake of environmentally sustainable practices.

The audit and e-survey highlighted industry strengths, weaknesses and opportunities and potential threats. Strengths were identified in all management areas examined, including implementation of sound soil erosion control strategies, broad control of risks posed through storage, application and disposal of agricultural chemicals, responsible storage of fertilisers and effective co-existence with environmentally sensitive areas such as waterways, wetlands and areas of native vegetation.

Industry weaknesses included lack of monitoring of sprinkler output, which can adversely affect water and nutrient availability, lack of bunding and chemical spill kits in chemical storage areas, indications that appropriate disposal of chemically contaminated materials

may not always occur, inconsistent uptake / attendance at Integrated Pest Management training as well as reliance on contentious 'soft' chemicals, inconsistent use of soil and leaf testing to determine crop nutritional requirements, inability to identify all relevant declared weeds and lack of communication with neighbours regarding activities that may impact them.

Opportunities exist for the industry to promote the good practices being undertaken and to implement programs to address priority areas coming from this report. Threats to the industry include the use of endosulfan and relationships with neighbours, particularly given issues of urban expansion.

ABS	Australian Bureau of Statistics
ALGA	Australian Lychee Growers' Association
DPI	Department of Primary Industries
HAL	Horticulture Australia Limited
IPM	Integrated Pest Management
QPIF	Queensland Primary Industries and Fisheries
SQF	Safe Quality Food
WQA	Woolworths Quality Assurance

Abbreviations and acronyms

Description of regions

Northern NSW/South East QLD	Ballina New South Wales to Bundaberg, Queensland and roughly 100km inland from the coast
Central QLD	Bundaberg north to and including Mackay and roughly 100km inland from the coast
Coastal Wet Tropics	Mackay north to Port Douglas along the coastal strip, roughly 30 – 50km inland from the coast. Includes the area around Jullaten (west-north-west of Port Douglas)
Atherton Tableland	Atherton to Mareeba region and north to Mt Molloy

Background

The Australian Lychee industry instigated this project in order to identify the current level of environmental performance of the industry. This was to be achieved by conducting on-farm environmental audits across a sample of growers, and to verify audit results with a broader grower survey.

The Australian Lychee industry comprises approximately 280 growers producing lychees on farms around the Atherton Tableland, coastal Wet Tropics, central Queensland, south east Queensland and northern NSW. Most lychee farms are less than 10 ha in size, with few being greater than 50 ha.

Objective

To quantify the current level of environmental performance in the Australian Lychee industry.

Methodology

Formation of the project team

A project team comprising John Tyas (HAL), Ian Groves (ALGA), John Bagshaw (QPIF) and Daryl Connelly (Project Manager, TQA Australia) convened via phone and email. Jane Lovell from TQA Australia later took on the Project Manager role. The project was developed and managed by TQA Australia. John Bagshaw (QPIF) was sub-contracted by TQA Australia to undertake a series of on-farm audits.

On-Farm Audits

Confidential audits were conducted on 24 lychee growing properties selected from the industry database. Growers were randomly selected, however the numbers audited in each region reflected the proportion of national growers in that region (see Figure 1A). An audit checklist was developed based on the HAL *Guidelines for Environmental Assurance in Australian Horticulture* and industry insight provided by QPIF and ALGA. Throughout the report, participants are referred to as having been "audited", this is not to be confused with certification audits against systems such as WQA or Freshcare Food Safety and Quality.

Grower survey

Following the on-farm audits, a shorter grower survey was extracted from the audit checklist, with particular attention paid to those audit questions that had yielded inconclusive results. The survey was launched online using the *Survey Monkey* tool, and a link sent to all lychee growers on the ALGA database. Despite a number of requests and reminders to growers, only 10 responses were received.

In total, 34 businesses or approximately 12% of the lychee industry participated in the environmental audit through the on-farm audits and the grower survey.

Results

Explanation

Results of the on-farm audit are presented graphically and are supplemented by a selection of comments made by participants. In addition, where e-survey questions of a similar nature were asked, responses have been included. Due to the low response rate to the e-survey it has not been possible to use these results as originally intended, that being, to test the veracity of the on-farm audit results.

The information collected has then been reviewed to highlight areas of strength and weakness in the lychee industry. Criteria for this assessment were as follows:

- strengths were generally those issues where greater than 75% of the industry was compliant / undertaking the practice.
- weaknesses were generally those issues where less than 50% of the industry was compliant / undertaking the practice.

In some instances where there were significant numbers of not applicable responses a judgement call was made.

Variation across regions has been included in the analysis but due to low sample numbers there is limited confidence in the veracity of regional differences.

Those with greater industry knowledge and experience will be better positioned to interpret or dismiss regional differences. Similarly assumptions have been made regarding what constitutes best environmental practice. These assumptions are based on broad industry experience and the practices outlined in across industry publications such as the Guidelines for Environmental Assurance for Australian Horticulture.



Profile of respondents audited and e-surveyed

Figure 1A Regional representation of participants audited

The percentage of businesses participating in the on-farm audit was considered representative of the main lychee growing areas of Australia.



Figure 1B Regional representation of participants e-surveyed

The majority of respondents to the e-survey were from Northern NSW / South East Qld and no responses were received from the Coastal Wet Tropics.



Figure 2A Age of participants audited, nationally and by region

Nationally the majority of audit participants were over 50 years of age, and in Northern NSW / South East Queensland all participants were over 50 years of age. There were no participants under 31 represented in this study. Results from the Australian Bureau of Statistics support this result with the median age of all Australian farmers being reported as 52 (ABS, 2006). The ABS also reports an increase in the proportion of Australian farmers older than 65 and a decrease in the proportion of farmers under 35 years of age (ABS, 2006).



Figure 2B Age of participants e-surveyed, nationally and by region

The average age of respondents was over 50, and there were no respondents under 31.





The size of lychee orchards audited varied considerably across the regions, with the majority of orchards in the Atherton Tablelands being in the 5 – 10ha category, while in Northern NSW / South East Queensland, the majority of orchards were in the 1 – 2ha category. This was also the only region to have orchards of less than 1 ha in size (16%). Nationally the breakdown of participants by orchard size was fairly evenly distributed across the 1-2ha, 2-5ha, 5-10ha and over 10ha categories.

Figure 3B Size of lychee orchard managed by businesses e-surveyed, nationally and by region



The majority of businesses responding to the e-survey were small, being up to 5ha. In Central Queensland, respondents were from larger properties, with over 60% having greater than 5ha of lychee orchard.



Figure 4A Representation of businesses audited, nationally and by region

Lychee businesses audited were almost all growers and packers. The exception being in Northern NSW / South East Queensland where 17% were growers only. This result may be correlated to the size of orchards, where a similar proportion of businesses in this region were <1ha in size (Figure 3A).



Figure 4B Representation of businesses e-surveyed, nationally and by region

The majority of businesses responding to the e-survey were grower and packers, with grower only businesses found in Northern NSW / South East Qld only.

Figure 5A Proportion of audited businesses with food safety, quality or environmental systems in place, nationally and by region.





Nationally, Freshcare Food Safety was the predominant certification system implemented by those participating in the environmental audit. Of note is the absence of any certifications to an environmental system, such as Freshcare Environmental, or a system with environmental components such as GlobalG.A.P. Businesses who stated they held certifications to "Other" systems were generally referring to approved supplier programs held to supply a larger marketing organisation. Part of the approved supply status is the requirement for certification to Freshcare Food Safety (John Bagshaw pers. comm.).



Figure 5B Proportion of businesses e-surveyed with a certified food safety, quality or environmental system in place, nationally and by region.

The majority of respondents to the e-survey were certified to Freshcare Food Safety. In Northern NSW / South East Qld one business had implemented WQA and SQF, and one business had implemented both Freshcare Food Safety and Freshcare Environmental. There was also one business that had not implemented any management systems

E-survey participants were also asked if they had other enterprises on the farm and if these enterprises required any external certifications. Seven respondents did not have any other enterprises, one also had avocados and required Freshcare Food Safety and one had a grazing enterprise that did not require any particular certification.

Land and soil management



Figure 7 Is appropriate drainage in place to reduce run-off and erosion?

With the exception of one business, all properties visited as part of the on-farm environmental audit had appropriate drainage systems in place. Practices included:

- grassed drains
- maintenance of ground cover over entire orchard
- vegetated riparian zones
- orchard plantings along contour lines
- diversion drains above orchards
- supplementing ground cover with mulch
- installation of ag-pipe drainage lines



Figure 8 Does the grower aim to minimise the time that soil is bare during site preparation and cover crop management?

The majority of growers audited utilised strategies to minimise the amount of time soil was bare during site preparation and cover crop management. There were instances where this was not the case in both the Coastal Wet Tropics and Atherton Tableland. This was generally because earthworks had been undertaken to prepare sites for planting.

Strategies utilised to maintain ground cover during planting included:

- planting into grass
- rapidly establishing grass after planting
- establishing a narrow row to plant into (by ripping or strategic use of herbicides) and maintaining inter-row grasses
- using mulch after planting to protect soil until grasses establish
- establishing a cover crop when establishing orchard
- establishing orchard during traditionally dry periods and assisting establishment with irrigation if required



Figure 9 Is permanent inter-row grass cover established as soon as possible after ground preparation for erosion control?

The overwhelming majority of lychee businesses audited actively managed grass cover in the inter-row area during planting. Some planted grass, others encouraged the regeneration of native grasses after planting, and many maintained grass in the inter-row area during planting.

The e-survey also asked about vegetation of inter-row areas. All respondents either had permanent inter-row grass areas or established grass as soon as possible after ground preparation and planting.



Figure 10 Is permanent inter-row grass cover maintained in mature orchards for erosion control?

All businesses audited maintained permanent grass cover in the inter-row area of mature orchards.



Figure 11 Is there adequate ground cover under trees for erosion control?

In all cases there was adequate ground cover under trees to control erosion. Typically ground cover included leaf and prunings or mulch, such as hay.

Respondents to the e-survey all indicated they maintained ground cover under trees, either through actively mulching, by side delivery of mowed grass onto tree drip lines or through self mulching by lychee leaf litter.



Figure 12 Is soil pH tested?

There was considerable variation by region with the use of soil pH tests. In all regions except the Coastal Wet Tropics, all audited businesses completed soil pH tests, although the frequency of testing ranged from twice annually to once every three years. In the areas where soil tests were not undertaken it appeared that orchards had been established for

some time and that in some instances soil tests had been undertaken initially but that growers now felt they were able to manage soil pH without the need for testing.



Water management

Figure 13 Is soil moisture monitoring used to manage irrigation?

Slightly more than half of the businesses audited used some form of soil moisture monitoring to manage irrigation. The Coastal Wet Tropics was the region with the greatest use of this technology with over 70% of participants using soil moisture monitoring equipment. By contrast, in the Atherton Tableland only 20% of businesses audited used soil moisture monitoring.

Some growers were actively using equipment including tensiometers, Enviroscan and 'FullStop'. Others had used gophers in the past and now felt confident to determine irrigation needs without continuing to use this equipment. Visual inspection of soil conditions to determine irrigation needs was also cited and included digging holes to check soil condition at depths of around 10cm.

Monitoring tree condition and crop size was another method used to determine crop irrigation requirements.

One grower was planning to work with Reef Rescue to improve the efficiency of his irrigation practices.

The e-survey asked respondents how they decided how much water to apply. Results were mixed and growers indicated they used a combination of methods. Some growers followed industry recommendations, some used soil moisture monitoring, some based their decision on experience and crop condition, while others dug holes to determine the depth of soil moisture.

Respondents were also asked if they had monitored soil moisture within the last five years to determine crop irrigation needs. Seven growers claimed they had and the majority had used an auger or dug a hole. Three had used tensiometers and two had used Enviroscan. One grower who had not actively carried out any monitoring of his own was sharing information gathered from a neighbour's tensiometer.



Figure 14 Is the uniformity of sprinkler output across blocks of trees checked at least annually?

Uniformity of sprinkler output was not checked by a high percentage of businesses audited. Some growers with under tree sprinklers regularly checked them, with one grower doing this 3 - 4 times a year. The use of pressurised or pressure compensated systems and trickle or T tape impacted on the need and ability to check output.

In some instances, growers recognised they currently had poor irrigation uniformity. A couple of participants admitted that they assume uniformity of output, while others checked only for blockages.

This question was also asked through the e-survey. Seven respondents used sprinklers and six checked output at least annually.





Few businesses audited captured rainwater for use in the packing shed. Of those that did not do this, some used bore water for the packing operations as it is considered cleaner, some used scheme water, while others did capture rainwater but did not use it in the packing shed.





Very few businesses audited recycled water from the packing shed. Those that did generally replaced water daily. In some instances the reused water went back into a dam, in other instances it was released into the orchard or just outside the shed.

Many of the businesses that did not recycle water within the shed released the water back into the orchard, while some released the water onto the ground and some into drainage systems.



Figure 17 Are silt traps/dams/vegetated filter strips/grass drains used to manage run-off water from the farm before release off site?

Essentially all businesses audited had implemented management strategies to manage water run-off from the farm. This included:

- vegetated buffer zones
- diversion drains with water diverted to grassed drainage areas
- maintaining ground cover across property
- use of on-farm dams as "silt traps" prior to water being released
- maintaining native vegetation in gullies

In the one instance where silt traps were not applicable, the whole farm was covered with vegetation. There were also times during the wet season when water covered most of the farm making any formal silt trap ineffective.

Chemical management

All of the e-survey respondents indicated they used chemicals during lychee production. One of the businesses audited was organic.



Figure 18 Is the chemical storage area secure and constructed and located to minimise the risk of contamination of the environment?

Approximately 80% of businesses audited had chemical storage facilities that were constructed and located to minimise the risk of environmental contamination. One business was organic and did not require chemical storage facilities.

Of the businesses that did not have an environmentally appropriate chemical storage area, issues that needed to be addressed included:

- Siting storage areas were next to dams and unbunded, or uphill from rivers.
- Construction storage areas were constructed of flammable materials.



Figure 19 Is the chemical storage area bunded?

Few chemical sheds were bunded, except in Northern NSW / South East Qld where 67% of businesses audited had bunded sheds.



Figure 20 Is the chemical storage area equipped with a spill kit?

Very few chemical sheds were equipped with spill kits. Equipment included in the spill kits sighted generally included a bucket, shovel and absorbent material such as lime or "kitty litter".

Six of the e-survey respondents had spill kits in their chemical storage area. One of the respondents who did not have a spill kit indicated that the chemical shed was bunded.



Figure 21 Are relevant staff aware of what to do with contaminated soak up material?

The majority of businesses audited were aware of how to handle material contaminated from soaking up chemical spills. This included:

- placing in a container and taking to the "dangerous chemicals area" of the council tip / transfer station
- sending to ChemClear®

A small number of participants indicated they would soak up any spillage with hydrated lime and spread the lime on the ground.

In terms of disposal of these materials, e-survey respondents claimed they would:

- contact the Council for advice regarding their disposal facilities
- take material to an external business equipped to handle the material
- take to ChemClear®
- place in a sealed container and dispose of correctly
- dilute the chemical to at least standard label rate then dispose in pit lined with plastic a metre deep, spread with hydrated lime and cover with half a metre of soil
- dilute as much as possible and move to an area dedicated to occasions such as this
- dilute as much as possible and wash down into the soil in the parking / loading area
- spread it around a safe area in very small amounts



Figure 22 Have any staff completed recognised chemical user training?

In all cases where chemicals are used on the property, staff had completed recognised chemical user training and certificates were sighted.





In the majority of cases, chemicals are only applied by people who have completed recognised chemical user training. In one instance, spraying was completed by other staff members who had been trained by the person who had completed recognised chemical user training.

Figure 24 Is the crop regularly monitored for signs of insects and disease so that informed decisions can be made on when to spray?



In all cases regular crop monitoring was undertaken for evidence of insects and disease and this information was used to determine the need to apply chemicals.

A broad range of monitoring activities and frequencies were observed:

- daily from flowering to harvest
- weekly
- monthly, becoming more frequent close to harvest
- fortnightly by consultant agronomist

Monitoring activities included looking for pests and diseases such as Macadamia nut borers, Fruit Spotting Bug and loopers as well as checking for predators. Some growers were confident with IPM principles and understood pest tolerance thresholds, others stated that by the time damage is observed it is often too late and so they apply some "calendar" sprays.

The e-survey produced similar results with all respondents monitoring their crop to assist in decision making regarding application of agrichemicals. Two respondents used a qualified consultant to assist in crop monitoring and three had completed training in Integrated Pest Management.



Figure 25 Where possible, are 'softer' chemicals used instead of broad spectrum chemicals?

The use of 'softer' chemicals across the lychee growing regions of Australia varied considerably, from 80% in the Atherton Tableland to 33% in Northern NSW / South East Qld. The evidence collected during site visits indicated that a number of businesses using softer chemicals were using endosulfan¹ to control Fruit Spotting Bug. Queensland Primary Industries and Fisheries currently recommend endosulfan for the control of this insect pest and it is considered the 'softest' alternative that is registered for use on lychees. Growers also reported it being "easier on beneficials" than alternative chemicals.

Other strategies used in the 'softer' chemical vein included using <u>Bacillus thuringiensis</u> formulations to control grubs, "Natrasoap" for flattids, as well as pyrethrum sprays. Biological control methods were also utilised, such as <u>Trichogramma</u> for moth control including control of Macadamia Nut Borer.

Nine of the e-survey respondents claimed they used softer chemicals where possible. One respondent highlighted the need for more registered 'soft' chemicals.

¹ At the time this audit was undertaken, endosulfan was registered and recommended for pest control. Lychee growers no longer use endosulfan and the industry is actively engaged in research to find suitable alternatives



Figure 26 Is netting used for insect pest exclusion?

Insect netting was used by over 80% of the businesses audited in the Northern NSW / South East Qld region, and by just over 50% of all businesses audited. Netting was considered effective against Piercing Moth and beetles, including Rhinoceros Beetle as well as birds and flying foxes.



Figure 27 Are neighbours that may be affected, informed before undertaking chemical application?

Over 70% of businesses audited did not inform neighbours that may be affected before undertaking chemical application. Of the other businesses that did inform neighbours:

- some were in peri-urban areas
- some were abiding by local council requirements for buffer zones including establishing vegetation
- informed neighbours of aerial spraying, but not ground spraying
- always informed the neighbours, even though the closest neighbour was 500m away

On further examination of the audit results, while few businesses inform their neighbours, it is unclear to what extent some of these neighbours would be affected. Some businesses that did not advise neighbours also claimed that:

- there were no downwind neighbours, or they were a long way away (e.g. at least 10km)
- they had arrangements with neighbours to avoid spraying near their property when staff were about
- buffer zones existed, in some cases this was about 1km of native vegetation
- discussions had taken place with neighbours and good relations were maintained but they were not informed every time sprays were applied

In other instances when neighbours were not informed, some participants advised that there are ongoing disputes with neighbours regarding issues such as spraying and noise. There were also cases where sprays applied by neighbours caused problems for the lychee grower.

Not all e-survey respondents had neighbours that could be affected, but of those that did, seven said they would inform neighbours and one said they would not. The business that
would not inform neighbours had farms on two sides and bushland elsewhere. This respondent said wind conditions were monitored prior to spraying.





All businesses audited reported they only sprayed in appropriate weather conditions.



Figure 29 If copper is used, are soils tested for copper?

Nationally, copper was used by 59% of the businesses audited. Of these, many were testing soil for copper. The lowest testing regime was in the Coastal Wet Tropics. Where testing did not occur businesses claimed they used very little copper or used it infrequently.



Figure 30 Where there is evidence of copper build-up, has action been taken to address this issue?

The audit did not uncover any evidence of copper build-up in soils.



Figure 31 Has anybody on-farm attended Integrated Pest Management training?

Nationally, 33% of the businesses audited had attended Integrated Pest Management training. Businesses audited in Northern NSW / South East Qld had twice the national average for IPM training. Of the businesses that had attended training, a number had attended DPI and consultant workshops.





Over 80% of participants used an approved program for disposal of used chemical containers. The drumMUSTER® program was well supported and accessed through local tips and participants understood and practiced correct disposal methods (triple rinsing, puncturing).

In instances where a non approved disposal method was used:

- one business triple rinsed containers and placed them in with general waste
- one business triple rinsed then burned containers on-farm.

Anecdotal evidence in other regions of Australia indicates that in some instances accessability issues hinder or prevent primary producers from participating in approved disposal programs such as drumMUSTER®.





Where unwanted chemicals existed, businesses audited disposed of them through an approved program.

In many instances participants specifically mentioned ChemClear®; some had used this service and some had chemicals in storage waiting for the next ChemClear® collection run. Participants had also utilised the appropriate chemical disposal section of the council transfer station.

Nutrient management





In all cases where businesses audited stored synthetic / non-organic fertilisers, storage occurred in a manner that prevented environmental contamination. The most common storage option was on a concrete pads or pallets in a covered shed.

Figure 35 Are your bulk animal manures sited and managed in a way that ensures rain/run-off water will not cause nutrients from the heaps to be washed into waterways?



Few businesses audited used bulk animal manures. The most common organic fertiliser used was "mill mud" or "filter press", a sugar cane by-product. Of the businesses that did use bulk animal manures, the majority stored them in a way that minimised the risk of environmental contamination. This included:

- storing on higher ground, away from low and drainage areas
- ensuring a grassed buffer between the storage area and any waterways
- storing in a bunded concrete bunker, situated at the top of a hill and covered with black plastic (chicken manure)

There was one instance where storage was not considered sufficient, and in this instance the product ("mill mud") was spread within 2 days of delivery.



Figure 36 Are animal manures and composts tested for nutrient status before use?

Nationally, just over 30% of businesses audited used animal manures or compost teas and one business tested them for nutrient status. One participant advised that an analysis of mill mud was available from the mill.



Figure 37 Does the grower apply small amounts of fertiliser often?

Ninety six percent of the businesses audited applied small amounts of fertiliser at a time. Regimes utilised include:

- twice a year from flowering to harvest, not during the wet season
- three applications a year, December, March, August
- four foliar applications a year
- monthly from June to November, none during the wet season
- monthly base fertiliser plus trace elements every second week closer to harvest

A number of businesses used fertigation, either alone or in combination with spreading, at a range of frequencies, for example:

- every 4 days from flowering to just before harvest
- weekly
- 25 times a year
- 3 times a year

The majority of e-survey respondents (6) also claimed to apply small amounts of fertiliser often.



Figure 38 Is fertiliser application equipment calibrated at least annually?

Nearly two thirds of businesses audited calibrated their fertiliser application equipment at least annually. This practice was fairly evenly distributed across the regions, with Northern NSW / South East Qld having the lowest figure at 50%.

Of the many growers that calibrated their equipment more regularly, with some doing it every time they used the equipment and others whenever they changed application rate.

Calibration of fertigation systems did not appear to be done as often as calibration of spreaders.





The use of soil testing to aid in determining the correct rate of fertiliser application varied dramatically across the lychee growing regions. All businesses audited on the Atherton Tableland used soil testing, while only 29% of businesses in the Coastal Wet Tropics used soil testing. The national average was just over 70%.

Of those growers that were not soil testing, a number had undertaken annual soil tests but now either followed the recommendations of a particular, usually organic, fertiliser supplier or had developed their own recommendations based on crop performance. One participant indicated that he had found the recommended amounts were too high for good lychee production so had cut back until the trees perform well.

E-survey respondents using soil testing were in the majority (7) with six of these businesses also using leaf testing.



Figure 40 How often is any given block soil tested?

The most common frequency for soil testing was annual, followed by biennial testing. Sixty percent of growers audited on the Atherton Tableland tested annually compared with 14% in the Coastal Wet Tropics. One grower on the Tablelands tested each block biannually.

The frequency of soil testing being conducted by e-survey respondents was at least every 5 years, with three of the seven businesses who do soil testing conducting soil testing at least annually. One respondent indicated that after testing every year for 10 years they now feel confident with what was happening in the orchard and therefore only needed to check occasionally.



Figure 41 Is leaf testing conducted to make informed fertiliser decisions?

Nationally, 46% of businesses audited carried out leaf testing. Leaf testing was most common in the Northern NSW / South East Qld region, with 67% of growers undertaking tests, and least common in the Coastal Wet Tropics with only 29% of growers undertaking tests.

Eight of the e-survey respondents used leaf testing to assist in determining fertiliser requirements.



Figure 42 How often are leaves tested in any given block?

Seventeen percent of businesses audited had leaf tests done at least annually. One business undertook four leaf tests per block annually, with tests being done monthly for four months in the lead up to harvest.

Amongst e-survey respondents, the most common frequency for leaf testing was at least every 5 years. Three respondents undertook leaf testing at least annually.

Biodiversity management



Figure 43 Has the grower assessed whether or not any significant flora/fauna exists on the property?

Nationally, 13% of businesses audited had assessed whether or not significant flora or fauna existed on their property. An assessment was considered not applicable for 13% of businesses audited as the properties were completely cleared.



Figure 44 Does the property include any sensitive areas such as waterways, wetlands and areas of native vegetation?

A large proportion of properties included sensitive areas such as waterways, wetlands or areas of native vegetation. The proportion of properties in this category was highest in the Costal Wet Tropics (86%), and lowest on the Atherton Tableland (60%).

The sorts of sensitive areas on properties included:

- Native vegetation regrowth
- Riparian vegetation and river flat
- Creeks
- Wetlands
- Revegetation with native vegetation including hoop pine

Significant areas on native vegetation existed on many of the audited properties. One property was 95% original native vegetation and contained a wide range of native fauna including koala.

All e-survey respondents indicated their property included areas of native vegetation, or waterways or wetlands and that these areas were up to 60% of the property.



Figure 45 Are these areas managed to protect them (e.g. restrict stock and human access)?

In the majority of cases, sensitive areas were managed to protect their environmental values. The data showed that of the properties with sensitive areas only one was not managed in this way, and it was used for trail bike and horse riding by family members.

Participants mentioned a variety of wildlife found in these areas including:

- diverse bird population
- diverse snake population, including King Browns and pythons
- kangaroo rats
- platypi
- quolls
- possums

In the case of e-survey participants, the management of these areas was generally passive, with the most common response (50%) being to "leave the areas alone". Where more active management practices were in place, they included:

- fencing
- weed control
- control of animal pests
- excluding stock
- fire management
- controlled grazing

Two respondents also indicated they used the area for recreational activities.



Figure 46 Are environmental weeds and feral animals controlled in these areas?

Nearly three quarters of businesses audited undertook control strategies for weeds and feral animals. In some instances sensitive areas were not managed at all, and in other instances audit results show control measures were in place on properties where no specific sensitive areas were identified.

The sorts of control measures used include:

- trapping and shooting pigs
- shooting of foxes, wild dogs, feral cats, and dingoes
- spraying Cat's Claw and Rats Tail
- controlling weeds such as Groundsel, Rats Tail and Water Hyacinth
- planning an area wide release of calicivirus to control rabbits.



Figure 47 Is the grower able to identify all of the declared weeds that occur in their region?

The ability to identify declared weeds varied considerably by region. In the Atherton Tableland, 20% of participants audited could identify these weeds; while in Central Qld 67% of growers could identify regionally relevant declared weeds.



Figure 48 Does the grower fulfil their obligation to manage declared weeds?

Ninety-six percent of businesses audited were fulfilling their obligation to manage declared weeds. In cases where growers were not able to identify weeds, many informed council and were often supported by active Weed Officers.

Figure 49 Does the grower encourage revegetation of land that is unsuitable for agriculture (e.g. restrict stock and human access/plant native vegetation in these areas)?



Just over one third of growers audited actively encouraged revegetation of land unsuitable for agriculture. Activities undertaken included steep banks being replanted with native trees, establishing windbreaks with native plants, and stabilising gullies with native vegetation. One grower had planted bird attracting vegetation around his farm house.

For nearly 30% of businesses this activity was not applicable as they had already left this land under native vegetation.

Nine of the e-survey respondents stated they encouraged revegetation of land that was unsuitable for agriculture.



Figure 50a - d Methods of bird and flying fox control

All businesses audited used netting to control birds and flying foxes. Nationally, 38% of businesses also used shooting as a method of controlling birds and flying foxes. The only region where shooting was not identified as a control measure was Northern NSW / South East Qld.



Scareguns are rarely used to control birds and flying foxes and electrical wires were not used to control flying foxes by any of the businesses audited.

Netting was used by all e-survey respondents to control flying foxes and birds. Full orchard exclusion and tunnel / row netting were the predominant methods used, with one respondent netting individual trees (800 trees) as well as full orchard exclusion (approximately 200 trees).

Waste management

Figure 51 Is rejected produce disposed of in a manner that will not disturb neighbours or allow it to enter waterways?



Rejected produce was generally disposed of in a manner that didn't disturb neighbours or allow it to enter waterways. Disposal methods included:

- selling via roadside sales or applying to garden as mulch
- dumping in cleared area away from water courses
- giving it to pig farmer for stock feed
- burning
- feeding to native animals
- placing in purpose made dump away from river

The most common disposal method was to apply the waste to the orchard as mulch.



Figure 52 Is oil recycled off farm?

Recycling of oil off farm varied with region. In Northern NSW / South East Qld all businesses audited used off farm recycling while in the Coastal Wet Tropics 43% of businesses used off farm recycling.

Where oil was not recycled off farm it was used for:

- burning fuel
- termite control
- farm machinery maintenance





Nationally, 67% of businesses audited were separating waste materials for recycling. Across the regions this ranged from 50% in Northern NSW / South East Qld to 83% in Central Qld. In some instances the separation of recyclable materials was done by the waste contractor.

Materials that were being recycled included:

- batteries
- tyres
- steel and reusable metals
- plastics
- cardboard

Eight e-survey respondents separated waste materials for recycling, although one of these was only occasional.

Air management



Figure 55 Are neighbours that may be affected informed before undertaking farm activities that may result in significant dust, smoke or noise?

Nationally 29% of businesses audited would inform their neighbours before undertaking activities that might affect air quality, such as creating significant amounts of dust, smoke or noise.

In some regions a permit was needed before burning which required neighbours to be notified.

Advising neighbours of noise was infrequently done and many businesses claimed not to create significant amounts of dust.

The e-survey asked businesses if they burn wastes on-farm and if they inform neighbours that may be affected before burning. Only four respondents did burn wastes and three of them did inform neighbours.



Figure 56 Does the grower avoid burning wet material, plastics and rubber?

In most regions the majority of growers audited avoided burning wet material, plastic and rubber. Many growers did not burn wastes at all.

For growers who did not avoid burning these materials, all acknowledged they had burnt plastics.

All e-survey respondents that did burn wastes also avoided burning wet material, plastics and rubber.



Figure 57 Are night time activities planned so that neighbours are least effected by noise?

Night time farming activities were not relevant for over one third of the businesses audited. However, this question did provide participants an opportunity to demonstrate their sense of humour with regard to non-farming night time activities. Reporting these results is not within the scope of this report.

The main farming activity reported as occurring at night and very early morning was spraying and many participants indicated they either stopped spraying to accommodate neighbours or sprayed in areas distant from neighbours to minimise the noise impact.

Energy management





All but one participant indicated that they maintained major machinery and equipment as per the manufacturer's recommendations. Maintenance was carried out by employees or by external mechanics.

Equipment serviced included:

- Coolrooms; most done annually.
- Tractors; according to manual / annually.
- Harvest equipment; annually after harvest.



Figure 59 When purchasing new plant/equipment, is fuel/electricity efficiency a major consideration?

Half of businesses audited advised that fuel / energy efficiency was a major consideration when purchasing new plant / equipment.

Examples included changing from a diesel pump to electric pump, changing vehicles from diesel to gas and moving to a lower geared tractor as it uses less fuel.

For some growers, the price of the plant / equipment was the first consideration.





None of the businesses audited were using renewable energy alternatives of Green Power instead of traditional non renewable power sources.

Responses indicated there was a lack of knowledge regarding Green Power and growers were unaware if it was available in their area. Others felt that Green Power was a "smoke and mirrors rip off".



Figure 61 Are refrigeration systems adequately sited and insulated?

All businesses audited with coolrooms had them adequately sited and insulated. This included having coolrooms under cover, with insulated floors and with plastic flaps on doors.



Figure 62 Has the grower implemented any strategies for maintaining energy efficiency in the packhouse?

Thirty-eight percent of growers audited had implemented strategies for maintaining energy efficiency in the packhouse.

Examples of some of the efficiencies implemented included:

- turning off equipment when not in use
- constructing vents in packing shed to reduce dependence on fans
- fitting sky lights and whirly gigs
- changing to 3 phase power, with a saving of \$1800/year in power costs
- insulating hydrocooler

If funding or other assistance was available to help you with your environmental management, what are the three areas you would most like assistance with?

This question was posed to e-survey participants and the responses included:

- irrigation / water management (4 requests)
- netting costs (4 requests)
- pest control (2 requests)
- weeds
- drainage
- best practice land management
- crop nutrition
- transport / food miles
- new varieties to improve yield and move away from a biennial crop
- fertigation
- fencing
- permanent roadway construction

Conclusion

Given the number of respondents and audit participants the conclusions that can be drawn from this project are general in nature and should not be considered a definitive industry or regional picture. Bearing these limitations in mind, it is still possible to develop a picture of the Australian lychee industry and for this to be used as a starting point from which to measure future progress in uptake of environmentally sustainable practices. The conclusions drawn here are generalisations; there will be exceptions but this summary provides a snapshot of the industry in 2009-2010.

Industry strengths

In all of the eight management areas assessed through the on-farm audit and e-survey, sound environmental practices were evident. This provides a sound base for the continued uptake and improvement of environmentally sustainable practices by the industry.

Land and soil management

Lychee growers understand the risk of erosion through run-off and have implemented sound practices to minimise the risk and impact of heavy rainfall events. These include, appropriate drainage systems (Figure 7), minimising the time soil is bare during site preparation (Figure 8), actively managing and maintaining permanent grass cover in the inter-row areas (Figures 9 and 10) and ensuring adequate ground cover under trees (Figure 11).

Water management

Related to land and soil management, growers had implemented management strategies to manage water run-off including silt traps, use of on-farm dams and vegetation of drains and gullies (Figure 17).

Chemical management

Agricultural chemical management was well managed from a number of perspectives. Chemical storage facilities were secure and constructed and located to minimise the risk of environmental contamination (Figure 18).

Staff involved with application of agricultural chemicals had completed recognised chemical user training (Figure 23).

The need to apply agricultural chemicals was being assessed through regular crop monitoring for signs of insects and diseases (Figure 24).

The risk of spray drift was being managed by carrying out spraying in appropriate weather conditions (Figure 28).

Disposal of used chemical containers was through approved programs, with drumMUSTER® being well supported by the industry (Figure 32). Similarly disposal of unwanted chemicals was through approved programs, such as ChemClear® (Figure 33).

Nutrient management

Storage of synthetic / non organic and organic fertilisers was managed in a way that minimised the risk of environmental contamination (Figures 34 and 35).

Fertilisers were applied often and in small amounts, by spreader and through fertigation (Figure 37). There is some ambiguity as to what "often" means; some growers indicated that applying fertilisers twice a year was considered "often and in small amounts", while others were applying monthly.

In most regions soil testing is commonly used to inform fertiliser decisions (Figure 39). The only anomaly appears to be the Coastal Wet Tropics. It is unclear why this would be the case.

Biodiversity management

Lychee orchards co-exist with other environmentally sensitive areas such as waterways, wetlands and areas of native vegetation (Figure 44). These sensitive areas are managed by orchardists to protect them (Figure 45) through a range of practices such as fencing, excluding or controlling stock access, controlling weeds, particularly declared weeds (Figure 48) and animal pests (Figure 46) and fire management.

Revegetation of land unsuitable for agriculture is encouraged (Figure 49) and has already been completed on many properties.

Waste management

Rejected produce is disposed of in manner that does not disturb neighbours or allow it to enter waterways (Figure 51).

Air management

Burning of wet materials, plastics and rubber are avoided (Figure 56).

Energy management

Major plant and equipment are maintained (Figure 58).

Refrigeration systems are adequately sited and insulated (Figure 61).

Industry weaknesses

Weaknesses also emerged from the on-site audits and e-survey, although not in all management areas. There were no significant weaknesses identified by the audit and e-survey in the area of land and soil management.

Water management

Checking the uniformity of sprinkler output does not appear to be a well established industry practice (Figure 14), particularly in Northern NSW / Southern Qld and the Atherton Tableland. This can have implications not only on water availability but also fertiliser distribution if the business utilises fertigation.

Very few businesses recycle packing shed water (Figure 16).

Chemical management

Chemical storage areas could be improved by installing bunding (Figure 19) and chemical spill kits (Figure 20).

While the majority of businesses audited were aware of how to handle material contaminated from soaking up chemical spills (Figure 21), results from the e-survey indicated some less than desirable disposal methods, such as "spreading the contaminated material around in very small amounts".

The use of 'softer' chemicals could be increased across industry (Figure 25). Many audit participants demonstrated their use of 'softer' chemicals by using endosulfan. It could be argued that this is not a particularly 'soft' or environmentally friendly chemical.

Attendance at Integrated Pest Management training is not common across the industry (Figure 31).

Nutrient management

Testing of the nutrient status of organic fertilisers used by the industry (mainly "mill mud") is very uncommon (Figure 36).

Leaf testing to assist making informed fertiliser decisions is not widely practiced in the industry (Figure 41). Further, the frequency of testing may not be sufficient to adequately monitor the nutritional trends and needs of the crop.

Biodiversity management

Assessment for the existence of significant flora / fauna exist on the property is unlikely to have taken place (Figure 43).

Growers were not generally able to identify all the declared weeds occurring in their region (Figure 47).

Air management

Communication with neighbours that may be affected by farming activities that cause significant dust, smoke or noise was not common (Figure 55).

While few growers burnt wastes, some admitted to burning plastics (Figure 56).

Energy management

Renewable energy sources and Green Power are not being used within the industry (Figure 60). With regard to Green Power this appears to be due to a lack of knowledge regarding its availability and a lack of confidence in the integrity of the "green" claims.

Implementing strategies for maintaining the energy efficiency of the packhouse should be encouraged (Figure 62). Some good examples of energy efficiencies and cost savings were volunteered by audit participants.

Opportunities

This project provides an opportunity to promote the good environmental practices already in place throughout the lychee industry. As part of the promotional strategy, an opportunity exists to build relationships with neighbours and minimise the risks of complaints and poor relationships. One participant, in an area experiencing urbanisation, created an information leaflet on lychee farming and distributed it to real estate agents and neighbours. Proactive initiatives like this could be undertaken to promote the industry and raise awareness of farming practices.

The identified industry weaknesses also provide opportunities to increase the uptake of environmentally sustainable practices. For instance, more IPM training could be offered in regions where attendance at these courses is low. Industry information sheets could be produced to promote awareness of renewable energy options, appropriate uses of used oil on-farm, options for increasing energy efficiency of packing operations and best industry practice with regard to soil and leaf testing.

Threats

The apparent reliance on endosulfan to control Fruit Spotting Bug and the fact endosulfan is considered the 'softer' option could represent a threat to industry. The negative environmental impacts of endosulfan on crustaceans, fish and water life are well known and included on the product label.

There is also widespread community and industry concern regarding endosulfan residues. The potential for negative publicity associated with the use of this product should not be underestimated. One such example was played out in the media in 2009 / 2010 culminating in an item on Sixty Minutes in April 2010. A commercial fish hatchery in Noosa reported incidents of fish deaths and deformities. Soon after, the media linked these incidents to endosulfan (and carbendazim) use on a neighbouring macadamia plantation. The issue extended to include agrichemical threats to the health of the Noosa River, thus taking it into the wider community. The amount of print, radio and television media coverage surrounding the possible link to the farm and endosulfan was extensive and much greater than the coverage given to the report by the Noosa Fish Health Investigation Taskforce that recently ruled the link out.

Informing neighbours that may be affected before undertaking chemical application was not a common industry practice (Figure 27). Given some participants advised there were ongoing disputes with neighbours regarding issues such as spraying and noise this may represent a threat to the industry.

Recommendations

General comments

Validity of data

The preliminary environmental audit of the lychee industry has yielded useful, though not conclusive, information. The industry may choose to further test the validity of the data by extending the survey. If this is the case, it is recommended that hard copies of the survey be made available as well as electronic copies. This may have been a barrier to participation.

Prioritise actions

It is recommended that the industry prioritise the opportunities identified to improve the environmental sustainability of the lychee industry. There are a number of activities that could be undertaken at minimal cost to the ALGA and business, such as encouraging all lychee growers to equip their chemical storage area with a spill kit, providing information on appropriate methods for disposal of materials used to clean up spills or information on regionally relevant declared weeds. Activities that could require considerable resourcing include investigating alternate control measures for insect pests such as Fruit Spotting Bug. Similarly, respondents to the e-survey highlighted a number of areas where further resources / research is required. The top three were:

- irrigation / water management
- netting costs
- pest control

It appears likely that these could be topics of interest to members of the ALGA. This assertion should be tested with lychee growers and packers.

To assist in prioritising, a list of specific recommendations is included below.

Provide information

Encourage the lychee industry to continue to adopt best practice with regard to environmental management by aiding in access to information through field days, production and distribution of best practice guidelines. The collation, and where necessary, development of such reference materials will overcome one of the apparent hurdles to adoption – not knowing what should be done or how to find the information. Delivering this information in a variety of formats (pamphlets, best practice manual, web based, field days, webinars, conferences) will maximise opportunities for access and implementation.

Certification ready

Consideration should also be given to assessing where the industry sits with regard to compliance with environmental systems such as the Freshcare Environmental Code of Practice; and proactively preparing for the eventuality of this system or similar being required by domestic retailers. It is strongly recommended that industry compliance and capacity be built in advance of certification being made mandatory for supply.
Monitoring progress

It is recommended that the ALGA determine the frequency for re-auditing the industry so that improvements and changes in industry needs can be monitored over time.

The ALGA should also consider how the information gathered through this project is to be used. There is an argument for developing positive case studies and press releases, but there is also an argument for not publicising the work undertaken and continue to quietly work towards greater levels of adoption of environmentally sustainable practices.

Specific recommendations

Specific recommendations to enhance environmental sustainability of lychee industry and to prepare the industry to be able demonstrate its environmental credentials to the broader community include:

- 1. Water use efficiency
 - a. Encourage regular, at least annual pre-irrigation season, checks of the uniformity of sprinkler output.
 - b. Encourage packing sheds to recycle water, such as diverting to irrigation.
- 2. Management of agricultural chemicals
 - a. Encourage bunding of all chemical storage areas, or of chemical containers. (For example place chemical containers in a tray that can contain any spills should the container break / leak. This can be a cheaper and more immediate solution for some growers).
 - b. Require all chemical storage areas to be equipped with chemical spill kits.
 - c. Distribute information on the appropriate way to handle and dispose of contaminated materials.
 - i. Include information regarding actual disposal sites / options.
 - d. Provide lychee specific Integrated Pest Management training / field days.
 - e. Encourage use of "softer" agricultural chemicals.
 - i. This could be in conjunction with IPM training. It may require specific research into chemical options available to lychee growers, including an analysis of chemicals currently available and their environmental impact and application for off-label permits on behalf of industry.
- 3. Nutrient management
 - a. Contact major suppliers of organic fertilisers and encourage the provision of information regarding the nutrient status of products to growers.
 - i. Potential for introduction of contaminants should also be considered and discussed with suppliers.
 - b. Advise growers of the benefits of understanding the nutrient status of organic fertilisers and the potential for other materials / contaminants to be present.
 - c. Seek advice on the merits of regular soil, leaf and sap testing as a means of strategic fertiliser application.
 - i. Consideration should also be given to defining what best practice is with regard to the frequency of these tests.

- ii. Distribute information regarding best practice for soil, leaf and sap testing.
- 4. Biodiversity management
 - a. Encourage assessment of properties for the existence of significant flora / fauna.
 - i. To assist in this assessment, hold field days in each of the regions / biodiversity sub regions, create / distribute reference materials detailing flora and fauna of significance in each region / sub region.
 - b. Distribute regionally relevant information regarding declared weeds to lychee growers.
- 5. Air management
 - a. Encourage proactive management of relationships with neighbours.
 - i. Consider developing a pamphlet that explains lychee production in layman's' terms for growers to distribute to neighbours.
 - b. Investigate regional waste disposal alternatives, particularly for disposal of plastics and advise growers of these rather than burning plastics.
- 6. Energy management
 - a. Investigate opportunities move industry toward renewable energy sources. Develop an information pack including locally relevant alternatives, details of government assistance and also deliver information at field days.
 - b. Provide information on options for energy audits to identify cost savings and areas of energy leakage / loss.
 - c. Encourage information sharing within the industry with regard to energy saving ideas.
 - d. Launch a "Lychee energy challenge" to identify and promote uptake of energy savings across the industry.
 - e. Investigate funding opportunities (external to Horticulture Australia Limited) through Climate Change and Greenhouse gas initiatives, such as through the Australian Government Department of Climate Change and Energy Efficiency.

Appendices

Appendix 1: E-survey used

2. Questions	
1. Is permanent inter-row grass cover maintained during, or established as soon as possible after, grou	ind preparation and planting?
) Ves	
Comments:	
2. Do you mulch around your lychee trees?	
Ves	
○ No	
Comment:	
3. How do you decide how much to irrigate?	
Soil moisture monitoring	
Dig hole/auger used to determine depth of moisture	
Industry recommendations	
Own experience	
I don't irrigate	
Other (please specify)	7
4. Have you monitored soil moisture within the last 5 years to determine crop irrigation needs? If so,	now have you monitored soil moisture?
I have not monitored soil moisture in the last 5 years	Water front detectors
Enviroscan	Dig hole
Tensiometers	Auger
Other (nlease specify)	
5. Is the uniformity of sprinkler output across blocks of trees checked at least annually?	
⊖ Yes	
O No	
I use a different irrigation method	
J I don't irrigate	
Comments:	
]
	-
6. Do you apply small amounts of fertiliser often ?	
U Yes	
) No	
J I don't use fertiliser	
Comments:	_
7. Do you use pesticides, including herbicides, on your lychee orchard?	
) Yes	
No - ao to question 13	
Comments	
	1
8. Is the crop regularly monitored for signs of insects and disease so that informed decisions can be ma	ade on when to spray?
No - my crop is not monitored	
Yes - I monitor my crop and have completed training in Integrated Pest Management	
Yes - I monitor my crop	
Ves - A qualified consultant monitors my crop	
Comments:	

. Is the chemical	storage area equipped with a spill kit?
) Yes	
) No	
Comments:	
.0. If you had a ch	emical spill, what would you do with the contaminated soak up material?
	Î
1. Where possible	, are 'softer' chemicals (eg Mimic, Success) used instead of broad spectrum chemicals?
🔾 Yes	
◯ No	
Comments:	
9 9	
12. Are neighbours	that may be affected informed before undertaking chemical application?
) Yes	
O No	
J I have no neig	phours that could be affected
Comments:	
12. Te esil acid/acid	ast tarting conducted to make informed factilizes desisters?
Soil testing	an resulty or more frequently
Soil testing	annuary of more nequency
Leaf testing -	at least once even 5 years
Cail as leafter	at least office every 5 years
	testing
Comments:	
14. Does vour prop	erty include any areas of native vegetation, or waterways, or wetlands?
Ves Ves	
No - go to que	estion 16
15. If so, what per	centage of your property do these areas take up?
16. How do you ma	nage these areas? (tick all that apply)
Leave the are	as alone
Fenced	
Stock exclude	ed .
Fire managem	ient
Controlled gra	zing
Native plants	and animals identified and actively protected
Weed control	
Pest animal c	ontrol
Used for recre	aational activities
Other (please spe	cify)
17. Do you encours	ne revenetation of land that is unsuitable for agriculture?
Ves	genereyesation of iano that is ulbuildble for agricuitdle?
O No	
All of my land	is suitable for agriculture
Commonter	
Comments:	

18. Do you use netting for bird and flying fox cor	ntrol? If yes, how is it deployed?		
No - I don't use netting			
Full orchard exclusion			
Tunnel/row netting			
Individual tree netting			
Other (please specify)			
19. If you don't use netting for hird and flying fo	ax control, how do you protect your crop from them?		
	_		
20. Do you separate waste materials for recyclin	ig?		
) Yes			
○ No			
Comments:			
21. If you burn wastes on your farm, do you info	orm neighbours that might be affected before burning?		
I don't burn on farm			
Ves			
○ No			
22. Do you avoid burning wet material, plastics a	and rubber?		
IND			
		Descious Next	
		Previous Next	
3. Tell us about yourself		Previous Next	
3. Tell us about yourself		Previous Next	
 3. Tell us about yourself 23. Where is your farm located? 		Previous Next	
 3. Tell us about yourself 23. Where is your farm located? Atherton Tableland 		Previous Next	
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28.	Nhat QA / food safety / environmental management standards are you cert	ified to?			
	None	WQA			ISO 14001
	Freshcare Food Safety	SQF			GlobalGAP
	Freshcare Environmental	НАССР			
	Other (please specify)				
29.	Do you have other enterprises on farm (eg grazing, other crops etc)? If so, w	hat QA / food safety / envi	ironmental certi	ifications do you have for these enterpr	ises?
30.	f funding or other assistance was available to help you with environmental	management, what are the	three areas you	would most like assistance with?	
		*			
			Previous	Done	

Appendix 2: Mailout survey



Australian Lychee Industry Environmental Stocktake

2. Instructions - PLEASE READ BEFORE PROCEEDING

When you click 'submit survey' at the end of this survey, your responses will be saved to a remote website that can only be accessed by the Project Manager.

The majority of questions can be answered by selecting the option/s that best suit your business. If you feel the answer is not as simple as 'yes' or 'no', please add a comment.

Please don't hesitate to contact me if you require any assistance. I would be happy to send you a hard copy of this survey if you would prefer.

I appreciate your participation.

Kind Regards

Amy Russell Project Manager TQA Australia P: 1300 952 221 Mob; 0400 160 442 E: amy.russell@tqainc.com.au

Questions		
1. Is permanent inter-row grass c as soon as possible after, ground	over maintained during, or establish preparation and planting?	ned
⊖ Yes		
O No		
Comments:		
0		
2. Do you mulch around your lych	ee trees?	
Yes		
O No		
Comment:		
3. How do you decide how much t	o irrigate?	*
Soil moisture monitoring		
Dig hole/auger used to determine depth of moi	sture	
Crop condition		
Industry recommendations		
Own experience		
Other (please specify)		
4. Have you monitored soil moistu crop irrigation needs? If so, how h	re within the last 5 years to determi ave you monitored soil moisture?	ne
I have not monitored soil moisture in the last 5 years	Water front detectors	
Enviroscan	Dig hole	
Tensiometers	Auger	
Other (please specify)		
•		

	<i>?</i>
6. Do you use	pesticides, including herbicides, on your lychee orchard?
O Yes	
No - go to quest	ion 12
Comments:	
Yes - I monitor	my crop
Yes - I monitor	my crop and have completed training in Integrated Pest Management
Yes - I monitor	ту сгор
Yes - A qualified	consultant monitors my crop
Comments:	· · · · · · · · · · · · · · · · · · ·
Comments:	
Comments: 8. Is the chem	ical storage area equipped with a spill kit?
Comments: 8. Is the chem O Yes	ical storage area equipped with a spill kit?
Comments: 8. Is the chem Yes No	ical storage area equipped with a spill kit?
Comments: 8. Is the chem Yes No 9. If you had a	ical storage area equipped with a spill kit? a chemical spill, what would you do with the contaminated
Comments: 8. Is the chem Yes No 9. If you had a soak up mater	ical storage area equipped with a spill kit? a chemical spill, what would you do with the contaminated rial?
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Comments: 8. Is the chem Yes No 9. If you had a soak up mater 10. Where posinstead of brox	a chemical spill, what would you do with the contaminated rial?
Comments: 8. Is the chem Yes No 9. If you had a soak up mater 10. Where pos instead of brok Yes	a chemical spill, what would you do with the contaminated rial?
Comments: 8. Is the chem Yes No 9. If you had a soak up mater 10. Where pos instead of brok Yes No	a chemical spill, what would you do with the contaminated rial?

chemical application?	
⊖ Yes	
O No	
I have no neighbours that could be affected	
Comments:	
12. Is soil and/or leaf testing conducted to decisions?	o make informed fertiliser
Soil testing - at least once every 5 years	
Leaf testing - annually or more frequently	
Leaf testing - at least once every 5 years	
Soil or leaf testing less often than every 5 years	
No soil or leaf testing	
13. Does your property include any areas	of native vegetation or
13. Does your property include any areas waterways, or wetlands?	of native vegetation, or
13. Does your property include any areas waterways, or wetlands?	of native vegetation, or
L3. Does your property include any areas waterways, or wetlands? Yes No - go to question 16 L4. If so, what percentage of your proper	of native vegetation, or ty do these areas take up?
 13. Does your property include any areas waterways, or wetlands? Yes No - go to question 16 14. If so, what percentage of your proper 	of native vegetation, or ty do these areas take up?
L4. If so, what percentage of your propert	of native vegetation, or ty do these areas take up?
 13. Does your property include any areas waterways, or wetlands? Yes No - go to question 16 14. If so, what percentage of your proper 	of native vegetation, or ty do these areas take up?
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13. Does your property include any areas waterways, or wetlands? Yes No - go to question 16 14. If so, what percentage of your proper	of native vegetation, or ty do these areas take up?

15. now do you manage these areas? (tick all th	at apply)
Leave the areas alone	
Fenced	
Stock excluded	
Fire management	
Controlled grazing	
Native plants and animals identified and actively protected	
Weed control	
Pest animal control	
Other (please specify)	
Comments:	
L7. Do you use netting for bird and flying fox con	trol? If yes, how is it
deployed?	
No - I don't use netting	
Full orchard exclusion	
Tunnel/row netting	
Individual tree netting	
Individual tree netting Other (please specify)	
Individual tree netting Other (please specify)	
Individual tree netting Other (please specify) 8. If you don't use netting for bird and flying fo	x control, how do you
Individual tree netting Other (please specify) 8. If you don't use netting for bird and flying for protect your crop from them?	x control, how do you
Individual tree netting Other (please specify) US. If you don't use netting for bird and flying for protect your crop from them?	x control, how do you
Individual tree netting Other (please specify) 18. If you don't use netting for bird and flying for protect your crop from them?	x control, how do you

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19. Do you separate waste materials for recycling?

O Yes O No

Comments:

20. If you burn wastes on your farm, do you inform neighbours that might be affected before burning?

I don't burn on farm

0	Yes

 \bigcirc No

21. Do you avoid burning wet material, plastics and rubber?

I don't burn on farm

Yes
No

Tell us about yo	ourself		
22. Where is your	farm located?		
Atherton Tableland		Central Queensland	
Coastal Wet Tropics		Northern NSW / South East QLD	
Other (please specify)			
23. What is your a	ge?		
0-30	41-50	O 61 and over	
31-40	51-60		
24. How many yea	rs have you bee	n involved in horticulture?	
0-5 yrs		25-34 yrs	
5-14 yrs		O 35-44 yrs	
0 15-24 yrs		45 yrs or more	
25. How many her	tares do vou hav	re planted to lychees?	
О 0-5 На			
О 5-10 Ha		O 31-40 Ha	
○ 11-20 Ha			
Other (please specify)		\mathbf{O}	
26 What best des	cribes your lyche	e operation?	
	chibes your lyche		
Grower and packer			
			a.
27. What QA / foo you certified to?	d safety / enviro	onmental management standa	ards are
None		ISO 14001	
Freshcare Food Safety			
Freshcare Environmenta			

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28. Do you have other enterprises on farm (eg grazing, other crops etc)? If so, what QA / food safety / environmental certifications do you have for these enterprises?

29. If funding or other assistance was available to help you with environmental management, what are the three areas you would most like assistance with?

*

Appendix 3: Bibliography

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