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Supporting production nursery businesses during a biosecurity incursion: Social and economic research report

Milestone 104

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Acknowledgments

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Executive summary

This research report is the second research component of a larger research project NY18010 *Ensuring Business Continuity during biosecurity incursions: Social and Economic research learnings for the Production Nursery Industry*. The overall project objective is to develop a framework of supportive measures to assist individuals and businesses in the production nursery industry to cope with and recover from a biosecurity incursion event.

This report presents the findings of qualitative and quantitative research (namely, interviews with growers and other stakeholders (n=31), and a survey of growers (n=80)) on the main social and economic impacts of a biosecurity incursion on production nursery businesses, and potential corresponding support measures.

Main findings:

A. Social and economic impacts

- The quantitative survey found that 40% (n=32) of participants had been impacted, directly or indirectly, by a biosecurity incursion. Around half of these (n=17) had been impacted by one incursion, while the remainder had been affected by two or more incursions.
- Around half of the survey participants (n=44, 55%) reported that they were not aware of any other production nurseries being impacted by a biosecurity incursion in the last 5 years.
- Operational impacts: because many of the economic impacts arise as a result of actions that nursery business are required by the authorities to undertake during an incursion response, these actions were categorised and listed as 'operational impacts'. They provide necessary context to many of the economic and social impacts and to corresponding improvements or supportive actions.
    - The main operational impact categories identified were, as follows:
        - movement restrictions (specific to host plants or more general to all plant materials, people, vehicles, etc)
        - surveillance – increased monitoring, inspection, recording of information, and reporting to authorities
        - new or additional pest control procedures – mainly in the form of chemical sprays, but also installation of netting, weed control, etc
        - new or additional biosecurity procedures – e.g., plant hygiene, nursery operational hygiene, visitor management
        - additional administration requirements – e.g., generating, compiling and provisioning records and compliance documentation to authorities and/or customers

        - isolation, quarantine and/or partitioning of plant stock
        - disposal and/or destruction of plant stock and other infested materials
    - The quantitative survey also revealed that some business experienced direct impacts such as a restriction or requirement placed upon them by government authorities (n=23 of 32 affected by an incursion); and/or indirect impacts such as flow-on effects from restrictions/requirements placed on another business (n=14 of 32 affected).
    - Quarantine orders appeared to be less prevalent among those affected (n=4 of 32 affected), as compared to the imposition of a geographic biosecurity zone (n=15 of 32 affected) or other restriction or requirement imposed (e.g., site inspection, request for records) (n=17 of 32 affected). In addition to government, customers also were identified as another originator of certain restrictions or requirements (n=7 of 32 affected)

- Economic impacts: the interview findings suggested economic impacts generally arose from the operational impacts, notably from movement restrictions that restricted trade, destruction of plant stock, new or enhanced pest control regimes (e.g., chemical sprays, netting) and, in a few cases, major reconfiguration of the nursery system or facilities to prevent infestations.
    - These findings were supported by the survey of growers, where the most common impacts reported included:
        - Increased costs (n=15, 47%)
        - Increased workload requirements (n=13, 41%)
        - Stock losses (destruction) (n=12, 38%)
        - Restricted or reduced trade (n=13, 41%)
        - Stock losses (reduced value) (n=9, 28%)
    - In terms of costs and financial impacts, the survey results showed that:
        - On average, participants spent $15,623 in managing the incursion. However, the distribution was positively skewed; with six participants (19%) not spending any money on managing the incursion and around one-third (n=11, 32%) spending less than $10,000.
        - On average, participants destroyed or disposed of $97,842 worth of plant-related stock and equipment. Again, the distribution was positively skewed; with 14 participants (44%) not losing any stock or equipment at all.
        - It was estimated that the average annual income lost was 4.6%.

- In addition to these quantifiable financial impacts, one-quarter of these survey participants (n=8, 25%) reported that they lost customers or markets because of the incursion.
- In terms of the duration of impacts, survey participants reported greatly varying time lengths, ranging from as little as up to a fortnight up to more than 20 years. Around one-third (n=10, 31%) indicated that their business was still 'moderately' to 'greatly' affected by the incursion.
- Restriction or reduction in trade tended to either occur within one's state/territory (n=10 of 13 affected), and/or with another state/territory (n=10 of 13 affected), which is consistent with the fact that the greatest proportion of plant and stock movement (in terms of sales and purchase) tends to occur within one's state.
- A minority of survey participants (n=2, 18.2%) experienced a period time where they were unable to sell any product.

- Social impacts
  - The interview study revealed four main types of social impacts experienced by growers:
    1) the operational demands of managing the business during an incursion response
    2) the financial implications of the incursion for the business
    3) conditions of high uncertainty, which exacerbated both 1 and 2, and
    4) difficulties arising in social relations with other parties, notably government authorities and other nursery businesses (but also the nursery industry bodies in a minority of cases).
  - Interview results suggested that the severity of social impacts was related to the severity of economic impacts, which was strongly related to the duration of time over which trade was impaired and the extent of that impairment, and to conditions of high uncertainty surrounding the incursion.
  - Interviews also showed that stress associated with difficulties in relationships with other nursery businesses (and to a lesser extent nursery industry bodies) was related to perceptions of being unfairly blamed for the incursion, with a resulting sense of stigma and ostracism from industry peers.
  - Results from the quantitative survey revealed that:
    - Stress reactions varied. A quarter (n=8, 25%) of impacted growers experienced moderate to overwhelming financial stress during the incursion, while the remainder reported none or a little financial stress (n=24, 75%).

- In terms of perceived stress, 17 (n=53%) rated the incursion experience as moderately to extremely stressful. However, most participants indicated that they felt able to cope. Additionally, the majority of participants reported that their business' reputation, and relationships with other nurseries and customers remained unchanged.
- In a hypothetical example presented to all survey participants, the majority (n=71, 89%) felt moderately to very confident that they could continue to trade through a biosecurity incursion. However, more than half (n=52, 65%) recognised that whether they could continue to trade through an incursion was largely outside of their personal control.
- When asked, in an open-ended question, what caused the greatest stress during the incursion, participants mainly commented on the uncertainty and unknown element of being impacted (i.e., Where did the disease come from? What is it? How long will it last?).

B. Supportive actions

- Supportive actions were identified for each of the major parties in an incursion – the production nursery business, industry representative bodies, and government authorities. Interviews showed that, while in many cases the responsible party(s) for certain actions is reasonably clear, in other cases views differed over the sharing of responsibilities, with the sharing of many responsibilities an ongoing conversation between industry and government.
    - Actions that production nursery businesses could take to mitigate the impacts of an incursion were reasonably clear: the main theme from interviews was 'preparedness'. This referred to being prepared in terms of biosecurity generally (to reduce the risk of an incursion), but also being prepared specifically for the eventuality of an incursion affecting the business at some point in the future.
        - Biosecurity preparedness at the farm-level was seen to start with the basics of biosecurity planning and practice – having a biosecurity plan and undertaking good biosecurity practices as standard business operations.
        - Planning specifically for the potential eventuality of an incursion was seen as having done some planning for an incursion, that is, business 'contingency planning' in terms of mapping a range of potential scenarios and planning for them. The main suggestions were for business diversification and contract design and management.

- At a broader level, preparedness for an incursion was seen as part of a mature, professional approach to business management, that included business risk management and business continuity planning.
- With regards to the survey results on what nurseries could do themselves to prepare and respond to an incursion, participants felt that they could:
    - Be aware of, and perform, biosecurity best practices in their nursery
    - Keep staff educated, informed, and well trained
    - Adhere to industry standards and government regulations
    - Access expertise through their networks
- Most participants (n=48, 73%) also placed a moderate to high priority on developing a biosecurity plan in case an incursion occurs.
- When presented with a list of potential supports, survey participants showed:
    - the most interest in accessing experts who can provide useful information and assistance on biosecurity-related matters,
    - moderate interest in receiving information and/or training on how to manage their business through an incursion,
    - slight interest in insurance cover and access to information on managing personal and social challenges.

- Areas where government authorities and industry representative bodies could support growers, from interview results:
    - providing information and tools to raise awareness and build capacity for both general biosecurity awareness and good practice, and for on-farm incursion management
    - with regards to preparedness for an incursion, supporting nursery business management improvements, particularly around scenario planning, business diversification and contract design and management
    - in the event of an incursion, rapid provision of useful and clear information specifically relevant to the incursion, to help dispel uncertainty and support practical action by growers to help achieve a faster return to trade
    - inclusion of grower information in the response decision-making process

        - as rapid return to trade was generally seen as the most effective and sustainable way to minimise the economic impacts of an incursion, suggestion to facilitate this included:
            - rapidly deployment of evidence- and risk-based approaches that could enable either partial or full return to trade
            - system-level incursion preparedness in terms of the development of biosecurity standards and protocols that could facilitate quicker resumption of trade
        - consideration/investigation of a more expansive compensation mechanism than the current Owner Reimbursement Costs (ORC) scheme
        - in the context of blaming, stigma and ostracism by industry peers, strong leadership by government authorities and industry bodies to show empathy and support may be helpful in blunting peer and community accusations and ultimately fostering a more a supportive environment.
    - Survey participants reported higher levels of satisfaction with support received from family and/or friends, the nursery industry association, and other nursery businesses. Satisfaction with support from government agencies and biosecurity officers was more variable and hovered around the mid-point of the scale.
    - Also variable was participant's rating of collective efficacy, which suggests that people differed in their experiences of various groups (businesses, government, industry people) working together to address the problems associated with the incursion.
    - With regard to the survey findings about what else government and industry could do, in open-ended comments, participants felt that government could help nurseries in managing biosecurity incursions by:
        - Improving and streamlining their communications
        - Consulting more with industry
        - Providing more financial and technical support
        - Acting more quickly and efficiently
    - Similarly, in open-ended comments, participants felt that the nursery industry associations could help nurseries by:
        - Maintaining their dissemination of up-to-date information
        - Continuing their current efforts

- Providing expert advice and support to members

The next steps of this project will involve utilising the information generated in this study to develop a business continuity framework for production nursery businesses. The aim of this framework is to provide a suite of supportive measures that aids planning and decision-making, by a range of relevant parties, to help production nursery businesses cope with and recover from a biosecurity incursion event.

1 Introduction

1.1 Background

This empirical research investigation is the second research component of a larger research project NY18010 *Ensuring Business Continuity during biosecurity incursions: Social and Economic research learnings for the Production Nursery Industry*. The overall project objective is to develop a framework of supportive measures to assist individuals and businesses in the production nursery industry to cope with and recover from a biosecurity incursion event. This empirical research follows a literature review (Loechel, 2020; Milestone 103), the first research component of the overall project, and will in turn inform the third research component that follows. The third component will comprise development of the business continuity framework, which will be tested with a range of stakeholders through a scenario workshop process. The third research component will be managed by NGIQ rather than CSIRO.

This empirical report will use a range of technical terms and refer to various aspects and components of the Australian plant biosecurity system, and the production nursery industry more specifically. For a guide to these technical and contextual aspects, it is recommended the reader refer to the preceding literature review component of this project.

1.2 Study rationale and structure

The literature review that preceded this empirical study (Loechel, 2020; Milestone 103, delivered November 2020) identified a range of social and economic impacts of biosecurity incursions on production nursery businesses and other plant industries in Australia. A range of corresponding support measures to help businesses respond and recover from biosecurity incursions were likewise identified. However, the review also highlighted the lack of relevant quality information available in the public domain specifically related to the production nursery industry in Australia. To fill this gap, this study sought to engage directly with production nursery business owners and managers, and other knowledgeable stakeholders, to gain their views on the impacts of biosecurity incursions on businesses and suggestions for supportive mechanisms.

Both qualitative and quantitative methodologies were employed to identify impacts and potential supportive measures. First, qualitative, semi-structured interviews were conducted with a range of stakeholders (n=31) who have been directly involved with a biosecurity incursion in Australia related to the production nursery industry. These included production nursery business owners and managers ('growers'), industry association personnel, and government officials and scientists involved in responding to emergency plant pest incursions in Australia. Second, findings from the interviews were used to guide development of a quantitative survey of production nursery businesses (n=80). The survey

was undertaken to gain a greater range of input specifically from growers, notably relating to the following areas: their awareness, of, and experience with, biosecurity incursions, particularly the different types and degree of severity of social and economic impacts; perceptions about potential future incursions; and, suggestions for ways that production nursery businesses could be best supported during an incursion. Participants in the qualitative and quantitative studies were not in any way linked, with two separate recruitment processes undertaken completely independently of one another, and the survey responses being anonymous to the researchers.

This report will first describe the findings of the stakeholder interviews before turning to those of the grower survey. The two sections are presented somewhat differently due to the nature of the research methodologies. The description of interview findings incorporates a range of views, from the different types of stakeholders, for each topic area – operational, social and economic impacts and suggested improvements and supportive actions. The blending and contrasting of different viewpoints require careful distinction and nuance and is therefore narrative in style. In contrast, reporting of the survey results is descriptive in style, and, due to the large number of questions involved, only a summary of key results is presented in the body of the report. The detailed survey results are supplied in full in Appendix A. The report concludes with a brief overview of findings, integrating results from both the interviews and survey.

2 Interview findings

2.1 Introduction

Interviews were undertaken with a range of stakeholders (n=31) involved in the response phase of a biosecurity incursion affecting production nursery businesses. These included growers as well as personnel in biosecurity-related roles in nursery industry associations, government agencies (national and state and territory levels), and some downstream industries and customers of production nursery businesses. The aim was to gain a broad range of perspectives on the impacts arising from a biosecurity incursion and potential measures to support nursery businesses to manage an incursion.

2.2 Method

To help focus the research, a number of Emergency Plant Pest (EPP) biosecurity incursions known to have occurred over the past decade and having significantly affected production nursery businesses, were identified. The EPP incursions were identified in consultation with the Biosecurity Manager of Greenlife Industry Australia, according to the following criteria: having a significant impact on one or more production nursery businesses; likelihood of recruiting potential interviewees impacted by the incursion; and, recency of the incursion.

The following five incursions were selected to focus on (from older to more recent discoveries): myrtle rust (2010), banana freckle (2013), cucumber green mottle mosaic virus (CGMMV; 2014), tomato potato psyllid (TPP; 2017), and citrus canker (2018). However, interviewees were not always limited to these 5 focal incursions, with some interviewees drawing on others to illustrate a point. The most common of these other incursions raised in interviews are both current incursions: blueberry rust (Victoria, 2014/2021) and serpentine leaf miner (2020).

2.2.1 Participant recruitment

A total of 31 interview participants were recruited, comprising four main categories of participants:

- production nursery business managers ('growers') known to have been affected (directly and/or indirectly) by one of the focal biosecurity incursions (n=9, representing 8 separate businesses as one interview included 2 interviewees)
- government biosecurity managers and scientists involved in incursion responses (n=14)
- production nursery industry personnel who were involved in assisting a response (n=4)
- downstream supply-chain industry personnel (i.e., from industries that included customer businesses of affected production nursery businesses (n=4)).

Interview participants were drawn from all the states and territories. Refer to Table 1 for a breakdown of participants by stakeholder type and jurisdiction.

Table 1. Interviewee recruitment numbers

STAKEHOLDER TYPE	NO.	JURISDICTIONS	NOTES
Growers	9	QLD, NSW, WA, NT	Representing 8 businesses
Nursery industry association	4	National, NSW, WA	
Government – national plant biosecurity management	3	National	Includes government-industry partnership organisation (PHA)
Government – state & territory:	11	QLD, NSW, VIC, TAS, SA, WA, NT	
biosecurity management	8		Main role type, includes some with scientific role
scientific & diagnostic	3		Main role type, includes some with management role
Government - total	14		
Supply chain industry/customers	4	National	
Total	**31**		

Recruitment of growers

Due to the sensitive nature of the topic, growers were recruited indirectly, anonymously and through a trusted source. It was understood that it was likely that some growers who had been impacted by a biosecurity incursion would not feel comfortable recounting their experience to a researcher, particularly given the focus on social and economic/financial impacts. For this reason, production nursery industry personnel, whose roles involved supporting growers during biosecurity incursions, were approached by the researchers to assist recruitment. The production nursery industry personnel first independently and anonymously identified potentially suitable growers before approaching them and asking whether they would be willing for their contact details to be passed onto the researchers. Of the 11 growers approached in this way, 9 agreed to be contacted by the researchers.

Recruitment of other stakeholders

Other potential interviewees were identified according to the criteria of being nursery industry, government or downstream supply chain personnel, who were likely to have either specific knowledge of, expertise in, or a current role relevant to, biosecurity incursions that affected the production nursery industry. These candidates all held a (past or present) outward-facing role regarding biosecurity related matters that included engagement with growers, other stakeholders and/or the public. They were identified either from publicly available information (e.g., organisational websites, media articles, industry newsletters) or from referral by production nursery industry personnel.

Potential interviewees were contacted by email and invited to participate in an interview and were provided with a Project Information Sheet and Consent Form (Appendix C).

While each of the nominated biosecurity incursions were originally detected in one particular state or territory in Australia, most of them went on to spread to other jurisdictions, and all of them had cross-jurisdictional impacts in terms of the response required from the other jurisdictions to develop inter-state trade protocols.

2.2.2 Interviews

Interviews were conducted over the period February to May 2021 and were undertaken primarily by telephone, with some via video-conference, and one in-person/face-to-face. Interviews were semi-structured in that a list of questions (Appendix B) was used to guide the interviews, however with flexibility to explore some questions in greater depth and/or include related issues. Interviews took 54 minutes on average and all were audio-recorded and transcribed for analysis.

Broadly speaking, the interview questions sought information on the following two topics:

- Impacts experienced by nursery businesses during a biosecurity incursion (operational, economic, and social), including their duration and severity
- Measures that could be taken by various relevant parties (businesses, nursery industry associations, government, and other biosecurity-related organisations) to reduce the

impacts of a biosecurity incursion on nursery businesses and to support nursery business owners and staff to manage and recover from an incursion.

Almost all the growers were questioned about the one particular incursion that they had experienced, however a small number of growers were able to draw on more than one experience. In contrast, most of the production nursery industry personnel and government officials and scientists interviewed, had experience with multiple biosecurity incursions. They were therefore able to answer questions in relation to several (and in some cases all) of the nominated case-study incursions. Therefore, due to time constraints, these interviewees were typically asked to provide comment on the impacts and responses to biosecurity incursions in general, drawing examples from the various cases they had experienced that had affected nursery businesses (rather than describing their experience with just one incursion or each of a number of the nominated incursions in turn).

2.2.3 Data analysis

The interview transcriptions were first 'cleaned' – errors in transcription corrected, mainly in relation to technical information – prior to entry to Nvivo qualitative analysis software. Interview transcripts were coded for main themes based on the key questions of interest, with the main theme points then summarised and organized accordingly. While it was initially intended to develop separate 'case-study' reports around each EPP incursion type (myrtle rust, banana freckle, TPP, citrus canker, and CGMMV), it quickly became apparent that many of the same themes emerged for each of the incursions, such that it would have made extremely repetitive reading to analyse the data by pest incursion. Additionally, due to the small number of participants involved in each incursion, particularly of growers, reporting by pest incursion type would have risked identifying individuals. Further, many government and industry participants were questioned, and responded accordingly, in terms of what they had observed and learnt across the various incursions they had experience of, not in terms of specific, individual incursions. For these reasons, themes were identified and analysed across all incursion types.

2.3 Main findings

2.3.1 Impacts

The interview questions sought information on three main types of impacts:

- operational – referring to impacts on the practical day-to-day operations of a production nursery business
- economic – financial losses, additional expenses, and impacts on trade (buying and selling of product)
- social – referring to social relations with other people and organisations as well as personal emotional/psychological impacts

Generally, the various types of interviewees – nursery business owner/managers, industry association representatives, and government officers – identified similar impacts on nursery businesses. Thus, for example, it was apparent that the government officials interviewed were well aware of the operational, economic and social impacts arising from the various restrictions and requirements that they often had to place on businesses.

Operational impacts

While the focus of this study was on the social and economic impacts, it became immediately clear that many of the economic impacts arose from changes to on-farm operational procedures required by the incursion response. For this reason, the main operational impacts are first listed to provide a brief description for context.

The main operational impacts on nursery businesses cited by interviewees included those related to:

- Movement restrictions – generally placed on plant stock, and sometimes only those types of plants (species, varieties) directly affected by the target pest. However, in other cases, depending on the nature of the pest and/or the response by authorities, restrictions on movement could be more general, applying to all plants (for example, if they were suspected of being a potential host for the pest or a pest vector), to people (nursery business managers, staff and visitors) and materials and equipment, especially vehicles. In many cases, a complete 'shutdown' of infected premises (IPs) or suspected IPs, was enacted by authorities in the early stage of an incursion for a short period of time – a few days or a week, but sometimes longer – until the authorities were able to gather enough information to make an informed decision about the risks posed by allowing plant movement to resume.
- Surveillance – the need for monitoring & inspection (of plant stock and of the property/premises more generally, e.g., for weed hosts), recording the information, and reporting as required. Surveillance regimes may need to be increased or otherwise enhanced (i.e., more comprehensive, frequent and/or rigorous inspections, use of improved technology). Surveillance issues also related to visitation by authorities to undertake their own site monitoring, inspection and investigations, associated requirements to provide authorities with surveillance records, and working with authorities to improve identification of the pest.
- New or additional pest control procedures – mainly in the form of chemical sprays, but also installation of netting, weed control, etc
- New or additional biosecurity procedures – plant hygiene (e.g., measures to ensure only 'clean' growing stock is imported to the site), nursery operational hygiene (workplace, work-practice, and equipment hygiene – e.g., disinfection of clothing, equipment and materials, etc.), visitor management
- Additional administration requirements on businesses – such as generating, compiling and provisioning records and compliance documentation to authorities and customers (e.g., interstate certification assurance, corporate customer assurances)

- Isolation, quarantine and/or partitioning of plant stock – while in some cases this merely required placing infested or susceptible plant stock in separate areas, in other cases it was more substantial, requiring reconfiguration of the plant growing system and physical infrastructure.
- Disposal and/or destruction of plant stock and other infested materials (fomites).

Operational impacts generally arose from the various restrictions and requirements government authorities (or large customers) placed on businesses during a biosecurity incursion. However, in some cases where there was great uncertainty about the appropriate action to take – where information from government or industry sources was delayed or inadequate – some businesses implemented their own controls (which all fell into one or more of the categories listed above).

Economic impacts

Economic impacts generally arose from the operational impacts, notably from movement restrictions that restricted trade, destruction of plant stock, new or enhanced pest control regimes (e.g., chemical sprays, netting) and, in a few cases, major reconfiguration of the nursery system or facilities to prevent infestations. Hiring of extra labour (or staff retrenchments) was rarely reported. However, the shift in task priority to those related to biosecurity, often diverted labour from more productive tasks. For example, increased surveillance and chemical spraying, isolation of plant stock, and compiling records for authorities, took the time otherwise spent on preparing plants for sale and dispatch (although, where movement restrictions were in place, the need for these tasks was reduced).

> *We were a lot smaller nursery at that stage, but it would have been probably 30% or something for the year we lost throughout that period i.e., in lost sales and then of course it was all the costs. The costs mounted up hugely in terms of, obviously the destruction of stock, the use of labour for (non)productive purposes; the huge volumes of spraying that you would never normally do just to get things under control. It's hard to quantify how much that would have gone down the line in terms of damage to reputation, huge sales… (#05, grower)*

For some nursery business interviewees, the operational impacts were considered more 'annoyance value' than a significant economic impost. However, requirements to destroy large quantities of plant stock, or movement restrictions that impacted the ability to trade, especially if they were in place for a protracted period, had much greater financial impacts.

Economic impacts could, however, also arise where nursery businesses did not experience any operational impacts; that is, where they had not experienced an incursion, and/or were not located in a designated biosecurity zone, and thus had no restrictions or requirements placed on their operations or property by authorities. The usual case here was that a customer (e.g., a vegetable grower or retail nursery store), who themselves were under biosecurity restrictions, was unable to accept supply from the production nursery business. In these cases, while the production nursery business was under no direct restriction of

trade, there was no point in supplying their product as it could not be accepted (and would not be paid for). These types of impacts were thus indirect, in that they flowed through from another business that had restrictions and requirements placed on them. However, they could be as equally devastating financially, especially where the customer in question represented a major proportion of the nursery business's sales.

Few of the interviewed growers reported receiving compensation for economic losses through the Owner Reimbursement Scheme (ORC). For various reasons most grower's losses did not fall into the scope of the scheme. Examples include: the defined nature of the official response (e.g., where it is not deemed technically feasible or economically worthwhile to eradicate a pest, so an official Response Plan is not prepared); the circumstances of the grower's business in relation to the response effort (e.g., being indirectly impacted); and, where the reasons for the types of losses incurred did not meet eligibility criteria (e.g., increased costs or loss of markets). Further, even where growers had received compensation through the scheme, the amount was generally perceived as small relative to the overall business losses.

> *Interviewer:*
>
> *Okay, so, eventually they did come to the party with compensation for the destruction of plants?*
>
> *Interviewee:*
>
> *Yeah. It obviously doesn't even touch what damage it actually caused the business. (#06, grower)*

The quantum of economic losses reported by interviewees very much depended on the size of the business and nature of the pest incursion and the associated response, particularly the proportion of plant stock affected and duration for which trade was impaired. Even in the small grower sample of this qualitative study, the loss amounts reported ranged from virtually negligible (where trade was not affected) to hundreds of thousands of dollars for larger businesses where all trade ceased for many months. In some cases, due to the nature of the pest (e.g., where it was not eradicated and required ongoing management) or due to reputational damage and associated loss of markets, economic impacts could linger for many years.

Social impacts

Types of social impacts

Various types of social impacts were reported, with personal stress reported in relation to four main causes: 1) the operational demands of managing the business during an incursion response; 2) the financial implications of the incursion for the business; 3) conditions of high uncertainty that exacerbated both 1 and 2; and, 4) difficulties arising in social relations with other parties, notably government authorities and other nursery businesses (but also the nursery industry bodies in a minority of cases).

Most businesses interviewees mentioned a broad range of biosecurity-related actions that they were required to undertake, typically under significant time pressure, which created some stress. However, they generally did not report this 'work pressure' as a significant stressor *per se*. Rather, the major stressor from managing an incursion appeared to derive from the high level of uncertainty associated with many aspects of the incursion. Uncertainty usually existed, at least initially, around many 'operational' details, including about the pest and its host range, how it could be treated, what other actions the nursery needed to physically do to manage/eradicate the pest, and details of correct procedure. There was also typically uncertainty related to the response by authorities: whether and for how long the nursery would be quarantined and/or have movement restrictions applied; what investigations by authorities would entail and what actions would be required of the nursery; results from diagnostic testing that could sometimes produce false positives or inconclusive results; and, whether destruction and disposal of plant stock would be required.

Associated with many of the operational actions to manage the pest and the requirements and restrictions placed on the business by authorities, were the financial implications, which typically generated the greatest stress for businesses. This was particularly the case where the restrictions on trade were significant and/or protracted. Where financial impacts were significant or had the potential to be, and yet great uncertainty remained about either the on-farm management of the pest, details of regulatory response, and/or the period of time that restrictions on trade would remain in place, in such circumstance financial stress could reach extreme levels.

The uncertainty, and associated confusion, was especially acute in the early stages of an incursion, when typically, the nursery would be pre-emptively shut down by the authorities as a precaution against potential spread, and to allow the authorities time to develop an understanding of the nature and extent of the incursion themselves, prepare a plan of response, and related information resources to assist growers. Once growers had some certainty about what they were dealing with and particularly, what they needed to do to manage a pathway to resumption of trade, which would relieve financial pressures, stress levels were generally greatly reduced (despite ongoing significant workload).

However, even once initial basic information was supplied, depending upon the nature of the incursion, uncertainty could linger, especially where there were delays in the preparation of an agreed plan/strategy (and/or official Response Plan) and associated pest management protocols to allow continuation of trade. Achieving agreed protocols between jurisdictions and especially a national protocol agreed to by all jurisdictions (and industry), could be particularly problematic and protracted, taking many months and in one case over a year. In extreme cases, the uncertainties inherent in such a process, alongside the ongoing financial impacts being experienced, resulted in an accumulation of stress over time that was reported to have severe psycho-emotional impacts on the mental health of affected growers and their families.

Other stressors mentioned that related to managing an incursion included: the trauma associated with physical destruction and disposal of valuable plant stock; the necessity to achieve a wide range of (sometimes unfamiliar) biosecurity-related actions in a short period of time; the extra workload and tedium involved in tasks such as frequent monitoring and inspection, chemical spraying, record-keeping, and preparing records and compliance documentation for authorities and customers; and awareness of the stress that these tasks placed on staff.

The stress associated with difficulties in relationships tended to stem from two main sources: problems dealing with the authorities, whose actions were often perceived as inadequate in some way; and relations with other nursery businesses, who were often reported to unfairly blame or ostracise the affected nursery. Dissatisfaction with government authorities related to a number of perceived deficiencies including:

- slow release of information and/or lack of useful/practical/actionable information
- insensitive or incompetent actions by officials, such as: inconsiderate comments to highly stressed growers; failure to follow basic biosecurity procedures during site visits (noted in one of the earlier incursions); and, sending staff with little to no knowledge of the target pest to undertake inspections
- failure to include affected businesses in deliberations and/or ignoring their on-farm pest data, and other information and suggestions growers supplied to help deal with the incursion
- perceptions of unfair treatment, notably in that only certain businesses (their own) were targeted for investigation because they were a more professional operation and therefore more likely to supply credible information and/or presented less of a challenge for achieving compliance
- poor information sharing and coordination of action with authorities of other jurisdictions.

Growers' repeated attempts to communicate with authorities and perceptions of delayed, inadequate or inconsiderate responses in return, reportedly generated considerable stress, including frustration, anger and despair. However, it is worth noting that many of these comments arose in relation to earlier incursions, such as myrtle rust and banana freckle, with more favourable commentary regarding later incursions (e.g. citrus canker, CGMMV) suggesting institutional learning from past experiences.

Poor relations within the nursery industry were generally experienced where an affected nursery perceived that they were being unfairly blamed for an incursion. Interviewees referred to 'finger-pointing' by other nursery businesses and/or the industry body, with unfounded accusations of 'letting in' the pest due to poor on-farm biosecurity practices and management. Relatedly, some interviewees remarked that they felt a sense of stigma when attending industry events and/or perceptions of other nursery industry members turning against them and of being ostracised by their peers.

In a minority of cases, difficulties were experienced with nursery industry representative bodies (state and/or national). Criticisms, in some cases similar to those levelled against government authorities, included:

- slow release of information and/or lack of useful/practical/actionable information
- overall lack of preparedness for the incursion
- insensitive or inconsiderate comments to affected nursery producers
- a sense that the nursery industry body was insufficiently attendant to, or supportive of the situation of the affected nursery; and relatedly,
- failure to provide sufficient representation (lobbying) to the authorities to gain their attention or support for the plight of the affected nursery.

Where there were perceptions of a lack of industry body support in the context of government inaction and other inadequacies, growers could feel particularly isolated and fighting a battle on their own. However, in most cases, and certainly with the more recent incursion events, growers reported much more positive and supportive experiences with nursery industry bodies.

Severity of social impacts

The severity of social impacts tended to be related to the severity of economic impacts, which was strongly related to the duration of time over which trade was impaired and the extent of that impairment (i.e., in terms of the proportion of the businesses plant stock that was affected and therefore could not be traded). As noted above, financial stress was also exacerbated by uncertainty. Where 'solutions' could be quickly identified, for example, where inspections and/or diagnostic results showed the nursery not to be infected or where effective treatment protocols could be quickly identified and implemented, and so return to trade was relatively rapid, stress levels were much relieved. However, perceived lack of support and/or a sense of isolation, and especially being blamed or ostracised within the nursery industry, appeared to result in more severe psycho-emotional impacts, even if experienced only for a relatively short period.

2.3.2 Opportunities, improvements, supportive measures

Interviewees generated a broad range of suggestions for how impacts of biosecurity incursions on production nursery businesses could be mitigated and how individuals and businesses could be better supported during a biosecurity incursion. The interview questions sought information on how the different types of impacts – operational, economic and social – could be minimised and how the different parties involved in an incursion response could best provide support. While in many cases the responsible party(s) for certain actions is reasonably clear – for example, on-farm biosecurity measures are best managed by the business in question, and improvements in the diagnostic capability of state-run facilities could reasonably be expected to be the responsibility of the state in question – in other cases it was apparent that views differed over the sharing of

responsibilities. The following sections will therefore focus on the nature of the actions suggested, while providing an indication rather than prescription of who should be responsible (unless this appears 'common-sense' and/or largely agreed), as in many cases the sharing of responsibility appears an ongoing conversation between industry and government. First, however, a couple of contextual issues pertinent to an incursion response, that became apparent during interviews, will be briefly mentioned.

Contextual issues

Balancing the competing imperatives of incursion management

It is worth noting that the ultimate goal of an incursion response is to minimise the spread of the pest, preferably through eradication, but where this is not technically or economically feasible through some form of management (containment, spread minimisation, etc.). Basically, businesses (and other plant industries) elsewhere and potentially at-risk from the incursion, have a strong interest in supporting a robust and effective incursion response, and are typically vigorous in lobbying government authorities to ensure this outcome. However, because of the potential financial implications of the incursion response on *affected* nursery business, particularly those arising from restrictions on plant movement and therefore trade, the overwhelming goal of business owner/managers impacted by an incursion is to implement as quickly as possible those actions that enable their return to trade. There appeared to be strong awareness across government interviewees of the need to balance these competing imperatives, emphasising the importance of an evidence- and risk-based approach, as the following officer's comment attests:

> *It's interesting because usually there's often a large part of industry or industries that do not want to be impacted by the pest or disease, so they want as much protection as possible, some strong intervention. Then there are those who are being intervened upon, and so there needs to be then a level of consideration but also justification for the restrictions that are being placed on them. There needs to be evidence-based and least restrictive and so they need to be risk-based but not over the top, and they need to be agile and nimble, so that they can quickly make every effort to enable those businesses to return to trade as quickly as possible. (#13, government officer)*

Interviewees from the nursery industry bodies and affected businesses also emphasised the need for an evidence- and risk-based approach in determining whether, to what extent, and for how long, restrictions on trade should be implemented (and conversely, for their easing). However, while mindful of the need to ensure a robust incursion response and protect their customers and other downstream industries (as well as their own business reputation), the production nursery businesses interviewed were generally, and perhaps understandably, more focussed on those aspects related to their business survival (i.e., supporting the easing of restrictions).

Institutional learning

As noted above, it was apparent that there had been significant institutional learning from prior incursions, with generally greater satisfaction expressed about the management of more recent incursions (e.g. citrus canker, CGMMV) than with earlier ones (myrtle rust, banana freckle). While TPP was relatively recent, the response nevertheless drew significant criticism, however this appeared largely due to inexperience being the first EPP response in WA for many years. However, even here some interviewees pointed to evidence that much had been learned and later response management (e.g., for citrus canker) was improved.

Relatedly, it was evident that it wasn't necessarily the size and associated quantum of resources available to a jurisdiction that determined the efficacy of a response. Rather, it appeared to reside in an approach that was proactively inclusive of a variety of relevant perspectives and open to learning from others, including: input from business and industry, the expertise of different levels and types of experts within and outside the bureaucracy, and including the experience of other government jurisdictions.

Protocols for intra- versus inter-state trade

While development of biosecurity protocols to allow trade within a single jurisdiction can be challenging, particularly in the early stages of an incursion when so much uncertainty exists, development appears relatively easy compared to protocols that need to be agreed between jurisdictions. For intra-state protocols, only the one jurisdiction is involved (although agreement between government and industry may take time) but ultimately the government has the authority to resolve a decision. It is much more difficult to agree on protocols for resumption of inter-state trade where multiple jurisdictions are involved, particularly for nationally agreed protocols that require agreement from all jurisdictions.

The following sections will begin with suggestions for improvement at the nursery business level before moving to those at the broader system level, including the contributions of both industry bodies and government.

Supportive actions for production nursery businesses

The main theme that appeared in relation to actions to reduce impacts on nursery business was 'preparedness'. This refers to being prepared in terms of biosecurity generally (to reduce the risk of an incursion), but also being prepared specifically for the eventuality of an incursion affecting the business at some point in the future. Interestingly, 'preparedness' appeared as a main theme of suggested actions for all parties, production nursery businesses, government authorities and industry representative bodies.

Biosecurity preparedness at the farm-level was seen to start with the basics of biosecurity planning and practice – having a biosecurity plan and undertaking good biosecurity practices as standard business operations. This began with biosecurity awareness and education of management and staff, and extended to the practices of biosecurity: ensuring propagation material was clean (whether seeds, tissue, cuttings, seedlings, etc.), strong surveillance regimes (systems of monitoring, inspection and record-keeping), actions to prevent infection (visitor management, operational hygiene, partitioned or zoned production

arrangements, physical barriers e.g., netting), and rapid reporting of suspect pests and symptoms. Good biosecurity practices were seen not only as a means of reducing the risk that an incursion would occur, but also as assisting a rapid response by authorities when one did occur. In particular, good record-keeping in relation to the purchase and sale of plant material, was singled out as important for the tracing and tracking of infected plant stock. At a broader level, the ability to provide evidence of good biosecurity practices through an accreditation or certification scheme, was seen as having potential to provide a higher level of assurance to government authorities and industry, and thereby facilitate quicker return to trade.

As noted, preparedness was also viewed in terms of planning specifically for the potential eventuality of an incursion. Again, this was seen as requiring a basic level of biosecurity awareness and education, in terms of keeping up to date with the most likely pest threats to the businesses and of having a rudimentary understanding of what is typically involved in a biosecurity incursion response effort. However, more specifically it was seen as having done some planning for an incursion, that is, business 'contingency planning' in terms of mapping a range of potential scenarios and planning for them. Suggestions included business diversification and contract design and management. Business diversification provides some protection against complete cessation of trade, or where this can't be prevented due the nature of the incursion, a quicker return to at least some level of trade, by being able to supply customers from the unaffected portion of the nursery's plant stock. Contract design and management may act to protect the business's markets, for example, assuring a resumption of trade with their customer(s) after the incursion restrictions are lifted. Interestingly, one government biosecurity officer noted that in their experience growers (and other stakeholders) showed little interest in learning about preparing for the eventuality of a biosecurity incursion. The officer describes how they had previously organised an event on precisely this topic, which had to be cancelled due to lack of interest:

> *…it would be fair to say that they don't have a lot of… there's not a lot of appetite for minimizing those impacts until they actually happen. It's like selling insurance, everyone thinks that it's a good thing to have, but you don't really need it until something happens. And yeah, it's just really hard to get good engagement on those issues. We've actually tried to run meetings with industry stakeholders and others previously, where we (were) going to get some growers who had been impacted by particular pest and disease issues, and get them to talk to other industry, growers and representative bodies, and things like that, basically so that they could share lessons learnt from them having their businesses impacted. And yeah there's just not a lot of appetite for it. We actually had a couple of really good meetings planned and just didn't get good engagement, people just weren't keen to come along… (#28, government officer)*

The reasons for this lack of interest in the case of growers weren't clear, although it was speculated that the many other pressing demands of running a business, together with the view that an EPP incursion on an individual grower's property was an unlikely event, may have seen it rated a low priority.

At a broader level, preparedness for an incursion was seen as part of a mature, professional approach to business management, in terms of the following key aspects:

- growers understanding their business, both in specific terms of how it operated and also in the broader context of how it was situated and inter-faced with wider institutional settings, notably the biosecurity system (including both government and industry aspects) and the business's (potential) markets
- having biosecurity as an integral component of risk-management for their business, including awareness and alignment with best-practice in biosecurity management, especially with regards to records management and contingency/ scenario planning for sudden loss of a key market (i.e., having a 'plan B'); and
- maintaining connections with and awareness of government and industry biosecurity contacts, networks and resources (including membership of the relevant nursery industry association).

Interestingly, the nursery business interviewees in this study – that is, managers whose businesses had been impacted by an incursion – were less likely to point to biosecurity practices as a means of reducing the impacts of a biosecurity incursion. This appears somewhat due to the nature of the pest incursion or the response to it, which in their own experiences resulted in an incursion affecting their property regardless of their own biosecurity practices. For example, it was apparent that investigations by authorities revealed that in the case of myrtle rust and TPP, the pests had been present in the environment for some time, perhaps years, before they were detected (and thus either flew or blew into the production facilities that they first infested). In the case of CGMMV, the ultimate origin appeared uncertain, though it was thought that most likely the pest was present in purchased seed (that had supposedly passed a government testing regime before purchase). Further, for the remaining nursery interviewees, their businesses were impacted either because they were located within a biosecurity zone (so had restrictions applied to them despite having no pest detection on their own property) or were indirectly impacted (their trade was impaired because another business that they traded with had been directly impacted). Thus, in the admittedly small sample of this qualitative study, there was probably little that the biosecurity practices of these business would have done to prevent the incursion impacts. Indeed, the only biosecurity practice mentioned – by a minority of the nursery business interviewees – in regard to *preventing* an incursion, was to ensure only clean propagation material is purchased.

With regard to how biosecurity practices matter to an incursion *response*, some nursery business interviewees mentioned the importance of good record-keeping, to assist in tracking and tracing of purchases and sales of plant stock. While not necessarily pointing to specific biosecurity practices, others mentioned how the incursion experience had motivated them to improve their operational management and practices and, in some cases, hire consultants to assist with their pest management regimes. However, most nursery business interviewees referred to actions other than improving biosecurity practices *per se*, as those most important in helping them manage their way through a biosecurity

incursion. These included, most notably, proactive communication with government authorities, industry representative bodies and other businesses they relied on, and (where possible), diversification, specifically, modifying their operations to increase production and sale of non-affected species so that the impact on their overall sales was minimised.

Proactive communication with government authorities and nursery industry representative bodies was often seen as crucial to encouraging timely attention, by these authorities and industry bodies, to actions that would assist the business to manage the incursion (and ultimately resume trading). Examples of such actions included:

- providing the business with information on the pest and its treatment, the nature and progress of the incursion and associated response plan, and any relevant requirements on the business
- accepting and incorporating nursery business records and on-farm pest surveillance data in response planning
- undertaking surveillance/ inspections to confirm pest presence/freedom
- liaison between jurisdictions, and
- development of agreed on-farm biosecurity standards and protocols that would allow resumption of trade.

Proactive communication by the business with other businesses such as suppliers and customers, was also seen as important to maintain a good business reputation, especially in terms of preventing unwelcome surprises and allowing these businesses time to prepare for and/or adjust to, changing circumstances.

Another action that some businesses took to enable a quick return to trade was identifying and producing alternative (non-affected) plant species. This course of action was feasible, or of significant value, to only some businesses, notably those where they were already supplying to these (or similar) markets, and in some cases were simply able to cease production of affected varieties and ramp up production of their non-affected varieties. In contrast, it appeared a more difficult and perhaps slower process (and was not mentioned by the growers interviewed) for a business to completely switch to a new species with which they had no prior experience producing or marketing.

Supporting nursery business biosecurity response efforts

Information and uncertainty

Given the importance of general biosecurity awareness and good practice for on-farm incursion management, providing information and tools to raise awareness and build capacity seems a central way that government and industry bodies could assist businesses prepare for an incursion. However, it is apparent that there have been, and continue to be, substantial efforts from both industry and government to provide these types of resources, so this will remain an important and on-going challenge.

As noted above, a major stressor for nursery business owners/managers during an incursion is the high level of uncertainty involved, and many expressed the need for more rapid provision of useful information specifically relevant to the incursion. While government and industry information on exotic plant pests (EPPs) is available through a number of channels (e.g., EPP incursion Contingency Plans) the specific nature and changing circumstances of an incursion can call for additional or updated information (e.g., specific pest control protocols). It was evident that once businesses had been provided with precise actionable information, they appeared highly motivated and capable of taking the required actions to maximise their ability to return to trade.

It was apparent that both government and industry bodies (and those representing both e.g., Plant Health Australia) had roles to play in providing useful information, with industry personnel (especially those in biosecurity roles) often providing a helpful mediation and interpretation role between government and the individual nursery business. Relatedly, a key action considered crucial to facilitating a more helpful incursion response for businesses, was inclusion of business and industry information in the response decision-making process. While representatives of affected industries are usually always included in incursion response-management bodies (namely, the Consultative Committee on Emergency Plant Pests (CCEPP)) it appeared it was generally the *extent* to which the industry bodies were engaged/listened to by the responsible jurisdictions (state/territory biosecurity authorities) that had a major impact on the efficacy of, and satisfaction with, response measures. Indeed, the inclusivity of the responsible jurisdiction more generally, including extending to incorporation of the views and experience of other jurisdictions who may have faced similar incursions in the past, was seen as a key factor in success.

Industry bodies could not only assist the provision of information from government authorities to affected businesses, but provide relevant practical and technical information upwards from businesses to government and the broader CCEPP, assisting the response. Of note here, were comments by some industry interviewees that despite businesses having best-practice biosecurity systems in place, including record-keeping, that some government authorities ignored this information, preferring to set up their own pest monitoring and recording procedures on the property. These businesses felt that their input and potential contribution of data to aid the response was ignored. In a paradoxical contrast, a business from which the authorities sought information felt that they had been unduly targeted, focussing on the business's operations and data, precisely because they ran a professional operation and could supply good quality data and/or otherwise undertake correct procedure. The contention of this business was that this targeting was unfair as the authorities did not appear to be paying sufficient attention to businesses that were less likely to provide good quality data and more likely to be at risk of spreading the pest.

> *My main problem was that the [Department] goes for low-hanging fruit and they came after the "big boys" like myself, because we had records and we do things properly and it's very easy to target us... We have spray records, we spray once or twice a week; we do everything correctly and we got shut down, but what about the [names of nursery retailers] that sell chili plants to the general public, those never get*

sprayed while they're in the shop; they're the ones mummy loads up and takes to [name of far-distant town] to their daughter-in-law as a present, or whatever the case may be. That's the high-risk incursion and nothing happens to those guys. They don't have to spray, they didn't get hammered, they didn't get shut down and I WAS, and that's a huge fault of the system. I'm not saying I know the answer but as far as I'm concerned sauce for the goose is sauce for the gander! … So, yeah, we have a reputation to maintain and we're the least of your problems, it's all the other flyby nights that are the real problem. (#02, grower)

Relatedly, some interviewees commented on the need for a registration scheme for nursery businesses, to cover those who were not members of an industry association (apparently a noteworthy proportion), and therefore represented a significant but unknown source of pest/disease spread risk during an incursion. Several interviewees suggested that an independent but mandatory scheme to both register all properties and ensure unique identifiers for every plant sold – similar in nature to the Property Identification Code (PIC) and National Livestock Identification Scheme (NLIS) used in the animal industries – was required to ensure comprehensive tracking and tracing of potentially infected plant stock during an incursion.

Biosecurity standards and protocols to facilitate resumption of trade

A range of interviewees, from businesses, industry bodies and government, suggested that development of a formal agreed biosecurity standard (e.g., similar in type to Biosecure HACCP) for adoption by businesses, could be helpful in providing authorities with assurance of the quality of business data and systems. Where businesses could demonstrate adherence to this standard (e.g., through a regularly audited certification scheme) governments, including those from other jurisdictions, would have confidence in utilising the information supplied in their decision-making and accepting the business's biosecurity practices, thereby speeding the path to resumption of trade.

For businesses that trade interstate, significant delays to resumption of trade can be experienced due to difficulties in gaining agreement between jurisdictions on the required trade protocols (Interstate Certification Assurance (ICA) procedures). Thus, quicker development and acceptance of these protocols by the relevant jurisdictions would be highly beneficial. Interestingly, a government interviewee noted that, given the competing demands on government biosecurity department resources during an incursion, there was an opportunity for nursery businesses, perhaps with assistance from relevant consultants and/or industry biosecurity specialists, to themselves develop and submit a proposed protocol to government for feedback and ultimate acceptance/approval. The inference was that, even if multiple drafts had to be submitted for feedback/review to the various jurisdictions involved before final agreement was achieved, an industry driven process could potentially lead to a quicker resolution and hence resumption to trade, than relying on government alone. It appeared, from a range of comments from a variety of interviewees, that inherent in this issue is the unfortunate reality of inter-jurisdictional frictions or

'politics', such that industry, in taking the process out of the hands of government to some extent, potentially provides a way around the blockages that these conflicts can create.

Supporting economic recovery and relief

Rapid return to trade

As noted, a rapid return to trade was generally seen as the most effective and sustainable way to minimise the economic impacts of an incursion. In particular, evidence- and risk-based approaches that could be rapidly deployed to enable a return to trade were overwhelmingly supported. However, it was apparent that there were contextual factors that often made a rapid response (at least in terms of nursery business commercial timelines) very difficult to achieve. Foremost, was the minimum period of time required for authorities to gain sufficient understanding of the nature and extent of the incursion, which could be quite difficult in some cases with complex pest-vector-host relationships. Some interviewees mentioned the imperative for good contingency planning, so that once a pest presence was verified, pre-developed plans to deal with it could quickly be enacted. However, interviews with government and industry personnel involved in past incursion responses suggested that, while sound in principle, situational particularities and pest complexities could often render contingency plans almost immediately redundant (echoing the military aphorism 'no battle plan survives contact with the enemy'). Nevertheless, overall, it was felt the speed of response was crucial, as the following government official explains:

> *To help, well, the more prepared they are for incursions, I think they'll avoid hopefully some impacts. The more prepared the Regulator is nationally to have conditions in place quickly, so that businesses aren't impacted for an extensive period of time, will help. But, yes, it's all about preparedness, being ready, having systems and processes in place, decision-making expedited as quickly as possible, there will be less economic impacts on those businesses if they're not shut down, or if they have to redirect stock because they've had closed markets. (#15)*

Compensation for losses

Strong support, particularly by the affected businesses interviewed, was also given to the concept of compensation for losses related to an incursion. However, the existing Owner Reimbursement Costs (ORC) scheme was considered to be too limited in its scope of application by the businesses interviewed. A number of examples were provided of where it was thought the scheme unfairly excluded significantly impacted businesses or where the amount of funds provided by the scheme was disproportionately small, relative to the business losses resulting from an incursion. However, other interviewees (predominantly from government and industry bodies) noted that the scheme was not intended to compensate for all losses incurred due to an incursion, only providing reimbursement for those most directly related. Further, covering the costs of the ORC scheme is shared between governments and industry, and therefore any expansion of the scope of application would most likely mean a higher level of contribution by industry, such that

individual businesses would ultimately need to be willing for their contribution, via industry levies, to be increased. While those businesses impacted by an incursion may (in retrospect) be willing to pay a higher levy amount to support an expanded compensation scheme, the question of whether other businesses, perhaps yet to experience the impacts of a biosecurity incursion, would agree, is an ongoing discussion.

Directly related to the concept of compensation was that of insurance, with some interviewees suggesting that insurance schemes that would cover the broad variety of costs associated with an incursion required further investigation. Other interviewees (again predominantly from government and industry bodies) suggested that the cost of such insurance, in terms of the premiums charged by insurance companies, were likely to be prohibitively expensive.

Other supports

Many other areas where it was suggested government and/or industry actions could either help minimise the size of economic impacts on businesses, or help them recover from unavoidable impacts, tended to relate to achieving a rapid and effective incursion response effort that ensured an early return to trade. Most apply not only to government and industry bodies but also to growers themselves (i.e., helping them help themselves and other businesses to prepare for, and respond to, an incursion). Many of these types of actions have already been mentioned above, so will only be briefly summarised here:

- Strong stakeholder engagement
    - Early and clear communication with growers, including practical information on the pest and its management, and any actions, procedures and protocols required that would assist businesses to achieve a partial or complete return to trade
    - Early and substantive inclusion of industry perspectives in planning the response effort
        - This includes a focus on incorporating the perspectives of affected growers, as well as on-farm information and data (where it can be demonstrated it is reliable)
        - Relatedly, supporting the development of systems and standards that underpin the biosecurity practices, and enable the collection and verification of pest data, that can be relied upon by both growers and incursion response planners during an incursion response
    - At a broader level, developing strong links and relationships between individual businesses, industry and government personnel to facilitate the communication, two-way flow of information, and collaboration required when an incursion eventuates
        - However, some interviewees noted the danger of relationships that could perhaps become too close, leading to protectionism of domestic

industry by jurisdictions (i.e., 'regulatory capture'), to the detriment of both interstate incursion investigations and early trade resumption

    - Relatedly, that jurisdictions adopt a collaborative approach to incursion response planning and management that is proactively inclusive of a variety of relevant perspectives, including those from business and industry, different levels and types of experts within and outside the bureaucracy, and the experiences of other government jurisdictions
    - Explicit efforts by all parties to learn from previous biosecurity incursion experiences, including, again, from a wide range of expertise and experience.

- An emphasis on preparedness – by all parties – somewhat related to the above stakeholder engagement and shared-learning approaches: i.e., through:
    - proactive communication and awareness raising
    - development of support networks (i.e., individuals across a variety of relevant organisations able to provide helpful information, advice or other supportive actions);
    - contingency and/or scenario planning; and,
    - investment in necessary resources (e.g. communication materials, educational initiatives, technical expertise, surveillance and diagnostic capability, tracking and tracing, etc.).
- A focus on evidence- and risk-based approaches that maximise the ability to enact only partial restrictions and/or brief shutdowns, while minimising the risk of disease/ pest spread
- An emphasis on the urgency and speed of response
- Supporting nursery business management improvements, particularly around scenario planning, business diversification and contract design and management
- Measures that promote the rapid return to trade between jurisdictions, including:
    - development of interstate trade protocols (ICAs)
    - development of nationally accepted biosecurity standards for businesses, that would give assurance of biosecurity practices of a standard sufficient to allow trade resumption

Mitigating social impacts and social support measures

As noted above, while the operational demands of managing an incursion could substantially increase the business's workload, the major sources of stress associated with an incursion derived from three key areas: uncertainty, financial impacts, and relationships with others, with aspects of these typically being interrelated.

Tackling uncertainty

To a large extent, some of these stressors are unavoidable, notably the uncertainty experienced in the very early stages of an incursion, particularly as it relates to potential financial impacts. The early stages of a biosecurity incursion are typically beset with many uncertainties, even where the pest has been identified and a specific pest Contingency Plan been pre-prepared. The specific nature of the pest may differ from what was expected, its origin or entry point and the extent of its spread may be unknown, and the economic implications for industry may be uncertain. However, while some initial uncertainty is to be expected, it nevertheless appears that several factors are key to reducing ongoing stress from uncertainty on growers:

- the speed of response by authorities
- inclusive and substantive engagement by the authorities of industry in discussions to develop a plan of response; and,
- the quality of communication by the authorities and industry bodies to businesses.

Where the authorities inclusively engage industry bodies in discussions around response planning, this reportedly improves both the quality of the planning (due to the ability to include practical industry specific knowledge that government authorities may not have) and the related quality of information able to be supplied to growers, reducing uncertainty and related stress. Further, strong engagement and dialogue with affected growers, by industry and/or authorities, to incorporate their farm-level knowledge and data into planning, would further improve quality of planning and communications, thereby reducing uncertainty and associated stress on growers. Overall, as noted above, once growers had some certainty about the nature of the pest they were dealing with, and particularly, specific actions they could take to do to manage a pathway out of the incursion restrictions, to resumption of trade, stress levels were greatly reduced (even despite ongoing workload pressures).

Where uncertainties are proving difficult to dispel, it appears that maintaining frequent communications with growers is just as important. Feelings of being abandoned and alone in their battle, with authorities and/or industry bodies taking insufficient interest in their plight, appears to add significantly to the stress growers experienced. Part of this communication, as noted above, is taking substantive consideration of the information and surveillance data that growers can contribute to investigations.

Uncertainty and interstate trade

In cases involving interstate trade, even when many of the uncertainties around the nature of the pest and its spread, and of treatments required for its control, are known, there can still be ongoing difficulties (and associated uncertainty) around achieving agreement on treatment protocols between jurisdictions (ICAs) that would allow a return to interstate trade. These types of interstate complications can be particularly pernicious, as they can take much more time to resolve than purely technical issues and may appear to involve a political element, as noted above. Apart from the increased levels of uncertainty involved in

such situations, they also result in much greater financial impacts, due to the extended period of trade restrictions on businesses, and consequentially, much greater psychological stress for growers.

Some interviewees suggested the need to prepare, well before an incursion, using evidence- and risk-based planning principles, nationally agreed protocols or ICAs for pests known to be likely to invade (i.e., akin to a high-level inter-governmental extension to a Contingency Plan). However, others pointed out the limitations of Contingency Plans (as noted above) even for application within a single jurisdiction, suggesting that these types of problems would only multiply with the addition of other jurisdictions. However, having a pre-prepared plan, or a range of scenario plans, that could be modified during an incursion according to new information as it emerges, would appear to be a superior position to be in than having no inter-jurisdictional planning at all for an EPP.

Also, as noted above, were the suggestions for a nationally accepted biosecurity standard for production nursery businesses, that could provide greater assurance to all jurisdictions of best-practice on-farm, and thereby facilitate a quicker return to interstate trade. Both of these suggested strategies, inter-jurisdictional contingency planning and a nationally accepted biosecurity standard for businesses, were viewed as potentially hastening return to trade and thereby reducing financial impacts and associated stress on businesses.

Financial stress

Apart from the approaches suggested above to hasten return to trade that ultimately reduces financial stress, the other main suggestion was, as noted earlier, to expand the scope of the ORC scheme to provide compensation for a greater range of situations and types of financial losses and costs. Or, alternatively, developing an insurance scheme that would do likewise. Apart from relieving a significant amount of financial stress, having a more generous compensation scheme was also seen as reducing the 'fear factor' that discourages growers from reporting unusual signs and symptoms.

Additionally, as noted earlier, assisting nursery businesses with careful contract design and management prior to an incursion, to better protect their markets in the event of an incursion, was another way financial impacts and associated stress could be mitigated. Actions to assist nursery business diversify away from affected species following an incursion and identify new markets, would likewise mitigate financial impacts and associated stress.

Interestingly, none of the growers interviewed suggested the more traditional, 'standard' or direct forms of financial support, such as provision of loans or referral to a financial advisor to help them achieve some form of financial assistance. Indeed, one grower, who had seen their application under the ORC scheme rejected, saw this form of support as an insult:

> *Well, that's as far as it ever went, it was never under control, we were never compensated, we were never given… you know what they offered me? They offered me financial counselling! They'd be better off offering marriage guidance for my wife and myself, or mental health assistance! Financial counselling, that was an insult, to*

receive that! That tells you the credibility of the people that make these decisions. (#03, grower)

Interpersonal stress

As described above, the stress associated with difficulties in relationships was apparent in relation to a) the frustrations and disappointments of dealing with government authorities and, to a lesser extent, industry bodies, and b) perceptions of being unfairly blamed by other growers (and, again, to a lesser extent, by industry bodies) for the incursion, with a resulting sense of stigma and ostracism.

In relation to dealings with government authorities, mention was made of the importance of having a knowledgeable officer that growers could talk to, one who was prepared to listen and genuinely consider the grower's perspective, and preferably through physical, face-to-face contact, such as a farm visit. It was also noted that consistency of representation, being able to contact an officer with whom the grower had already developed a good relationship, was valued. Having a nursery industry contact who was similarly accessible, willing to listen, and knowledgeable and involved in the response effort, was viewed as extremely important.

In relation to the problems of blaming, stigma and ostracism, these were seen as much more difficult to combat as they lay outside the direct control of government and industry bodies. However, it would appear that there is a need for clear communication during the incursion by both government and industry to dispel any myths arising, to explain how the infestation may not be the 'fault' of affected growers, and to call for community support and understanding. Strong leadership to show empathy and support may be helpful in blunting peer and community accusations and ultimately fostering a more a supportive environment. However, it is noted that the current strong messaging about the importance of good on-farm biosecurity practices to protect growers from infestations does, to some extent, run contrary to the message that a grower is not at fault when an infestation occurs on their property. Careful messaging may have to be developed in this respect.

Most of the affected growers interviewed mentioned how much they had learnt from the incursion experience, with some expressing how it had ultimately helped them improve the management of their business.

We utilised it in a business sense we challenged a lot of things and as I've said to you, that's been very much a… I can honestly say I'm a world's better grower as a result of it and am probably a more complete grower with a much more complete skillset and a much more better idea of what I'm doing and I think probably a lot of those skills and the need for those skills came out of that period. So, I try and look at it like that now and say, well, we wouldn't be doing what we're doing now and having the successes we're having now without some of that hardship and that's the way I look at it and that's the way we analyse it as a business to try and get past it, I suppose. (#05, grower)

However, many noted that there had been no systematic effort by government or industry (prior to this project) to learn from their experiences and to promote the sharing of their

experiences with other growers. While all expressed hope that this project would help in this regard, it was notable that, as described earlier, a government biosecurity officer had found little appetite by growers not yet affected by an incursion, to learn about how to deal with one should it eventuate. Nevertheless, several growers mentioned that in their view more recent incursion events had been much better managed by the authorities and industry bodies than previously, suggesting system-wide learning was occurring. They mainly attributed the improvements to greater willingness by the government authorities to listen to industry bodies and businesses during an incursion, and to a more proactive stance by both, but particularly industry bodies, towards supporting growers on biosecurity related matters.

Few of the nursery business interviewees explicitly mentioned the need for formal support services such as psychological or mental health counselling, however descriptions of the trauma experienced at the time by some suggest these services may have been helpful. Overall, it was apparent that the key forms of support that growers most appreciated were more practical and problem-focussed in nature, notably: rapid supply of good quality information, inclusive and substantive engagement, and practical guidance on incursion management, particularly those actions required to meet requirements for a speedy resolution to the movement restrictions and return to trade.

3 Survey results

3.1 Introduction

The aim of the telephone survey was to extend upon the qualitative study, by exploring the social and economic impacts of biosecurity incursions as experienced by a broader sample of production nurseries in the industry – that is, to survey production nurseries either affected directly or indirectly by a biosecurity incursion. Due to the large number of questions in the survey questionnaire, only a summary of key findings is provided in this section, with the full results presented in Appendix A.

3.2 Method

A telephone survey (see Appendix D) was administered to 80 production nurseries in Australia, from Tuesday 6th July, 2021 to Tuesday 13th July, 2021. Five hundred and sixteen production nurseries were telephoned, and of these, 61 did not answer and 7 phone numbers were disconnected. Of the calls that were successful (in terms of either reaching a person or answering machine, n=448), 80 agreed to participate in the survey (17.86% response rate).

The survey was conducted by a third-party agency (KG2) on behalf of CSIRO. The publicly available Nursery Industry Trade Register comprising 528 production nurseries served as the sampling frame.

Participants were asked about their experiences with biosecurity incursions, which were defined in the survey as a situation where an emergency plant pest or disease has been detected, and in some way has impacted their business – either directly or indirectly. Direct and indirect impacts were further defined for participants as follows:

- Being directly impacted means that biosecurity restrictions or requirements were directly imposed on your business either by government or another organisation – for example, a quarantine order or a wider biosecurity zone; requirements for your business to undertake site inspections or restrictions on movement of product.
- Being indirectly impacted means that biosecurity restrictions or requirements were not applied to your business, but were applied to other businesses, producing effects that flowed through to have an impact on your business (e.g., quarantine of another business reduced your sales or ability to purchase stock)

3.3 Key Findings

3.3.1 General

Around half of the survey participants (n=44, 55%) reported that they were not aware of any production nurseries being impacted by a biosecurity incursion in the last 5 years. However, the remainder were aware of other production nurseries being impacted.

Most survey participants (n=53, 66.25%) reported that a large proportion (75% to 100%) of their household income came from their production nursery – signifying a high level of financial dependence on the business and implicitly, a strong need for the business to continue operating.

3.3.2 Past experiences with incursions

Less than half (40%) of participants reported that they had been impacted, directly or indirectly, by a biosecurity incursion. Around half of these (n=17) had been impacted by one incursion, while the remainder (n=15) had been affected by two or more incursions.

Of those impacted (n=32), when thinking of an incursion that impacted their business most significantly:

- Most (n=23, 72%) participants recalled an incursion that first impacted their business in the years 2010 to 2019.
- Most (n=23, 72%) had experienced a restriction or requirement imposed by government authorities, which tended to be either the application of a geographic biosecurity zone (n=15, 65%) or another type of restriction or requirement (e.g., site inspection) (n=17, 74%). The imposition of a quarantine order was less common (n=4, 17%). The length of time that the restriction or requirement was imposed varied, ranging from up to a month to longer than 20 years.

- Others had experienced a restriction or requirement imposed by another organisation (typically customers) (n=7, 22%) or were indirectly affected by a restriction or requirement being placed on another business that flowed on to affect them (n=14, 44%).
- The most common impacts on the business included:
    - Increased costs (n=15, 47%)
    - Increased workload requirements (n=13, 41%)
    - Stock losses (destruction) (n=12, 38%)
    - Restricted or reduced trade (n=13, 41%)
    - Stock losses (reduced value) (n=9, 28%)
- Some reported periods of not being able to sell some or all of their product. A loss of customers or markets was mentioned by around half (n=5) of those who reported restricted or reduced trade. This implies that in some cases, participants were still able to sell some of their product, but customer demand and/or certain product markets had dropped or disappeared.
- In terms of the duration of impacts on the business, participants reported greatly varying time lengths, ranging from as little as up to a fortnight up to more than 20 years. Around one-third (n=10, 31%) indicated that their business was still moderately to greatly affected by the incursion.
- In terms of costs and financial impacts:
    - On average, participants spent $15,623 in managing the incursion. However, the distribution was positively skewed; with six participants (19%) not spending any money on managing the incursion and around one-third (n=11, 32%) spending less than $10,000.
    - On average, participants destroyed or disposed of $97,842 worth of plant-related stock and equipment. Again, the distribution was positively skewed; with 14 participants (44%) not losing any stock or equipment at all.
    - It was estimated that the average annual income lost was 4.6%.
- In addition to these quantifiable financial impacts, one-quarter of participants (n=8, 25%) reported that they lost customers or markets because of the incursion.
- A quarter (n=8, 25%) experienced moderate to overwhelming financial stress during the incursion, while the remainder reported none or a little financial stress (n=24, 75%). A similar pattern of results was observed for other subjective measures of stress and coping, suggesting that the majority felt that they were able to manage the situation.

- When asked what caused the greatest stress during the incursion, participants mainly commented on the uncertainty and unknown element of being impacted (i.e., Where did the disease come from? What is it? How long will it last?).
- In terms of social supports:
    - Most participants were moderately to strongly satisfied with support received from family, friends, other nurseries, and the industry association.
    - Satisfaction with support from the local community, and government agencies and biosecurity officers was comparatively less strong hovering around the mid-point of the scale.
    - Just under a half (n=14, 43%) agreed that nursery businesses, government and people from industry effectively worked together to address problems associated with the incursion, while another good proportion (n=11, 33%) disagreed that this occurred. This pattern of results suggests varied experiences in relevant stakeholders coming together to address the incursion.
- Most (n=26 to 27, 81 to 84%) indicated that their business's reputation, relationships with other nurseries and customers remained unchanged. Fewer (n=4 to 5; 13 to 16%) indicated that these relationships had deteriorated somewhat.
- In terms of positive impacts resulting from the experience, on average, participants felt that their business experienced:
    - moderate improvement in their knowledge of how to manage biosecurity incursions, and biosecurity practices and procedures.
    - some improvement in their connections with biosecurity experts, and general management practices.

3.3.3 Perceptions of future incursions

- On average, participants thought that there was a 30% chance of a biosecurity incursion affecting their nursery in the future. The distribution was positively skewed, with most participants (n=51, 64%) nominating less than a 30% chance.
- Most (n=64, 80%) participants indicated that if their nursery was affected by an incursion, the impacts would be moderately to extremely negative. Only 5% (n=4) thought they were would experience no negative impacts at all.
- Most (n=71, 89%) were moderately to very confident in their ability to manage the situation so that the nursery could continue to trade through the incursion.
- However, more than half (n=52, 65%) agreed that whether the nursery continued to trade was something out of their personal control.

- Interestingly, around one-third (n=25, 31%) reported that they could remain closed for trading for six months or more yet still survive in the long-term.
- Most participants (n=58, 72.5%) placed a moderate to high relative importance (priority – compared to other issues in running the nursery) on developing a biosecurity plan in case of an emergency plant pest incursion.

3.3.4 Potential supports

- When presented with a list of potential supports, participants showed:
    - the most interest in accessing experts who can provide useful information and assistance on biosecurity-related matters,
    - moderate interest in receiving information and/or training on how to manage their business through an incursion,
    - slight interest in insurance cover and access to information on managing personal and social challenges.
- In open-ended comments, participants felt that government could help nurseries in managing biosecurity incursions by:
    - Improving and streamlining their communications
    - Consulting more with industry
    - Providing more financial and technical support
    - Acting more quickly and efficiently
- Similarly, in open-ended comments, participants felt that the nursery industry associations could help nurseries by:
    - Maintaining their dissemination of up-to-date information
    - Continuing their current efforts
    - Providing expert advice and support to members
- In terms of what nurseries could do themselves, participants felt that they could:
    - Be aware of, and perform, biosecurity best practices in their nursery
    - Keep staff educated, informed, and well trained
    - Adhere to industry standards and government regulations
    - Access expertise through their networks

4 Conclusion

The results for the interview and survey components show many similarities, as could be expected. However, while the interviews only included growers who had been impacted by an incursion (n=9), the survey respondents included both directly and indirectly impacted growers (total 40%), and those not impacted (60%).

The interviews revealed key relationships between the various impacts on growers, notably how operational impacts led to key economic impacts, which in turn generated social impacts, namely financial stress. However, social impacts were also related to other factors, such as high levels of uncertainty, increased operational demands under time pressure, and problems arising in relationships with government authorities, industry bodies, and/or other nursery businesses.

Uncertainty around the incursion and its implications was revealed as a significant stressor for growers. Tellingly, when asked, in an open-ended question, what caused the greatest stress during the incursion, survey participants mainly commented on the uncertainty and unknown implications of being impacted. Uncertainty in the early stages of an incursion is generally unavoidable, due to the many initial unknowns, even among experts, about the pest type, origin and spread. Nevertheless, the issue does point to the need for strong communication between authorities, industry bodies and growers to, as quickly as possible, provide clear and up-to-date information to growers, to help dispel uncertainties and support practical action at the farm-level.

Supportive actions were identified for each of the major parties in an incursion – production nursery businesses, industry representative bodies, and government authorities – and while in some cases the responsible party(s) for certain actions is reasonably clear, in other cases views differed over the sharing of responsibilities. A shared approach suggested for all parties, that would provide significant support in the event of an incursion, is being well prepared. For growers this generally means already having in place best-practice biosecurity procedures, including biosecurity incursion planning. Biosecurity incursion planning for growers relates to many of the elements of business continuity planning: risk-management; scenario and contingency planning; protection of markets and income streams; and options for business diversification into alternative markets.

For government authorities and industry bodies, preparedness is likely to involve supporting grower preparedness through capacity building; strengthening relationships and communication channels with one another and growers; explicit attempts to learn from past incursions, notably from the experience of a broad spectrum of relevant players; contingency planning and scenario exercises; and developing and improving plans, systems and resources to support rapid action in future incursions. Many of these tasks can be, and are currently, undertaken by both government and industry bodies, and in numerous cases are conducted in conjunction or collaboration with one another for greater effectiveness. In this context, the sharing of responsibilities between industry and government appears an ongoing conversation, for the ultimate benefit of growers.

Fortunately, it is evident from the interviews that institutional learning is already occurring, although further work is required, particularly in relation to gaining faster agreement by jurisdictions on interstate trade protocols.

The next steps of this project will involve utilising the information generated in this study to develop a business continuity framework for production nursery businesses. The aim of this framework is to provide a suite of supportive measures that aids planning and decision-making, by a range of relevant parties, to help production nursery businesses cope with and recover from a biosecurity incursion event.

Appendix A Detailed survey results

Sample description

Most participants were male (n=59, 73.75%), aged between 35 and 64 (n=60, 75%), operated their business in either Queensland, New South Wales, or Victoria (n=70, 87.5%), and were an owner manager (n=59, 73.75%). Most survey participants reported their main plant type produced as ornamental plants or landscape stock (n=61, 76.25%), with fewer participants mainly producing other plant types. The main horticultural market was retail greenlife (n=52, 65.00%) and domestic and/or commercial/government landscape (n=22, 27.50%).

Table 2 Survey participant and production nursery characteristics

PARTICIPANT AND NURSERY CHARACTERISTICS	N (%)
Sex	
Male	59 (73.75%)
Female	21 (26.25%)
Age group	
18-24	2 (2.50%)
25-34	3 (3.75%)
35-44	14 (17.50%)
45-54	21 (26.25%)
55-64	25 (31.25%)
65 or over	15 (13.00%)
State or territory of business	
Queensland	25 (31.25%)
New South Wales	25 (31.25%)
Victoria	20 (25.00%)
South Australia	5 (6.25%)
Western Australia	3 (3.75%)
Northern Territory	2 (2.50%)
Australian Capital Territory	0 (0.00%)
Tasmania	0 (0.00%)
Role in nursery	
Owner manager	59 (73.75%)
Manager	16 (20.0%)
Staff member	5 (6.00%)
Member of State or National nursery industry association	
Yes	77 (96.25%)
No	2 (2.50%)
I'm not sure/I don't know/I prefer not to say	1 (1.25%)

PARTICIPANT AND NURSERY CHARACTERISTICS	N (%)
Accreditation	
NIASA accreditation	24 (30.00%)
Eco Hort certification (Australian Plant Production Standard APPS)	10 (12.5%)
BioSecure HACCP certification	6 (7.5%)
Other	0 (0.0%)
Interstate Certification Assurance (ICA)	3 (3.75%)
None	38 (47.5%)
Gross value of production or trade in 2019-2020	
Up to $200,000	7 (8.75%)
Between $200,000 and $500,000	5 (6.25%)
Between $500,000 and $1 million	19 (23.75%)
Between $1 million and $2.5 million	15 (18.75%)
Between $2.5 million and $5 million	15 (18.75%)
Between $5 million and $10 million	3 (3.75%)
Above $10 million	3 (3.75%)
I'm not sure/I don't know/I prefer not to say	13 (16.25%)
Main plant type produced	
Ornamental plants	42 (52.50%)
Vegetable seedling stock	11 (13.75%)
Forestry stock	4 (5.00%)
Fruit and nut tree stock	10 (12.50%)
Landscape stock	19 (23.75%)
Plug and tube stock	5 (6.25%)
Revegetation stock	4 (5.0%)
Mine revegetation	0 (0.00%)
Other	0 (0.00%)
Australian natives	26 (32.50%)
Main horticultural market	
Retail greenlife	52 (65.00%)
Domestic and/or commercial/government landscape	22 (27.50%)
Interior-scapes/plant hire	0 (0.00%)
Vegetable growers	1 (1.25%)
Plantation timber	0 (0.00%)
Orchardist	2 (2.50%)
Cut flower	0 (0.00%)
Revegetation	4 (5.00%)
Mine site rehabilitation	0 (0.00%)
Other	0 (0.00%)
Wholesalers (nursery suppliers)	1 (1.25%)

Business characteristics

The average length of time operating the business was 28.75 years (SD=15.53, range of 3 to 90 years). The average number of full-time equivalent staff was 17.58 (SD=41.32, range of 1 to 350 employees). Excluding the single respondent with 350 FTE staff, the average FTE staff was 13.37 (SD=17.16, range of 1 to 120 employees). Eighty-six percent of respondents had 29 or less FTE staff.

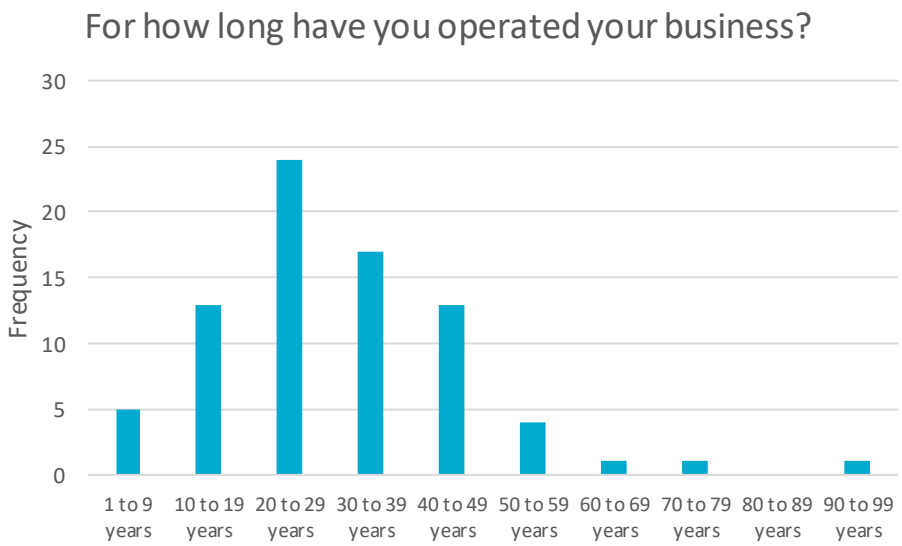

Figure 1 Frequency distribution of length of time operating business

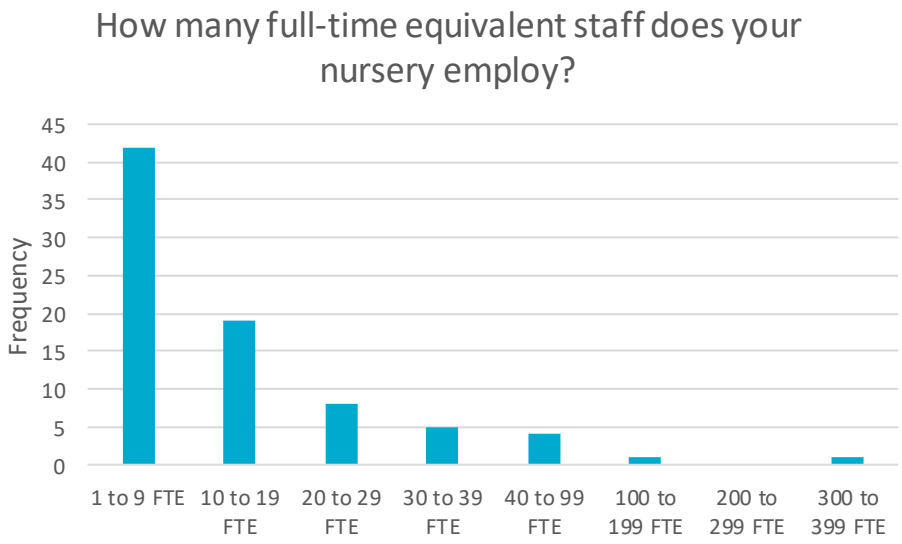

Figure 2 Frequency distribution of full-time equivalent staff employed

Stock movement

In terms of movement of plants, plant material and stock, most participants sold or purchased plants and stock within Australia, especially within their state.

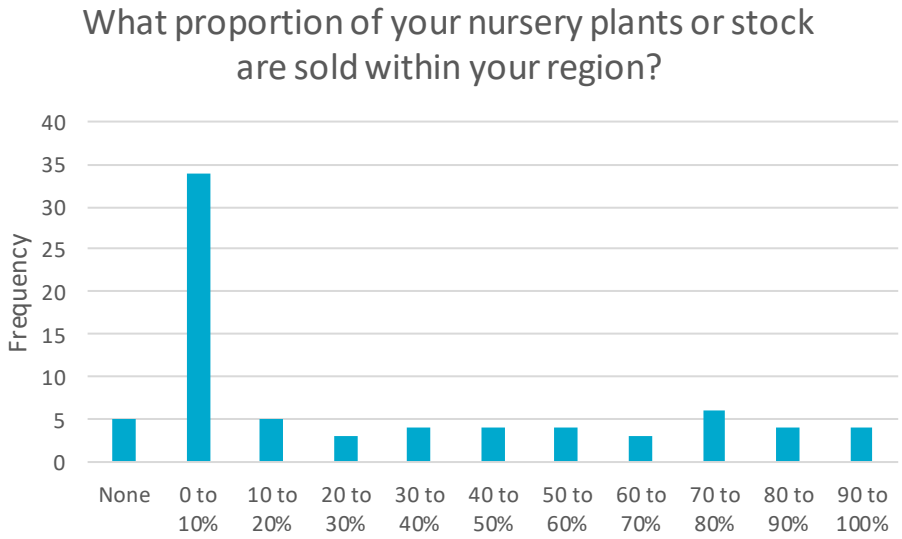

Figure 3 Proportion of plants/stock sold within region

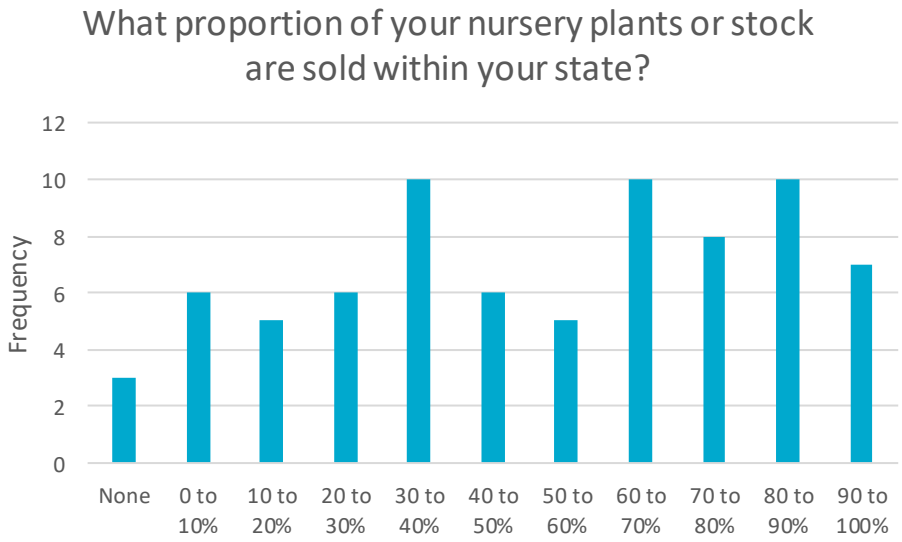

Figure 4 Proportion of plants/stock sold within state

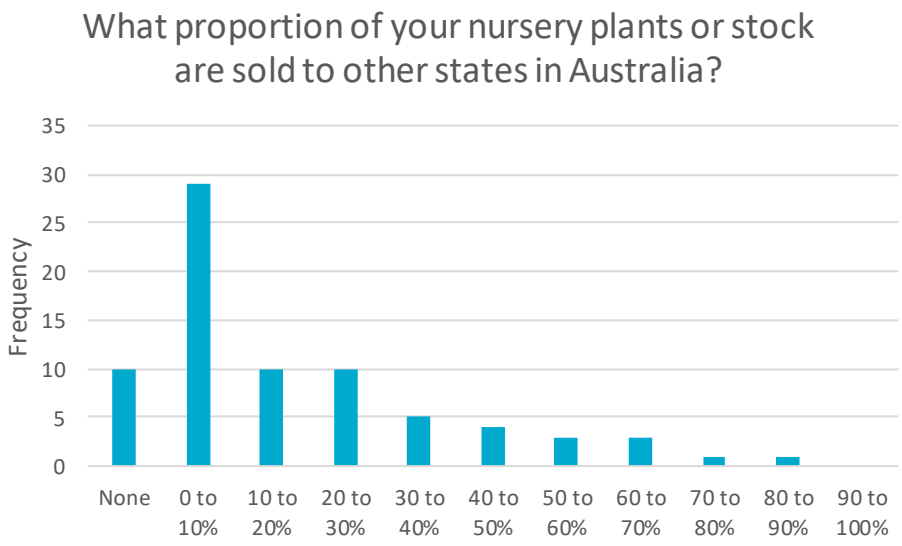

Figure 5 Proportion of plants/stock sold to other states in Australia

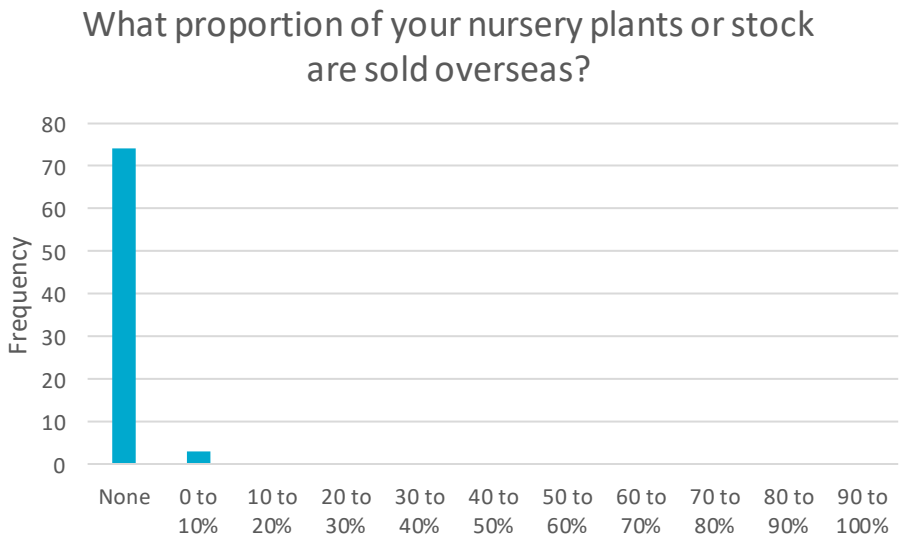

Figure 6 Proportion of plants/stock sold overseas

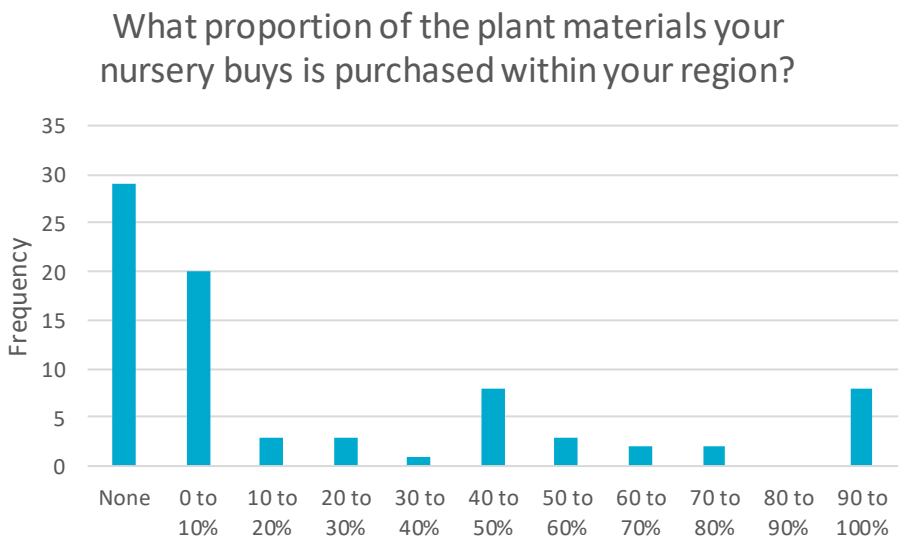

Figure 7 Proportion of plant materials purchased within region

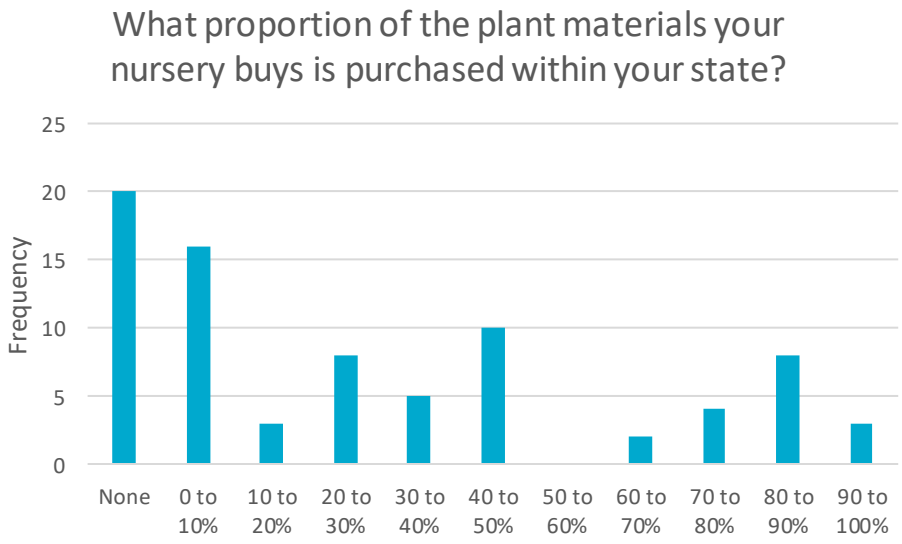

Figure 8 Proportion of plant materials purchased within state

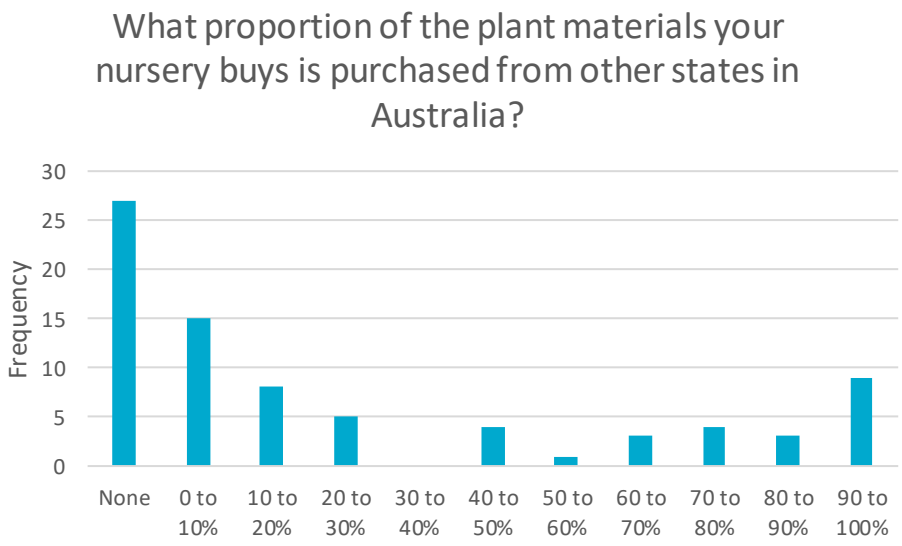

Figure 9 Proportion of plant materials purchased from other states in Australia

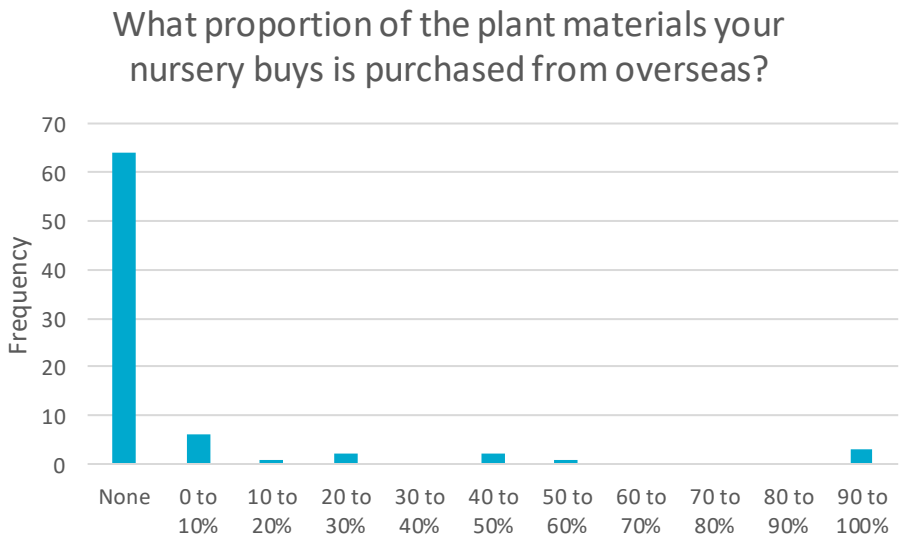

Figure 10 Proportion of plant materials purchased from overseas

Income derived from nursery

Most survey participants reported that a large proportion (75% - 100%) of their household income comes from the production nursery (n=53, 66.25%). This result signifies significant financial dependence on the business' continued operation, among many production nursery operators.

Table 3 Proportion of household income derived from the production nursery

PROPORTION OF HOUSEHOLD INCOME DERIVED FROM THE PRODUCTION NURSERY	N (%)
None	2 (2.50%)
A small amount (less than 25%)	4 (5.00%)
A moderate amount (around 50%)	13 (16.25%)
A large amount (around 75%)	13 (16.25%)
All my income (100%)	40 (50.00%)
I'm not sure/I don't know/I prefer not to say	8 (10.00%)

Awareness of, and experience with biosecurity incursions

Many participants reported that they were not aware of (n=28, 35%), or did not know (n=16, 20%) any production nurseries being impacted by a biosecurity incursion in the last 5 years. However, some participants (n=28, 35%) were aware of up to 30 nurseries being impacted by an incursion in the last 5 years.

Table 4 Awareness of other production nurseries impacted by a biosecurity incursion

HOW MANY OTHER PRODUCTION NURSERIES ARE YOU AWARE OF THAT HAVE BEEN IMPACTED BY A BIOSECURITY INCURSION?	N (%)
None	28 (35.00%)
Less than 10	21 (26.25%)
10 to 30	7 (8.75%)
All in my area	1 (1.25%)
All in SE QLD	2 (2.50%)
All in State	2 (2.50%)
All of them	3 (3.75%)
Don't know	16 (20.00%)

When asked about their personal experience, most (n=48, 60%) survey participants indicated that their business had not been impacted by a biosecurity incursion, either directly or indirectly, in the time that they had operated their business. Thirty-two (40%) participants indicated that they had experienced one or more biosecurity incursions in this time.

Table 5 Number of biosecurity incursions that have impacted survey participant nurseries

NUMBER OF BIOSECURITY INCURSIONS THAT HAVE IMPACTED THE BUSINESS (EITHER DIRECTLY OR INDIRECTLY)	N (%)
None	48 (60.00%)
One	17 (21.25%)
Two	9 (11.25%)
Three or more	6 (7.50%)
I'm not sure/I don't know/I prefer not to say	0 (0.00%)
TOTAL	80 (100%)

Participants who reported that they had been impacted by biosecurity incursions (n=32, 40%) were asked to consider an incursion that had significantly impacted their business. Most (n=23, 72%) participants indicated that this incursion occurred in the years 2010-2019.

Table 6 Year biosecurity incursion first impacted business

YEAR RANGE	N (%)
2020-2021	1 (3.13%)
2015-2019	12 (37.51%)
2010-2014	11 (34.39%)
2005-2009	5 (15.64%)
2000-2004	1 (3.13%)
1995-1999	1 (3.13%)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

Restrictions or requirements

The subsample of affected participants (n=32, 40% of total sample) were then asked whether any restrictions or requirements were placed on their business because of the biosecurity incursion – either by a government authority or another organisation. These restrictions or requirements were considered to *directly impact* their business. They also were asked to consider whether any restrictions or requirements applied to another property or business during the incursion flowed on to affect their business (this was classified as an *indirect impact*).

Most (n=23, 72% of the subsample of affected participants) participants indicated that they experienced restrictions or requirements imposed on their business by government authorities. The most frequent type of restriction or requirement applied by government authorities was either a geographic biosecurity zone that included the participant's property (n=15, 65%) or another type of restriction or requirement (n=17, 74%). In the case of these restrictions imposed by government authorities, the duration was variable ranging from up to a month (n=4, 17%) to longer than 20 years (n=3, 13%).

Table 7 Type of restriction imposed directly on business, or another business (with flow on effects to the business).

RESTRICTIONS OR REQUIREMENTS AFFECTING THE BUSINESS, EITHER DIRECTLY OR INDIRECTLY (SELECT ALL THAT APPLY)	N (%)
Restriction or requirement imposed by government authorities (direct impact)	23 (71.88%)
Restriction or requirement imposed by another organisation (e.g., customer) (direct impact)	7 (21.88%)
Restriction or requirement on another business flowed on to affect business (indirect impact)	14 (43.75%)
No restriction or requirement applied to business, either directly or indirectly (i.e., respondent answered 'no' to the 3 restriction questions above)	4 (12.5%)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s. Participants could indicate that they experienced restrictions/requirements directly from multiple sources (government authorities and another organisation) and/or were affected indirectly via restrictions/requirements being applied to another business.

Table 8 Type of restriction or requirement imposed by government authorities.

TYPE OF RESTRICTION OR REQUIREMENT APPLIED BY GOVERNMENT AUTHORITIES (SELECT ALL THAT APPLY)	N (%)
Quarantine order	4 (17.39%)
Geographic biosecurity zone	15 (65.22%)
Other restriction or requirement (e.g., site inspection, request for records, new or different procedures, extra sprays, movement restrictions)	17 (73.91%)

Note. This question was only presented to n=23 participants who indicated that they had been impacted by biosecurity incursion/s AND had a restriction or requirement imposed by government authorities.

Table 9 Length of time the restriction or requirement was imposed (for the longest period)

LENGTH OF TIME RESTRICTION OR REQUIREMENT WAS IMPOSED BY GOVERNMENT AUTHORITY (LONGEST PERIOD)	N (%)
Up to a fortnight	0 (0.00%)
Up to a month	4 (17.39%)
Up to half a year	3 (13.04%)
Up to a year	3 (13.04%)
Up to 18 months	1 (4.35%)
Up to 2 years	1 (4.35%)
Up to 5 years	0 (0.00%)
Up to 10 years	2 (8.70%)
Up to 20 years	3 (13.04%)
Longer than 20 years	3 (13.04%)
I'm not sure/I don't know/I prefer not to say	3 (13.04%)

Note. This question was only presented to n=23 participants who indicated that they had been impacted by biosecurity incursion/s AND had a restriction or requirement imposed by government authorities.

By comparison, in the case of restrictions or requirements imposed by another organisation – which was commonly customer-imposed – the average duration of the longest restriction or requirement was 7 years and 40 weeks (SD=8 years and 27 weeks) (ranging from 6 weeks to 20 years), with 3 (42.9%) indicating the restriction or requirement was ongoing.

Table 10 Organisation applying restrictions or requirements to business

ORGANISATION (SELECT ALL THAT APPLY)	N (%)
Customer	6 (85.71%)
Supplier	0 (0.00%)
Processor	0 (0.00%)
Marketing body or group	0 (0.00%)
Industry association	0 (0.00%)
Local or regional council	0 (0.00%)
Agricultural show society	0 (0.00%)
Other *("Other nurseries")*	1 (14.29%)
I'm not sure/I don't know/I prefer not to say	0 (0.00%)

Note. This question was only presented to n=7 participants who indicated that they had been impacted by biosecurity incursion/s AND had a restriction or requirement imposed by another organisation.

Impacts on the business

Participants who indicated that they had been impacted by biosecurity incursion/s were asked to indicate the ways in which their business had been impacted during the incursion. Many participants indicated that they experienced increased costs (n=15, 47%), increased workload requirements (n=13, 41%) and/or restricted or reduced trade (n=13, 40.63%)[1]. Stock loss in terms of destruction (n=12, 38%) or reduced value (n=9, 28%) was also a commonly reported impact.

Table 11 Impacts during the biosecurity incursion

IMPACTS (SELECT ALL THAT APPLY)	N (%)
Restricted or reduced trade	13 (40.63%)*
Reduced staff productivity (e.g., labour diverted to biosecurity tasks)	3 (9.38%)
Stock losses (destruction)	12 (37.5%)
Stock losses (reduced value)	9 (28.13%)
Increased costs	15 (46.89%)
Increased workload requirements (e.g., implementing biosecurity measures)	13 (40.63%)
Socio-emotional stress or anxiety on yourself, family and/or staff	3 (9.38%)
Staff changes (layoffs or recruitment)	1 (3.13%)
Business's reputation	2 (6.25%)
Other*	7 (21.88%)
I'm not sure/I don't know/I prefer not to say	0 (0.00%)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s. *two of these participants provided an open-ended response, which could be classified as reduced trade ("drops in sales" and "markets of that particular product disappeared completely as a result").

[1] 2 participants did not select the 'restricted/reduced' option. However, they selected the 'Other' category and provided an open-ended response that could be classified as 'restricted or reduced trade'.

In terms of how long the incursion affected their business, participants reported a large range of durations from up to a fortnight to longer than 20 years. Most participants indicated that there business was no longer or only a little affected.

Table 12 Duration of impacts

LENGTH OF TIME AFFECTED	N (%)
Up to a fortnight	2 (6.25%)
Up to a month	3 (9.38%)
Up to a few months	2 (6.25%)
Up to half a year	2 (6.25%)
Up to a year	4 (12.50%)
Up to 18 months	0 (0.00%)
Up to 2 years	5 (15.63%)
Up to 5 years	3 (9.38%)
Up to 10 years	3 (9.38%)
Up to 20 years	4 (12.50%)
Longer than 20 years	1 (3.13%)
I'm not sure/I don't know/I prefer not to say	3 (9.38%)
TOTAL	32 (100% of affected subsample)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

Table 13 Currency of impacts

STILL EXPERIENCING THE EFFECTS	N (%)
Not at all (business is no longer experiencing the effects)	14 (43.75%)
Still a little affected	8 (25.00%)
Still moderately affected	7 (21.88%)
Still greatly affected	3 (9.38%)
I'm not sure/I don't know/I prefer not to say	0 (0.00%)
Overall Mean=2.28, SD=1.46 on a scale from: 1=not at all to 5=still greatly affected	32 (100% of affected subsample)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

Trade impacts

Participants who indicated that they experienced restricted or reduced trade during the incursion (n=11, 34% of the subsample affected)[2] indicated that such trade restrictions/reductions occurred mainly within their state/territory, or with another state/territory.

Table 14 Geographic restriction on trade

GEOGRAPHIC TRADE RESTRICTION OR REDUCTION (SELECT ALL THAT APPLY)	N (%)
Within state/territory	10 (90.90%)
With another state/territory	10 (90.90%)
Internationally	2 (1.82%)
I'm not sure/I don't know/I prefer not to say	0 (0.00%)

Note. This question was only presented to n=11 participants who indicated that they had been impacted by biosecurity incursion/s AND experienced restricted or reduced trade.

In terms of restrictions on trade, two participants experienced a period of completely being unable to sell any product (which lasted 2 and 5 weeks each). Three participants experienced a period of not being able to sell some products, but not all (two did not provide a timeframe for this period, however, indicated it was 'weeks' in duration; and one participant was unsure/did not know). Participants reported that they are now able to sell all their products as usual.

Table 15 Product sales impacts

IMPACT ON TRADE (SELECT ALL THAT APPLY)	N (%)	DURATION OF TIME MEAN (SD) (MIN-MAX)	% SALES LOST MEAN (SD) (MIN-MAX)
Experienced a period when completely unable to sell any product	2 (1.82%)	5 weeks & 2 weeks	-question not asked-
Experienced a period when able to sell some products, but not all	3 (2.73%)	Duration in weeks (but unspecified)	100% (n=2 participants)

Note. These questions were only presented to n=11 participants who indicated that they had been impacted by biosecurity incursion/s AND experienced restricted or reduced trade.

Costs and financial impacts

To further probe the financial impacts of the biosecurity incursion, participants were asked to estimate the costs of managing the incursion, the value of stock and equipment that had to be destroyed/disposed of, and overall, the % of annual income lost because of the incursion.

[2] Note that the 2 participants who selected the 'Other' category and provided an open-ended response that could be classified as 'restricted or reduced trade' (bringing the total to n=13) were not asked the questions about geographic trade restrictions and product sales impacts, so are not included here, hence n=11.

Table 16 Costs of managing the incursion, value of stock/equipment loss, and % of annual income lost because of biosecurity incursion.

FINANCIAL IMPACTS	MEAN (MEDIAN) (MIN-MAX)
Additional costs in managing the biosecurity incursion ($)	$15,623 ($1000) ($0 to $200,000)
Value of plant-related stock and equipment that had to be destroyed or disposed of ($)	$97,842 ($0) ($0 to $1,500,000)
Percentage of annual income lost (%)	4.6% (2%) (0% to 25%)

Note. These questions were only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s. 6 respondents reported that they were 'not sure, didn't know or preferred not to say' to the questions relating to additional costs and value of stock; 9 respondents also reported that they were 'not sure, didn't know or preferred not to say' to the question of % annual income lost.

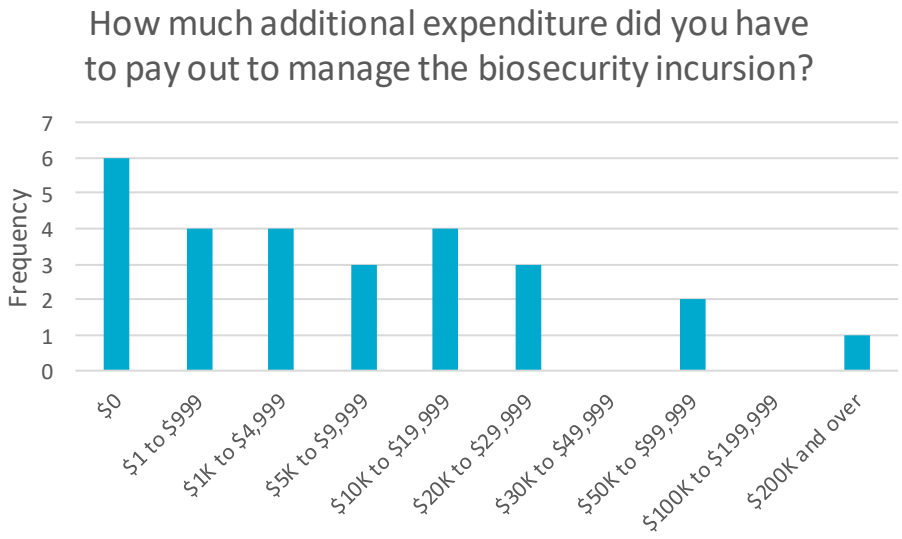

Figure 11 Frequency distribution of additional costs in managing the incursion

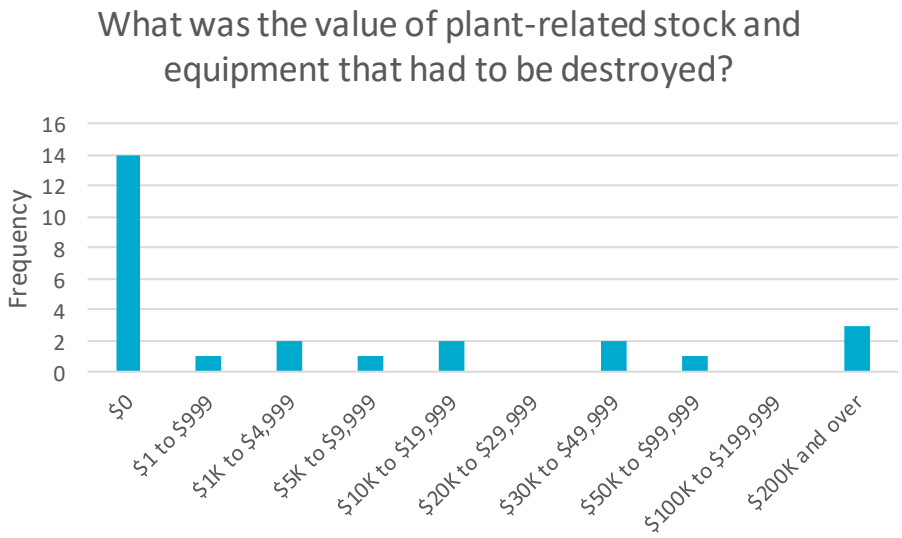

Figure 12 Value of plant-related stock and equipment that had to be destroyed or disposed of

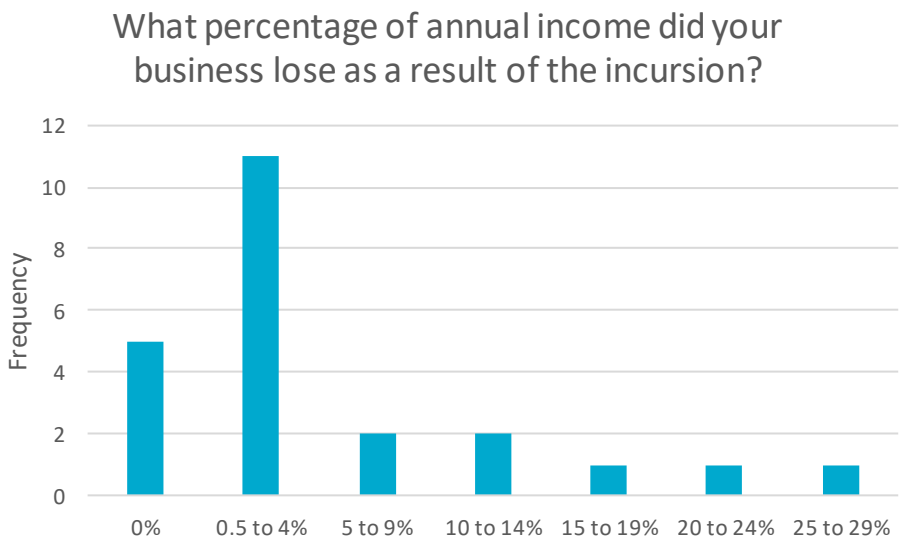

Figure 13 Approximate percentage of annual income lost as a result of the incursion

Regarding additional costs in managing the incursion, when the single respondent who spent $200,000 was removed from the calculation, the average cost reduced to $8,248 (median=$1000, ranging from $0 to $50,000). Regarding the value of plant-related stock and equipment that had to be destroyed, when the single respondent who spent $1,500,000 was removed from the calculation, the average cost reduced to $40,150 (median=$0, ranging from $0 to $500,000). Regarding the percentage of annual income lost, the spread was more even, with half of the respondents for this question losing less than 2% of their annual income but just under a quarter (22.7%) losing more than 10%.

Other economic costs

In addition to these financial impacts, participants were asked if they had experienced any other economic costs because of the biosecurity incursion.

Table 17 Other economic costs incurred because of the biosecurity incursion.

OTHER ECONOMIC COSTS (SELECT ALL THAT APPLY)	N (%)
Loss of customers or markets	8 (25.00%)
Stock sold at discounted price	4 (12.50%)
Higher financing/loan costs	0 (0.00%)
Other *"infrastructure for biosecurity and inspection costs"* *"abiding by rules had costs associated"* *"short term loss of customers"*	3 (9.38%)
None, no other types of costs	19 (59.38%)
I'm not sure/I don't know	0 (0.00%)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

Financial stress

In terms of the financial stress that participants experienced during the incursion, on average participants indicated that they felt a little stressed (Mean=2.03, SD=1.18).

Table 18 Subjective assessment of financial stress experienced during the biosecurity incursion.

FINANCIAL STRESS	N (%)
No financial stress at all	13 (40.63%)
A little financial stress	11 (34.38%)
A moderate amount of financial stress	4 (12.50%)
A lot of financial stress	2 (6.25%)
Overwhelming financial stress	2 (6.25%)
Overall Mean=2.03, SD=1.18 on a scale from:	32
1=no financial stress at all	(100% of affected subsample)
5=overwhelming financial stress	

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

Similarly, on average, participants reported that they found it easy to make ends meet (Mean=1.78, SD=1.13).

Table 19 Subjective assessment of difficulty in making 'ends meet' during the biosecurity incursion.

DIFFICULTY IN MAKING ENDS MEET	N (%)
Very easy to make ends meet	18 (56.25%)
Easy to make ends meet	8 (25.0%)
Neither difficult nor easy to make ends meet	2 (6.25%)
Difficult to make ends meet	3 (9.38%)
Very difficult to make ends meet	1 (3.13%
Overall Mean=1.78, SD=1.13 on a scale from:	32
1=very easy to make ends meet	(100% of affected subsample)
5=very difficult to make ends meet	

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

Stress, uncertainty, and coping

Participants rated the biosecurity incursion experience as a little to moderately stressful on average (Mean=2.56, SD=1.16); they were not at all to somewhat uncertain about the future of their business (Mean=1.47, SD=0.92) and felt moderately able to cope (Mean~3.50, SD~0.90). Most participants reported that they were 'very much' able to cope with the situation and were 'on top of things'.

Table 20 Subjective assessment of how stressful the biosecurity incursion experience was

PERCEIVED STRESS *OVERALL, HOW PERSONALLY STRESSFUL DID YOU FIND THE INCURSION EXPERIENCE?*	N (%)
Not at all stressful	7 (21.88%)
A little stressful	8 (25.0%)
Moderately stressful	11 (34.38%)
Very stressful	4 (12.5%)
Extremely stressful	2 (6.25%)
Overall Mean=2.56, SD=1.16 on a scale from: 1=not at all stressful 5=extremely stressful	32 (100% of affected subsample)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

Table 21 Uncertainty perceptions regarding the future of the business

UNCERTAINTY *DURING THE INCURSION, TO WHAT EXTENT DID YOU FEEL UNCERTAIN ABOUT THE FUTURE OF THE BUSINESS?*	N (%)
Not at all	24 (75.0%)
Somewhat	3 (9.38%)
Moderately so	3 (9.38%)
Very much so	2 (6.25%)
Overall Mean=1.47, SD=0.92 on a scale from: 1=not at all 4=very much so	32 (100% of affected subsample)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

Table 22 Ability to cope with the situation

COPING *DURING THE INCURSION, TO WHAT EXTENT DID YOU FEEL…* *[1=NOT AT ALL, 2=SOMEWHAT, 3=MODERATELY SO, 4=VERY MUCH SO]*	MEAN (SD) (MIN-MAX)
That you were able to cope with the situation?	3.47 (0.92) (1-4)
That you were on top of things?	3.53 (0.88) (1-4)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

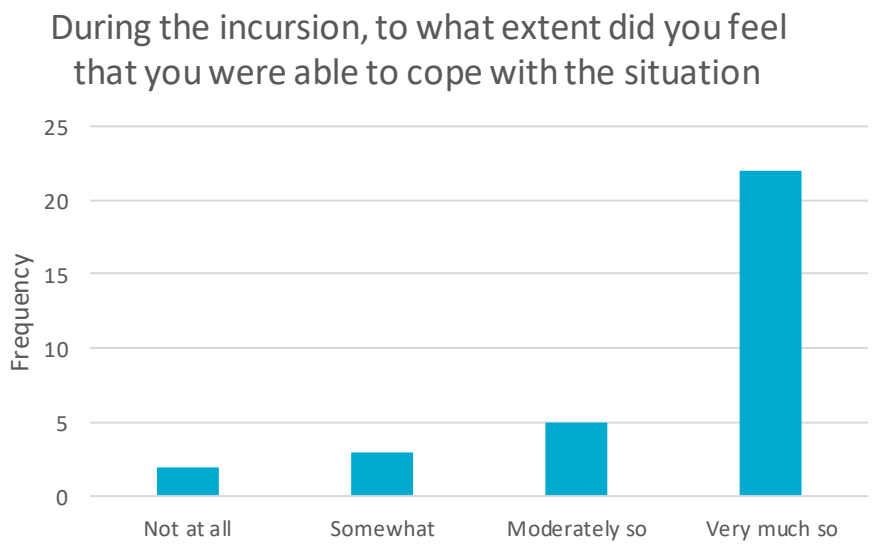

Figure 14 Frequency distribution of felt ability to cope during the incursion

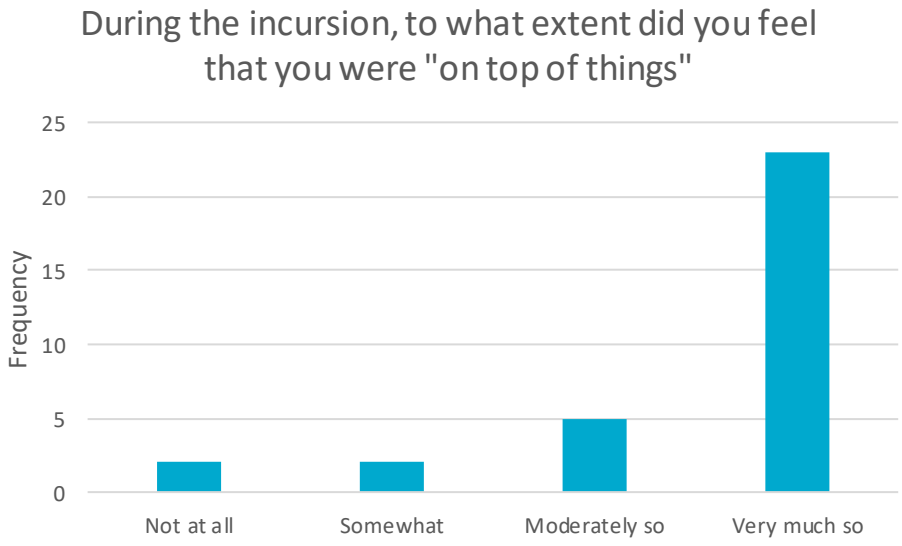

Figure 15 Frequency distribution of feeling 'on top of things' during the incursion

Sources of stress

An open-ended question was posed to participants to explore the aspects of the incursion that created the greatest stress or strain for them. The most mentioned sources of stress centred on uncertainty regarding the outbreak itself (when, where, how long, how to treat?).

Table 23 Open-ended responses to the source of greatest stress during incursion

THEME	EXAMPLE QUOTES	N (%)
Fear of potential spread/ outbreaks impacting your operation	The fact that these things can occur and you don't know whether the next one may really impact you - makes you follow due process of things that you're not sure about. The general public don't consider biosecurity. [1] the potential unknown of how much it was going to be an issue - you worried get worse [15]	11 (34.38%)
Uncertainty/ unpredictability	Uncertainty, didn't know where the disease came from or what it was for a long time [3] Unknown, don't know initial impact or how long it will last for [31]	9 (28.13%)
Lack of available information/ knowledge about pathogens	Having to find out how they operated and getting information about what they can/can't do - delay of weeks to get that information is nursery's cost [26] The outbreak, aware of the stake. Unknown of how infested it was. [58]	7 (21.88%)
Lack of bureaucratic direction/ clarity	Frustration with government departments [28] Long-term uncertainty and government lack of willingness to consider options. [79]	5 (15.63%)
Extra workloads	Change in procedures for packing and dispatch - totally re-write [51] Nothing too difficult, increased workload [56]	5 (15.63%)
Severity of restrictions	The restriction of trade [44] The unknown of the extent. Did not know how many families would be affected. First time they saw the severity of restrictions [80]	5 (15.63%)
Paperwork/red tape/ permits	Increased workload, extra time that you had put in. Everything has to be drenched and treated and extra paperwork [30] Concern that pest would get to the nursery (unimpacted so far) - would just have to shut down because of the red tape and costs and effort to continue to sell [37]	4 (12.5%)
Time delays in finding appropriate actions/ treatments	Having to find out how they operated and getting information about what they can/can't do - delay of weeks to get that information is nursery's cost [26] The fact that there was such an open-ended timeline [27]	3 (9.38%)
Extra costs/ expenses	Having to find out how they operated and getting information about what they can/can't do - delay of weeks to get that information is nursery's cost [26] Having to pay regularly to have fire ant checks [36]	3 (9.38%)

	Concern that pest would get to the nursery (unimpacted so far) - would just have to shut down because of the red tape and costs and effort to continue to sell [37]	
Environmental/ ecological impacts	The impacts on the environment because they are spraying or the disease damaging the ecology [33] The fear of it spreading further and the lack of alternative varieties of plant [42]	3 (9.38%)
Public perception/ image associated with your business	The unnecessary fact that they have been singled out and looked at as a fire ant risk even though they don't have them. [52] Frustrated customers, the initial telling customers of why they can't buy the tree [54]	2 (6.25%)
Inadequately trained people/ others not taking threats seriously nor acting responsibly	Untrained people going into plant shows and people who only learnt about it recently were employed to go around an inspect stock and had very little knowledge. [10] The general public don't consider biosecurity. [1]	2 (6.25%)
Lack of control	We can be responsible for our own site but not for what's outside of our site, the government and council response and not being able to control that [47]	1 (3.13%)
Nothing	There wasn't anything [19] There was no issue [66]	3 (9.38%)

Social support and collective efficacy

Overall, participants were satisfied with the support received, especially from family and/or friends, the nursery industry association, and other nursery businesses. Satisfaction with support from government agencies and biosecurity officers was more variable.

Table 24 Satisfaction with support received from various sources during the biosecurity incursion

SUPPORT *HOW SATISFIED WERE YOU WITH THE SUPPORT YOU RECEIVED FROM THE FOLLOWING SOURCES DURING THE INCURSION?* *[1=VERY DISSATISFIED, 2=DISSATISFIED, 3=NEITHER SATISFIED NOR DISSATISFIED, 4=SATISFIED, 5=VERY SATISFIED]*	MEAN (SD) (MIN-MAX)
Family and/or friends	3.88 (0.91) (3 to 5)
People in your local community	3.09 (0.86) (1 to 5)
Other nursery businesses	3.59 (0.84) (1 to 5)
The nursery industry association	3.88 (0.94) (2 to 5)
Government agencies and biosecurity officers	3.22 (1.26) (1 to 5)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

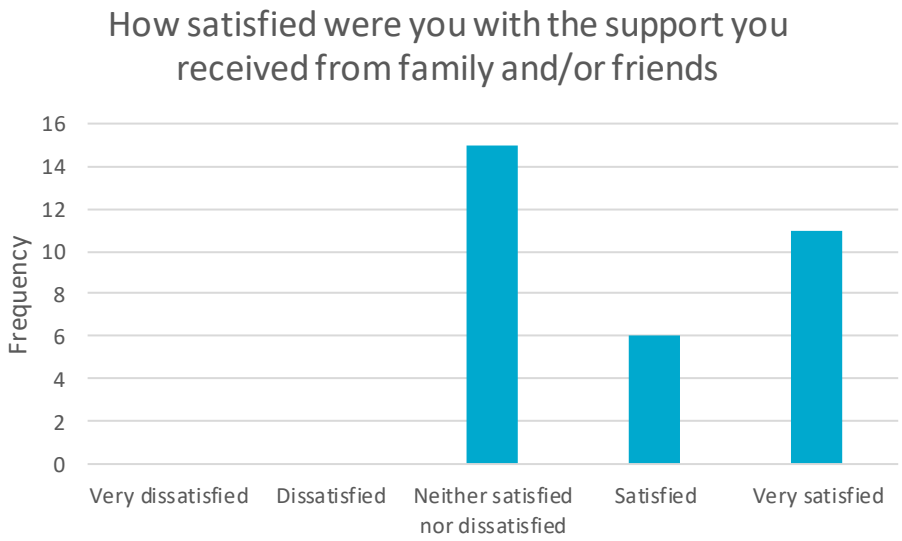

Figure 16 Frequency distribution of satisfaction with support from family and/or friends

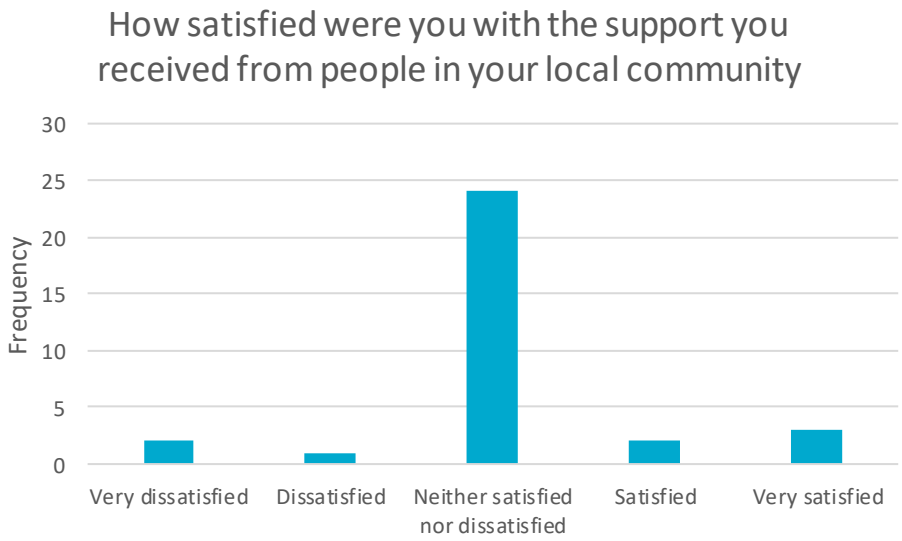

Figure 17 Satisfaction with support from the community

Figure 18 Satisfaction with support from other nursery businesses

Figure 19 Satisfaction with support from the nursery industry association

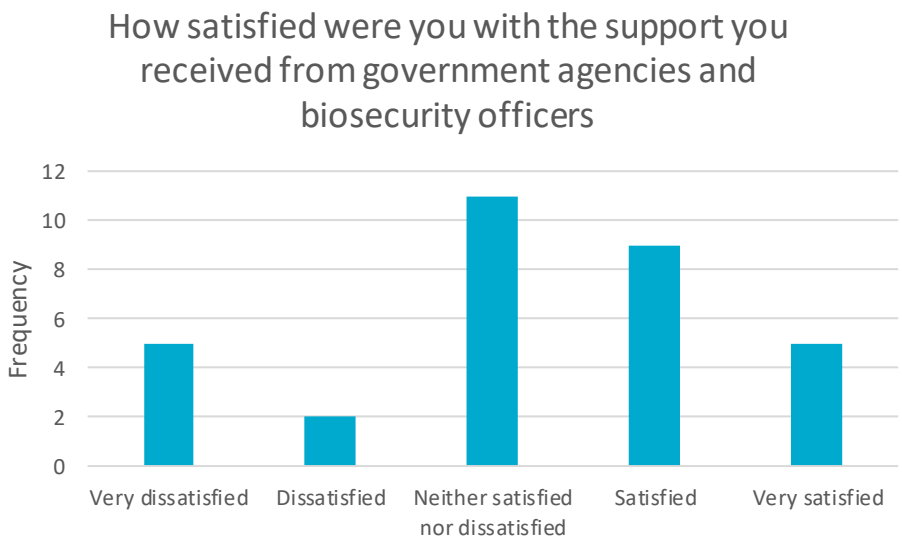

Figure 20 Satisfaction with support from government agencies and biosecurity officers

Participants' ratings of collective efficacy varied across the spectrum, which suggests that people's experiences differed. Some felt that different stakeholders effectively worked together in solving problems, while others strongly disagreed that this had occurred.

Table 25 Collective efficacy

COLLECTIVE EFFICACY *THINKING ABOUT NURSERY BUSINESSES, GOVERNMENT AND PEOPLE FROM THE INDUSTRY WORKING TOGETHER, HOW MUCH DO YOU AGREE THAT ALL OF THESE GROUPS WORKED EFFECTIVELY TOGETHER TO ADDRESS PROBLEMS ASSOCIATED WITH THE INCURSION?*	N (%)
Strongly disagree	8 (25.0%)
Disagree	3 (9.38%)
Neither agree nor disagree	7 (21.88%)
Agree	11 (34.38%)
Strongly agree	3 (9.38%)
Overall Mean=2.94, SD=1.37 on a scale from 1=strongly disagree 5=strongly agree	32 (100% of affected subsample)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

Business's reputation and relationships

Questions were asked about if and how the business' reputation and relationships (with customers, other nurseries) changed because of the incursion. Most participants indicated that their reputation and relationships remained unchanged.

Table 26 Perceived change in business' reputation

BUSINESS'S REPUTATION *HOW DID YOUR BUSINESS' REPUTATION CHANGE, IF AT ALL, AS A RESULT OF THE INCURSION?*	N (%)
Reputation declined a lot	0 (0.00%)
Reputation declined somewhat	5 (15.63%)
Reputation remained unchanged	26 (81.25%)
Reputation improved somewhat	1 (3.13%)
Reputation improved a lot	0 (0.00%)
Overall Mean=2.88, SD=0.42 on a scale from:	32
1=reputation declined a lot	(100% of affected subsample)
5=reputation improved a lot	

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

Table 27 Perceived change in business' relationship with other production nurseries in the industry

BUSINESS'S RELATIONSHIPS WITH OTHER PRODUCTION NURSERIES IN THE INDUSTRY *THINKING OF YOUR BUSINESS' RELATIONSHIPS WITH OTHER PRODUCTION NURSERIES IN THE INDUSTRY, OVERALL, HOW DID THESE RELATIONSHIPS CHANGE, IF AT ALL, AS A RESULT OF THE INCURSION?*	N (%)
Relationships deteriorated a lot	0 (0.00%)
Relationships deteriorated somewhat	4 (12.5%)
Relationships remain unchanged	27 (84.38%)
Relationships improved somewhat	1 (3.13%)
Relationships improved a lot	0 (0.00%)
Overall Mean=2.91, SD=0.39 on a scale from:	32
1=relationships deteriorated a lot	(100% of affected subsample)
5=relationships improved a lot	

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

Table 28 Perceived change in business' relationship with customers in supply chain

BUSINESS'S RELATIONSHIPS WITH CUSTOMERS IN SUPPLY CHAIN *THINKING OF YOUR BUSINESS' RELATIONSHIPS WITH CUSTOMERS IN YOUR SUPPLY CHAIN OVERALL, HOW DID THESE RELATIONSHIPS CHANGE, IF AT ALL, AS A RESULT OF THE INCURSION?*	N (%)
Relationships deteriorated a lot	0 (0.00%)
Relationships deteriorated somewhat	5 (15.63%)
Relationships remain unchanged	27 (84.38%)
Relationships improved somewhat	0 (0.00%)
Relationships improved a lot	0 (0.00%)
Overall Mean=2.84, SD=0.37 on a scale from: 1=relationships deteriorated a lot 5=relationships improved a lot	32 (100% of affected subsample)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

Positive outcomes from the experience

Participants generally reported that their biosecurity knowledge of, and practices/procedures moderately improved because of the incursion. Other positive outcomes, such as improved connections, general management practices, and market share increases were less prevalent.

Table 29 Positive outcomes associated with the biosecurity incursion.

POSITIVE OUTCOMES *THERE MAY BE POSITIVE OUTCOMES THAT RESULT FROM EXPERIENCING AN INCURSION. TO WHAT EXTENT DID YOUR…* *[1=NOT AT ALL, 2=SOMEWHAT, 3=MODERATELY SO, 4=VERY MUCH SO]*	MEAN (SD) (MIN-MAX)
…business' knowledge of how to manage biosecurity incursions improve?	2.97 (0.90) (1 to 4)
…business' biosecurity practices and procedures improve?	3.03 (0.97) (1 to 4)
…business' connections with biosecurity experts improve?	2.22 (0.91) (1 to 4)
…business' management practices in general improve?	2.44 (0.98) (1 to 4)
…business secure new markets or gain a greater market share?	1.28 (0.68) (1 to 3)

Note. This question was only presented to n=32 participants who indicated that they had been impacted by biosecurity incursion/s.

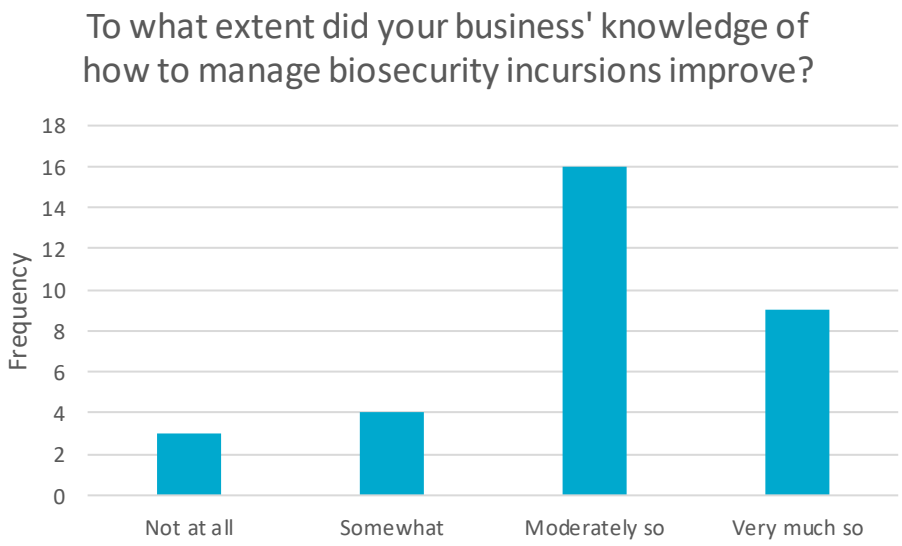

Figure 21 Frequency distribution of improvement in knowledge of how to manage a biosecurity incursion

Figure 22 Improvement in biosecurity practices and procedures

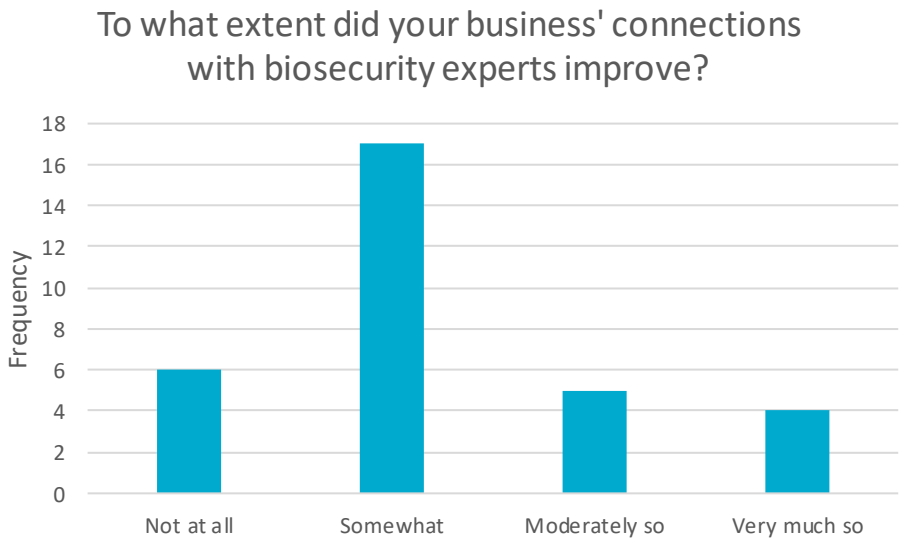

Figure 23 Improvement in connections with biosecurity experts

Figure 24 Improvement in general management practices

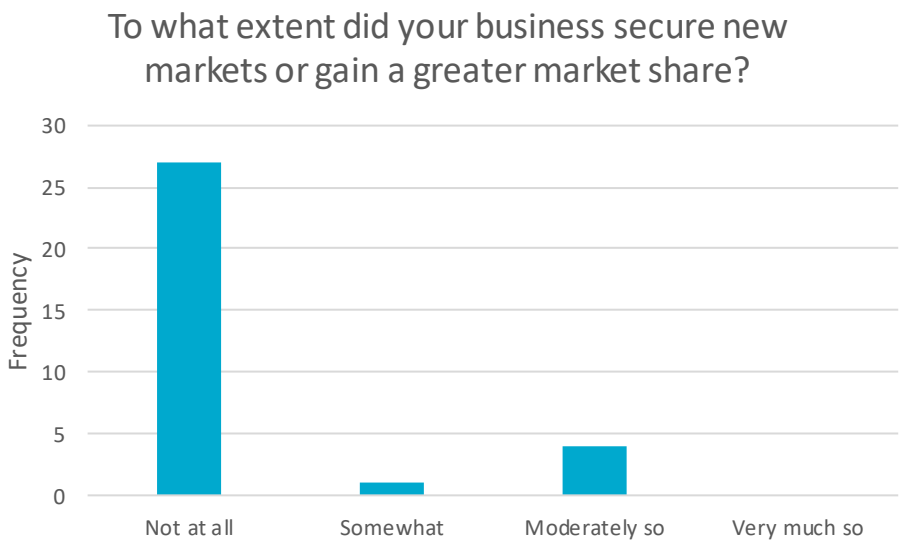

Figure 25 Improvement in securing new markets or gaining a greater market share

Perceptions of future biosecurity incursions

All participants (n=80) were presented with a series of questions about biosecurity incursions that could occur in the future.

Likelihood of a future biosecurity incursion

First, they were asked how likely they thought that a biosecurity incursion would impact their nursery in the next 12 months. On average, participants thought that there was a 30.30% (SD=29.76%) chance or likelihood of a biosecurity incursion affecting their nursery (0%=not at all likely, no chance of it happening, 50%=a 50-50 chance of happening, 100%=it's certain, it will definitely happen).

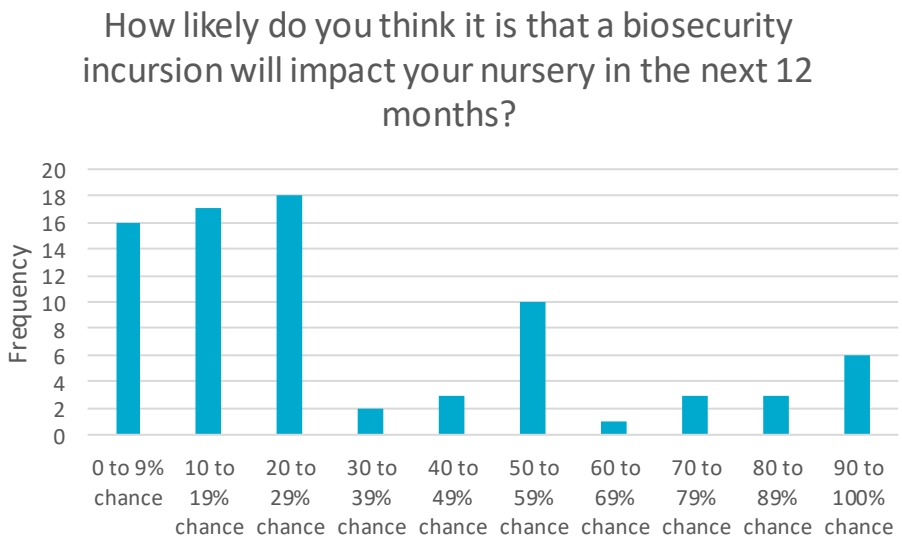

Figure 26 Frequency distribution of perceived likelihood of a biosecurity incursion affecting own nursery in the next 12 months

Severity of a future biosecurity incursion

Participants were then asked how severe they thought the impact of any incursion would be. The responses were somewhat skewed in that most (59%) thought the impacts would only be moderate or less, whereas a significant proportion (30%) expected the impacts would be at the extreme end.

Table 30 Perceived negative impacts on business if a biosecurity incursion were to occur.

POTENTIAL IMPACTS *IF A BIOSECURITY INCURSION WERE TO AFFECT YOUR NURSERY, EITHER DIRECTLY OR INDIRECTLY, HOW NEGATIVE DO YOU THINK THE IMPACTS WOULD BE?*	N (%)
No negative impacts at all	4 (5.00%)
Slightly negative impacts	12 (15.00%)
Moderately negative impacts	31 (38.75%)
Very negative impacts	9 (11.25%)
Extremely negative impacts	24 (30.0%)
Overall Mean=3.46, SD=1.21 on a scale from: 1=no negative impacts at all 5=extremely negative impacts	80 (100%)

Maximum duration of shutdown for business survival in a future biosecurity incursion

Participants were asked about how long their business could be shut down (closed for trading) in an incursion before it threatened long-term business survival. Over two thirds (68.74%) indicated 3 months or less.

Table 31 Maximum length of time business could afford to remain closed for trading and still survive

LENGTH OF TIME CLOSED FOR TRADING *IF YOUR BUSINESS WAS TEMPORARILY SHUT DOWN DUE TO A BIOSECURITY INCURSION, HOW LONG DO YOU THINK YOUR BUSINESS COULD REMAIN CLOSED FOR TRADING YET STILL SURVIVE IN THE LONG TERM?*	N (%)
A few days up to a week	3 (3.75%)
A few weeks	9 (11.25%)
One month	11 (13.75%)
Two months	14 (17.5%)
Three months	18 (22.5%)
Six months or more	25 (31.25%)
Overall Mean=4.38, SD=1.51 on a scale from: 1=a few days up to a week 6=six months or more	80 (100%)

Confidence in managing an incursion

Participants were asked about their confidence in being able to manage to continue trading throughout an incursion. The vast majority (89%) of participants were 'moderately' to 'very' confident.

Table 32 Confidence in managing the biosecurity incursion, to continue trading

CONFIDENCE IN CONTINUING TRADE *HOW CONFIDENT ARE YOU IN YOUR ABILITY TO MANAGE THE SITUATION SO THAT YOUR BUSINESS COULD CONTINUE TO TRADE THROUGH A BIOSECURITY INCURSION?*	N (%)
Not at all	4 (5.00%)
A little confident	5 (6.25%)
Moderately confident	40 (50.00%)
Very confident	31 (38.75%)
Overall Mean=3.23, SD=0.78 on a scale from: 1=not at all 4=very confident	80 (100%)

Sense of control over ability to trade during an incursion

Almost two thirds (65%) of participants agreed that their capacity to continue trading during an incursion was 'somewhat' to 'entirely' out of their control. This presents an interesting contrast to the previous question, where the vast majority were 'moderately' to 'very' confident they could manage the situation to enable continuation of trading during an incursion.

Table 33 Control perceptions regarding continuation of trading through a biosecurity incursion.

CONTROLLABILITY *TO WHAT EXTENT DO YOU AGREE THAT WHETHER YOUR BUSINESS CONTINUES TRADING THROUGH AN INCURSION IS SOMETHING THAT IS ENTIRELY OUT OF YOUR CONTROL?*	N (%)
Strongly disagree (it's entirely within your control)	3 (3.75%)
Disagree (it's somewhat within your control)	16 (20.00%)
Neither agree nor disagree	9 (11.25%)
Agree (it's somewhat out of your control)	26 (32.5%)
Strongly agree (it's entirely out of your control)	26 (32.5%)
Overall Mean=3.70, SD=1.23 on a scale from: 1=strongly disagree 5=strongly agree	80 (100%)

Preparing for a future incursion

Over a third of participants (37.5%) indicated it was highly important/ a high priority for their business to prepare a biosecurity plan in case of a future incursion.

Table 34 Importance of developing a biosecurity plan in case of a biosecurity incursion.

RELATIVE IMPORTANCE OF DEVELOPING A BIOSECURITY PLAN *COMPARED TO OTHER ISSUES YOUR NURSERY IS DEALING WITH IN RUNNING THE BUSINESS, HOW IMPORTANT IS IT THAT YOUR BUSINESS SPENDS TIME OR INVESTS IN DEVELOPING A BIOSECURITY PLAN IN CASE AN EMERGENCY PLANT PEST INCURSION OCCURS?*	N (%)
Not at all important / not a priority	2 (2.5%)
Low importance / low priority	20 (25.00%)
Moderate importance / medium priority	28 (35.00%)
High importance / high priority	30 (37.5%)
Overall Mean=3.08, SD=0.85 on a scale from: 1=not at all important 5=high importance	80 (100%)

Supports required

When provided a list of potential supports, participants appeared to be most interested in accessing experts who can provide information and assistance on biosecurity-related matters. They were moderately interested in information and/or training to learn how to manage through an incursion themselves. And they were slightly interested in insurance cover.

Interest in types of support

Table 35 Interest in various supports to help business in preparing for and/or in managing a biosecurity incursion.

POTENTIAL SUPPORTS *HOW INTERESTED WOULD YOU BE IN THE FOLLOWING OPTIONS, TO HELP YOUR BUSINESS IN PREPARING FOR AND/OR IN MANAGING A BIOSECURITY INCURSION…* *[1=NOT INTERESTED AT ALL, 2=SLIGHTLY INTERESTED, 3=MODERATELY INTERESTED, 4=VERY INTERESTED, 5=EXTREMELY INTERESTED]*	MEAN (SD) (MIN-MAX)
…access to experts who can provide useful information and assistance on biosecurity related matters	3.75 (1.35) (1 to 5)
…information and/or training on how to manage your business through a biosecurity incursion	3.04 (1.45) (1 to 5)
…access to information on managing personal and social challenges	2.56 (1.39) (1 to 5)
…insurance cover (i.e., income protection, in the event of an incursion)	2.34 (1.32) (1 to 5)

Other supports suggested

In addition to the pre-determined list of supportive measures, a series of open-ended questions were asked to explore whether there was anything that participants thought that government authorities, nursery industry associations, another type of organisation, or production nursery businesses themselves, could do to help production nurseries in managing biosecurity incursions. The following four tables display the main themes/types of support, suggested for each of the four categories of organisations.

Table 36 Actions by government authorities

THEME	EXAMPLE QUOTES	N (%)
Improved / streamlined avenues of communication	Disseminate information better and create a comprehensive database to supply information and contact people. [17] Building a database and effective communication to nurseries and financial support [23]	25
More consultation with industry	They need to have some industry connection and more consultative meeting with industry and nurseries. With myrtle rust, take a more a balanced approach rather than turn it into a big scar - an overreaction. [10] To understand that biosecurity risk is a joint management decision, it is preventative and control. Need to work together, not just shut everything and everyone down. Work between states better, the laws and plant species are not common. [71]	20
More Government support / responsibility	Depends on severity. If not someone's fault and came in overseas you'd like more government support and acceptance on blame [9] Financial and technical support for nurseries. Networks of nurseries. [33] Not to look at them as the enemy, to look at in terms of preventing incursions, we are the front line and that deserves more support. For example, for seeds to be brought into the state it has to pass quality control despite the fact it's already been brought into the country and inspected. [79]	15
Be quicker to act / organize responses/ have action plans ready to put into effect/ be prepared	Getting on top of things in a quick manner - e.g., myrtle rust - I wouldn't things being traded until it's safe. Stop the spread - be proactive and quick to manage [1] To respond to the treatment of fire-ants quicker than they currently do, they should be there within a few days [36]	13
Financial support	Support - when anything happens that any community or business need support to be able to provide work, security and safety. Financial support - when things happen beyond our control we need help. [12] Financial assistance when an incursion occurs [31]	12

THEME	EXAMPLE QUOTES	N (%)
On the ground access to better trained experts	Provide technical information and access to exports in regard to action to take [7] Localised expert help, rather than people who come from places far away - as they closed the local DPI office - localised expert help [15]	11
Recognize the Nursery industry is efficiently maintained, capable and autonomous	Govt - attitude as nursery industry is well organised with knowledge - some may need financial help but have shown to be well self-maintained. [16] Allow self-management within the industry, the industry is more than capable of managing itself, experts only fake their way through issues, need to allow producers to regulate freely rather than depend on government henchmen [28]	10
Unify state-based bodies into a Nationally coordinated authority	Country wide unified approach, less state segmented regulations. The whole eastern side of Australia having multiple ways of dealing with issues is tiresome [47] Govt try to work together but sometimes like states are not working together Biosecurity similar to COVID in terms of states blocking each other to an extent. Need to talk to each other more to eliminate the risk [76]	8
More stringent proactive quarantine policies	They could do quite a few things, faster action on the behalf of quarantine agencies and more stringent quarantine and eradication efforts [3] Do a better job of quarantine. Better preventative approaches [77]	7
Establishing a database tracking and recording biosecurity impacts	Disseminate information better and create a comprehensive database to supply information and contact people. More of a regulatory body [17] Building a database and effective communication to nurseries and financial support [23]	6
Doing as well as can be expected	They have it pretty well in hand [2] Think they have done a pretty good job. Have not had to deal with them apart from COVID [39]	5
Simplify paperwork	Make the imported permits more simple [4] The Biosecure HACCP program is generic and the downside is there's a lot of red tape that doesn't apply to what we want to do in helping to manage possible biosecurity risks. Not reactive, more preventative approach from the government. [59]	2
Don’t know		14

Table 37 Actions by nursery industry associations

THEME	EXAMPLE QUOTES	N (%)
Maintain dissemination of up-to-date information	In my experience they send out flyers and biosecurity teams - make sure you keep on top of that information [1] They are doing their job - keeping us in the loop and informed [18]	25
Doing a good job so far	Pretty good - long way away - they were very proactive in the information [15] Do not think they can do much better than they already are[55]	23
Provide access to support / assistance and advice for members	Conduit for expert advice [57] Updating on information is big thing. Possibly offering technical assistance on management of situation [65]	20
Lobby government authorities on behalf of members	Lobby the government that nurseries are trained and ready. Assist with training. [14] Lobby harder for horticultural industry to keep and up and be on top of things [25]	12
Engage government bodies and work together	Need to get onto the government quick, them working together [6] They could work with the government and the nurseries, be the intermediary. [71]	8
Increased vigilance over imports / quarantining	Improvements of the freighting channels [2] There need to be a lot more servere penalties in regard to illegal importation, no deterrent for offenders and needs harsher penalties [28]	5
Don't Know		17

Table 38 Actions by other organisations

THEME	EXAMPLE QUOTES	N (%)
Improved communication, cohesion, co-operation and involvement across industries and government	DPI or LLS - a bit unknown because they aren't like they were - all the guys we knew in the myrtle rust lost their jobs, local land services - changed - don't have a dedicated person out of need or fiscal reasons - there's no go to person in those organisations. [1] Correspondence between government agencies - the nursery garden industry and the local department of primary industries [15]	10
More involvement from industry associations	Industry associations, like citrus industry associations specific ones for the nurseries - specific crop associations [5] Farmers association - if there was a citrus [incursion], it will affect all orchards and everything - it would be a big blow to the economy - they need to be in the loop [6]	3
Provide access to experts / inspectors	Primary industries could be doing more, expert inspectors are now limited, DPI fireants section DPI no longer provides this services not for the last 3 years -- legislation has been enforced no more DPI support [50] Nursery visits to make sure things aren't going unnoticed [70]	3
Improve finance possibilities / insurance	Insurance - lack of cover available and what is on offer is expensive [25] Matter of stress and strain (paperwork to prove you've managed it well) and finance (applied for 450k and got 240k) - if someone can help this then yes [26]	2
Local groups to provide access to information / Support	GreenLife - they could do a similar thing - awareness, strategies and support [19] Bush regeneration community site would be good to have for better access to information [24]	2
Engage Bunnings	Think everyone supports each other. Bunnings will bring freight to help out. More helping one another [29] Bunnings are a supply chain leader so have access into the mailboxes of growers that the government does not. Get them involved for large scale operations [55]	2

THEME	EXAMPLE QUOTES	N (%)
Involve universities and research bodies	Hort innovation provide funding, more departments and unis could help with the problem [63] Agencies like CSIRO could develop procedures in case of major problems with a disease. Be proactive and assess global risks and make national decisions [76]	2
Industry bodies to raise funds against incursions/ levies	Associations need to have a pot levy, wherein you become a member of the association and get information from the association. [21] Hort innovation provide funding, more departments and unis could help with the problem [63]	2
Access to database / detailed information on pathogens	In an ideal world they could identify what plants and diseases are in the country and have a state by state database of whether they are an issue there. Common database that shows what disease is an issue in different states. Common resource of plant, plant name, disease and disease name [71] Agencies like CSIRO could develop procedures in case of major problems with a disease. Be proactive and assess global risks and make national decisions [76]	2
No / Nothing comes to mind		11
Don't know		47

Table 39 Actions by businesses themselves

THEME	EXAMPLE QUOTES	N (%)
Awareness of biosecurity requirements / hygiene / testing for pathogens / biosecurity action plan / tracking/ being prepared / best practices	Being aware of what people know. Businesses need assistance to be totally prepared - knowing where to look, if we don't know what we are looking for and what we should be doing. What to look out for, how to prevent, "if you see this get in touch with us". There is a lack of confidence in government to give credible, quality knowledge e.g., EPA - so underfunded they don't do a lot. And we have good, from my opinion, I like the tissue culture. If there was an outbreak I don't know what is there [14] General overall hygiene and standards [22] Preparation- be on top of your stock - assess your stock every day - responding - not to sweep it under the carpet, get on top it as soon possible, treating if you can or contacting someone who can [11] Track already well where plants come from and go to. Improve product tracing. Vigilance for problems to spot early [79]	56
Keep their staff educated / trained to be vigilant / keep informed of risks	Educate people, policy and procedure to prepare for it [6] Everybody should have a biosecurity plan and more training courses - education can help with a lot of it - the government should push money that way to the association to incorporate education and training. [10]	25
Adhere to industry standards / government regulations	Following the advice of the government [2] It's all about safework practice - a continuous safework practices - going by industry standards, reducing your ability to import, control or monitor the developments on any weed or pest outbreaks - good horticultural practice helps to minimise that. [8]	15
Establish access to expert advice / accreditation assistance / greater communication among nurseries	Do the checks that they need to do. Have contacts within and external to identify. Need to have better communication between nurseries [23] A lot of businesses could prepare themselves better or join an affiliation group to inform [46]	12

THEME	EXAMPLE QUOTES	N (%)
Accreditation programs / registration	Have some sort of registration again [17] Track what you do - inward and outward stock and managing the nursery under an accredited system. Incursions can be the fault of many different people and impact is harsh so can only prepare so much [26] Prepare to best of their ability - get accredited, etc [51] Working within the parameters of the industry the Biosecure HACCP would be useful. Best tool being offered by the industry to manage biosecurity [77]	8
Doing a good job as it is	All doing a pretty good job [49] Already doing well and working well together [73]	5
Select or produce your own resistant / less vulnerable plant species	Select plants that are less susceptible - smart plant selection to reduce exposure and risk [7] Run a few things themselves. Produce your own stock where you can, to avoid buying in. Limit the contact between production nurseries. [67]	4
Don't Know		11

Appendix B Interview questions

INTERVIEW QUESTION LIST

1. What is your organisation and your role in it?
2. [If not a nursery business] What is the relationship of your organisation and/or role to the production nursery industry?

DESCRIPTION OF THE BIOSECURITY INCURSION AND ACTIONS TAKEN TO RESPOND TO IT

3. Please describe your experience or knowledge of an emergency plant pest incursion in the production nursery industry [or "horticulture industry" if not specific to nurseries]?
    a. What was the nature of the outbreak (type of plant, type of pest, localized or widespread, duration, etc)?
    b. What happened in the nursery business (how many plants affected; what parts of the business were affected; how long did it take for detection, reporting and a response to occur; any other related businesses/supply chain affected)?
    c. What actions did the nursery business owner/manager take to respond?
        i. How was this action viewed by the authorities?
        ii. How was this action viewed by the nursery industry?
    d. What actions did the authorities involved in the response take to respond?
        i. How was this action viewed by the business owner/manager?
        ii. How was this action viewed by the nursery industry?
    e. What actions did the nursery industry take to respond?
        i. How was this action viewed by the business owner/manager?
        ii. How was this action viewed by the authorities?
    f. What actions did other businesses in the supply chain take to respond?
        i. How was this action viewed by the business owner/manager?
        ii. How was this action viewed by the authorities?
    g. Who else (roles or organisations) were significantly involved or took action, what did they do, and what was the reaction by others?

IMPACTS

4. What were the impacts of the incursion event and associated regulatory response by the authorities on *specific nursery operations*?
    a. Were some operations or aspects of the business more impacted than others?

5. What were the economic impacts of the incursion and associated response on the nursery business?

    a. How *severe* was the economic impact (lost revenue and/or increased costs as a proportion of business revenue)?

    b. How *broad or specific* were the economic impacts (only affected one part of the business or affected many parts)?

    c. How long did the economic impacts last?

        i. Did the duration differ for different parts of the business/types of operations?

        ii. What were the short-term, medium-term and long-term impacts?

6. Apart from the economic impacts on the affected nursery business just described, what were the economic impacts on *other businesses*?

    Prompts:

    a. In the nursery industry?

    b. In the broader supply chain?

    c. In the local community?

7. How would you describe the social impacts of the incursion and associated response on the nursery business?

    a. On the owner/manager of the affected nursery?

    b. On the staff? (Please avoid providing identifying information and speak in general terms only)

        Prompts:

        1. their health and wellbeing?
        2. their relationships
        3. connection to community, networks, sense of trust (social capital)
        4. standing/reputation in the industry
        5. their way of life – how they live, work, play and interact on a day-to-day basis
        6. their fears and aspirations/hopes – their perceptions about:
            a. their sense of security
            b. the future of their business, industry & community
            c. their aspirations for their future and the future of their children

8. Apart from the social impacts on the nursery business just described, what were the social impacts on other individuals and organisations:

Prompts:

a. In the nursery industry?

b. In the broader supply chain?

c. In the local community?

ALTERNATIVES & SOLUTIONS

Economic impacts

9. What actions could have been taken (or what actions would you recommend be taken in future in similar cases) to reduce or mitigate the economic impact on the *affected nursery business* (e.g. to prevent complete shutdown and/or to provide alternative business/trading opportunities)?

   Prompts:

   a. Actions by the affected nursery business itself?

   b. Actions by the authorities involved in the response?

   c. Actions by other businesses in the supply chain?

   d. Actions by any other relevant individual roles, organisations or entities?

10. What actions could have been taken (or what actions would you recommend be taken in future in similar cases) to reduce or mitigate the economic impact on *other nursery businesses*?

    Prompts:

    a. Actions by the affected nursery business?

    b. Actions by the authorities involved in the response?

    c. Actions by other businesses in the supply chain?

    d. Actions by any other relevant individual roles, organisations or entities?

11. What actions could have been taken (or what actions would you recommend be taken in future in similar cases) to reduce or mitigate the economic impact on *other types of businesses in the supply chain*?

    Prompts:

    a. Actions by the affected nursery business?

    b. Actions by the authorities involved in the response?

    c. Actions by other businesses in the supply chain?

    d. Actions by any other relevant individual roles, organisations or entities?

12. What actions could have been taken (or what actions would you recommend be taken in future in similar cases) to reduce or mitigate the economic impact on the *broader community*?

    Prompts:

    a. Actions by the affected nursery business?

b. Actions by the authorities involved in the response?

c. Actions by other businesses in the supply chain?

d. Actions by any other relevant individual roles, organisations or entities?

Social impacts

13. What actions could have been taken (or what actions would you recommend be taken in future in similar cases) to reduce or mitigate the social impacts on the *affected nursery business*?

    Prompts:

    a. Actions by the affected nursery business?

    b. Actions by the authorities involved in the response?

    c. Actions by other businesses in the supply chain?

    d. Actions by any other relevant individual roles, organisations or entities?

14. What actions could have been taken (or what actions would you recommend be taken in future in similar cases) to reduce or mitigate the social impact on *other related businesses*?

    Prompts:

    a. Actions by the affected nursery business?

    b. Actions by the authorities involved in the response?

    c. Actions by other businesses in the supply chain?

    d. Actions by any other relevant individual roles, organisations or entities?

Operational impacts

15. What actions could have been taken (or what actions would you recommend be taken in future in similar cases) to reduce or mitigate the operational impacts on the *affected nursery business*?

    Prompts:

    a. Actions by the affected nursery business?

    b. Actions by the authorities involved in the response?

    c. Actions by other businesses in the supply chain?

    d. Actions by any other relevant individual roles, organisations or entities?

16. What actions could have been taken (or what actions would you recommend be taken in future in similar cases) to reduce or mitigate the operational impacts on the *other related businesses*?

    Prompts:

    a. Actions by the affected nursery business?

    b. Actions by the authorities involved in the response?

    c. Actions by other businesses in the supply chain?

d. Actions by any other relevant individual roles, organisations or entities?

17. Is there anything else about this issue you would like to share with me, any other aspect I may have missed?

18. Are there any individuals you would suggest may be relevant and/or interested in speaking with CSIRO about this topic? (Yes/No)

    a. If yes, would you be comfortable approaching them to see if they would consent to having their contact details provided to CSIRO so that I could contact them about the project?

Appendix C Participant Information Sheet and Consent Form

Ensuring Business Continuity during biosecurity incursions in the Production Nursery Industry (the Project): Participant Information Sheet

The aim of this project is to understand the social and economic impacts of emergency plant pest incursions on production nursery businesses, to develop a framework of support that helps achieve greater business continuity during a biosecurity event.

The Project

The Project involves engaging with nursery industry growers and stakeholders to gain a stronger understanding of the social and economic impacts of past biosecurity incursion events on production nursery businesses. This information will be used to develop a framework of supportive actions that growers, industry and government can take to mitigate these impacts, minimise interruptions, and better support nursery producers during an emergency plant pest response in the future. A key objective of this research is to better understand how pest and disease movement can be restricted during a biosecurity incursion in production nursery businesses, without shutting down the 'whole of business' operations.

What is involved in the Project?

The Project will focus on several discrete case-studies of emergency plant pest incursion events. You are invited to participate in the Project because of your interest or experience in managing biosecurity events.

Your participation will involve taking part in a telephone, online or face-to-face interview. The interview will take approx. 45 minutes and, with your consent, will be audio-recorded and transcribed to preserve the accuracy of information you provide. Your information will be kept secure and confidential and will be de-identified in any publication from the Project.

Native Paper Daisies [Photographer: Carl Davies]

It is important to remember that there are no right or wrong answers regarding the information you contribute to the Project. We are only interested in sharing in your knowledge and honest thoughts and opinions related to this topic.

The researchers will seek your views on the following main areas:

- Social and economic impacts of emergency plant pest incursions on production nursery businesses
- Actions that can be taken to mitigate social and economic impacts and support producers through a biosecurity incursion
- Business measures that can be taken to restrict pest and disease movement during a biosecurity incursion, without shutting down 'whole of business' operations
- Improving the capability of businesses to return to effective operations and a viable level of trade

Participation and withdrawal

Participation in the Project is valued, completely voluntary and you are free to withdraw at any time without explanation. If you wish to withdraw, simply notify the researcher(s) and you will be free to exit. If you withdraw, any data you have provided prior to its aggregation with other research data will be removed from the Project and will not be included in any further analyses.

Will I receive payment for taking part in the Project?

Those participating will not receive payments for taking part.

Risks involved in participation

In general, there are few risks in participating in the Project beyond those of normal living. However, there is a foreseeable risk to participants in this study of revealing information previously undisclosed to authorities about past actions taken by yourself or others that may pose a current biosecurity risk. The researchers, along with all Australian citizens, have an obligation to report previously undisclosed information about a current biosecurity risk to authorities. While we encourage you to disclose any such information to the authorities yourself, we will not be seeking this type of information from you. To mitigate this risk for participants, the researchers will provide a reminder at the commencement of the interview, to actively discourage you from revealing this type of information to us.

Confidentiality of Data

Interview recordings will be transcribed but the data will only be seen by members of the Research Team and the contracted transcription provider. All information collected from you will be anonymised using a coding system before it is published, so that there can be no direct association between your identity and the data you provide. The data will be stored in a secure area that is not accessible to any individuals other than the Research Team.

How will my information be used?

Your personal information is protected by the *Privacy Act 1988* (Cth) and CSIRO will handle your personal information in accordance with this Act and the NH&MRC National Statement on Ethical Conduct in Human Research (2007) as amended from time to time.

Your personal information including your name, contact details and your opinions and answers to the interviews, is being collected for the purpose of conducting the Project and related scientific research and development. CSIRO may also collect your sensitive information, such as your image, as part of the recording of the interview. If you do not provide your personal information, you will be unable to participate in the Research.

CSIRO may disclose your information to third parties including a contracted transcription provider, for the purposes outlined above.

The information you provide will be de-identified and/or aggregated before it published/presented in a variety of forums, including a report to Nursery & Garden Industry Queensland (NGIQ), academic publications, journal publications and book chapters, as well as conference/ seminar presentations. Your details will only be published with your consent. Where information may potentially re-identify you, your consent will also be sought prior to publication. The aim is for the findings of the Project to be integrated with other current levy-funded research by NGIQ on managing natural hazards and supporting business continuity, in order to develop an integrated, whole-of-industry business continuity management framework.

The CSIRO Privacy Policy available at https://www.csiro.au/en/About/Access-to-information/Privacy outlines how your personal information will be handled, including details about how you can seek access or correction of the personal information we hold about you and how you can complain about a breach of the Australian Privacy Principles (APPs) and how CSIRO will deal with the complaint. If you require further

information on how your personal information will be handled, please contact privacy@csiro.au.

How is the Project funded?

The Project has been funded by Hort Innovation, using the Nursery Industry research and development levy and contributions from the Australian Government. The Project is one research component of a broader project funded by Hort Innovation and led by NGIQ known as 'NY18010 Ensuring Business Continuity during biosecurity incursions; Social and Economic research learnings for the Production Nursery Industry'. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

Ethical Clearance and Contacts

The Project has been cleared in accordance with the ethical review processes of CSIRO, within the guidelines of the National Statement on Ethical Conduct in Human Research (2007). If you have any questions concerning your participation in the Project feel free to contact the researchers involved.

Alternatively, any concerns or complaints about the conduct of the Project can be raised with the Manager of Social Responsibility and Ethics on (07) 3833 5693 or by email at csshrec@csiro.au.

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Thank you for your help with this important research

Ensuring Business Continuity during biosecurity incursions in the Production Nursery Industry (the Project): Research Consent Form

The aim of the Project is to develop a framework of support that helps production nursery businesses achieve greater business continuity during a biosecurity event.

Your involvement in the Project is highly valued. Please review the information below and sign if you agree to participate in the Project.

I acknowledge that:

- I have agreed to participate in this social research project and I am 18 years of age or older.
- I understand my participation in the Project will involve a 45 minute face-to-face, telephone or online interview.
- I understand that the interview will be recorded for transcription and reference purposes to help ensure accuracy of the data.
- I can obtain further information about the project from the Research Team at any time during the project.
- I understand that if I reveal information previously undisclosed to authorities about past actions taken by myself or others that pose a current biosecurity risk, the researchers are obliged to notify the authorities.
- I understand that the Project has been cleared in accordance with the ethical review processes of the Commonwealth Scientific and Industrial Research Organisation (CSIRO). I have been provided with contact details of the CSIRO Human Research Ethics office, where I can speak to an independent ethics officer if I have any concerns about the Project.
- I understand that I am able to stop taking part in the Project at any time without giving an explanation for my withdrawal.
- I understand that if I do withdraw from the Project, any data I have provided prior to its aggregation with other research data will be removed from the Project and will not be included in any further analyses.
- I understand that I will not be paid directly for my participation in the Project.
- I agree to the collection, use and disclosure of my personal information in the ways described in the Participant Information Sheet titled 'Ensuring Business Continuity during biosecurity incursions in the Production Nursery Industry.'

Sign: _____ Date: _____

By providing my consent to participate in this research, I confirm that I have read and understood the accompanying Participant Information Sheet and the contents of this Consent Form

Thank you for your participation

RESEARCH TEAM CONTACTS

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Appendix D Survey questionnaire

Survey of production nurseries in Australia (the Survey)

Hello and thanks for agreeing to do this survey! We appreciate your time and value your answers.

This survey is being conducted by CSIRO and the Nursery and Garden Industry Queensland. It has been funded by Hort Innovation, using the Nursery Industry research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

The survey aims to understand the impacts on production nurseries, and how they can be supported to keep operating, during a biosecurity incursion – that is, when your business is affected by an emergency plant pest or disease detection, whether in your production nursery or in a related business or location that affects your business.

We'd like to know your experiences, and ideas for how production nurseries can be supported when an incursion occurs. It will take around 15 minutes to complete.

Please note that your participation is completely voluntary. Your responses will remain entirely anonymous, confidential, and private. In the reporting of results, your responses will be grouped together with many other production nurseries. If there are any questions you don't wish to answer, that's totally fine, just let me know and we will skip to the next question.

The survey has been reviewed and cleared by CSIRO's ethics and privacy units so you can be assured of the privacy of your information and the ethical conduct of the study. Would you to hear more about ethics and privacy as I can read out CSIRO's privacy statement? [see overleaf]

If you have any questions or concerns about the survey, I will provide you with the details of who to contact, and also how to receive feedback at the end of the survey.

Would you like to continue?

Privacy Statement

Your personal information is protected by the *Privacy Act 1988* (Cth) and CSIRO will handle your personal information in accordance with this Act and the NH&MRC National Statement on Ethical Conduct in Human Research (2007) as amended from time to time.

Your personal information including your demographic information and answers to the survey questions, is being collected for the purpose of conducting the Survey. While the collection of your information is not intended to identify you, it is possible that some of the information may have the potential to re-identify you once collated. If you do not provide your personal information, you will be unable to participate in the Survey.

The information you provide will be de-identified and/or aggregated before it is published/presented in a variety of forums. This may include a report to Nursery & Garden Industry Queensland (NGIQ), academic publications, journal publications and book chapters, as well as conference/seminar presentations. The aim is for these findings to be integrated with other current levy-funded research by NGIQ on managing natural hazards and supporting business continuity, in order to develop an integrated, whole-of-industry business continuity management framework.

For information about how KG2 handles personal information, please see their Privacy Policy.

The CSIRO Privacy Policy available at https://www.csiro.au/en/About/Access-to-information/Privacy outlines how your personal information will be handled, including details about how you can seek

access or correction of the personal information we hold about you and how you can complain about a breach of the Australian Privacy Principles (APPs) and how CSIRO will deal with the complaint. If you require further information on how your personal information will be handled, please contact privacy@csiro.au.

First, can you tell me, is your nursery a production nursery?	0=no [terminate survey] 1=yes [proceed with survey]
Are you the owner, a manager or a staff member?	0=no [ask for someone who is in charge of looking after the plants, else terminate the survey] 1=owner 2=manager 3=staff member

Thank you, let's get started then! In this survey, we will ask you about biosecurity incursions, which refers to a situation where an emergency plant pest or disease has been detected, and in some way has impacted your business – either directly or indirectly.

Being directly impacted means that biosecurity restrictions or requirements were directly imposed on your business either by government or another organisation – for example, a quarantine order or a wider biosecurity zone; requirements for your business to undertake site inspections or restrictions on movement of product.

Being indirectly impacted means that biosecurity restrictions or requirements were not applied to your business, but were applied to other businesses, producing effects that flowed through to have an impact on your business (e.g. quarantine of another business reduced your sales or ability to purchase stock)

1. How many biosecurity incursions have impacted your business, either directly or indirectly, in the time that you have operated this business?	0=None – go to Question 34 (Awareness of Biosecurity incursions) 1=One 2=Two 3=Three or more 9=I'm not sure/I don't know/ I prefer not to say
2. Of these incursions, please think about the biosecurity incursion that has impacted your business most significantly. In what year did this incursion first impact your business?	 _____year

Government authorities - restrictions

3. During this incursion, did government authorities apply any restrictions or requirements on your business (for example, was your business placed under quarantine, or did your property fall within a biosecurity zone, or was some	0= No – go to Question 6 1= Yes 9=I'm not sure/I don't know

other type of government restriction or requirement applied to your business)?	
4. Of the following, what restrictions or requirements were applied by government authorities? (select all that apply)	1=a quarantine order was applied to your property 2= a geographic biosecurity zone was imposed, which included your property 3= other types of restrictions or requirements were applied (e.g. site inspections, requests for records, new or different procedures, extra sprays, movement restrictions, etc)
5. Of these restrictions or requirements imposed by government authorities, what was the longest period for which any of them was imposed?	1=up to a fortnight 2=up to a month 3=up to a few months 4=up to half a year 5=up to a year 6=up to 18 months 7=up to 2 years 8=up to 5 years 9=up to 10 years 10=up to 20 years 11=longer than 20 years 99=I'm not sure/I don't know/I prefer not to say

Other organisations - restrictions

6. During this incursion, did <u>any other organisation</u> apply restrictions or requirements on your business (for example, one of your customers requested that you provide records of site inspections)	0= No – go to Question 9 1= Yes 9=I'm not sure/I don't know/I prefer not to say
7. What other types of organisations applied restrictions or requirements to your business (select all that apply)?	1=customer 2=supplier 3=processor 4=marketing body or group 5=industry association 6=local or regional council 7=agricultural show society 8=other (please specify) 9=I'm not sure/I don't know/I prefer not to say

8. Of these restrictions or requirements imposed by other organisations, what was the longest period for which any of them was imposed?	_____weeks _____months _____years 9=I'm not sure/I don't know/I prefer not to say

Indirect impact

9. Did any restrictions or requirements that applied to another property or business during an incursion, flow through to affect your business (e.g. quarantine of another business, or declaration of a biosecurity zone elsewhere, impacted your sales or ability to purchase stock)?	0= No 1= Yes 9=I'm not sure/I don't know/I prefer not to say

Impacts – type and duration

10. In what way was your business impacted during the biosecurity incursion? (select all that apply) [for interviewer: trade is defined as the ability to buy or sell product]	1=Restricted or reduced trade 2=Reduced staff productivity (e.g., labour diverted to biosecurity tasks) 3=Stock losses (destruction) 4=Stock losses (reduced value) 5=Increased costs 6=Increased workload requirements (e.g. implementing biosecurity measures) 7=Socio-emotional stress or anxiety on yourself, family and/or staff 8=Staff changes (layoffs or recruitment) 9=Affected your business's reputation 10=Other (please specify) 99=I'm not sure/I don't know/I prefer not to say
11. Overall, for how long would you say the incursion affected your business in a significant way?	1=up to a fortnight 2=up to a month 3=up to a few months 4=up to half a year 5=up to a year 6=up to 18 months 7=up to 2 years 8=up to 5 years 9=up to 10 years 10=up to 20 years 11=longer than 20 years

	99=I'm not sure/I don't know/I prefer not to say
12. To what extent is your business still experiencing the effects of the incursion?	1=Not at all (your business is no longer experiencing the effects) 2=Still a little affected 3=Still moderately affected 4=Still greatly affected 9=I'm not sure/I don't know/I prefer not to say

Trade impacts (only if Q10=1)

13. You mentioned before that your trade was restricted or reduced, can you tell me how your trade was affected geographically?	Was your business restricted from trading… (select all that apply) 1=Within your State/Territory 2=With another State/Territory 3=Internationally 9=I'm not sure/I don't know/I prefer not to say
14. During the incursion, was there a period of time when you were completely unable to sell <u>any</u> product?	0=No – go to Question 16 1=Yes 9=I'm not sure/I don't know/I prefer not to say
15. Approximately how long were you completely unable to sell any product?	_____weeks _____months _____years 9=I'm not sure/I don't know/I prefer not to say
And as of today, are you still completely unable to sell any product at all?	0=No 1=Yes 9=I'm not sure/I don't know/I prefer not to say
16. And was there a period when you were only able to sell <u>some products, but not all</u>?	0=No – go to Question 19 1=Yes 9=I'm not sure/I don't know/I prefer not to say
17. Approximately how long were you only able to sell some products, but not all?	_____weeks _____months _____years 9=I'm not sure/I don't know/I prefer not to say

And as of today, are you still completely only able to sell some products, but not all?	0=No 1=Yes 9=I'm not sure/I don't know/I prefer not to say
18. Approximately, what percentage of sales was lost during this partial shutdown?	_____ % 9=I'm not sure/I don't know/I prefer not to say

Subjective assessment of costs and financial impacts

19. Now thinking about costs, approximately how much additional expenditure did you have to pay out to manage the biosecurity incursion? (e.g. for extra chemical sprays, purchasing equipment or materials, new or extra procedures, extra labour cost, etc) [note for interviewer: We are only after a rough, ballpark figure, it doesn't need to be precise]	$_____thousand
20. What was the value – in dollar terms – of plant-related stock and equipment that had to be destroyed or disposed of as a result of the incursion? (e.g. plants, plant stock, growing media, equipment, etc)	$_____thousand
21. Were there any other economic costs incurred as a result of the incursion (select all that apply)	1= loss of customers or markets 2= stock sold at discounted price 3= higher financing/loan costs 4= other (please specify) 5= none, no other types of costs 9=I'm not sure/I don't know
22. Approximately what percentage of your annual income did your business lose as a result of the incursion?	_____ % 9=I'm not sure/I don't know/I prefer not to say

Financial stress

23. How would you rate the level of financial stress you were under during the incursion?	1=no financial stress at all 2=a little financial stress 3=a moderate amount of financial stress 4=a lot of financial stress 5=overwhelming financial stress
24. To what extent did you find it difficult to make ends meet during the incursion?	1=very easy to make ends meet 2=easy to make ends meet

	3=neither difficult nor easy 4=difficult to make ends meet 5=very difficult to make ends meet

Perceived stress and uncertainty, sources of stress

25. Overall, how personally stressful did you find the incursion experience?	1=not at all stressful 2=a little stressful 3=moderately stressful 4=very stressful 5=extremely stressful
26. During the incursion, to what extent did you feel… …that you were able to cope with the situation? …that you were on top of things? …uncertain about the future of the business?	1=not at all 2=somewhat 3=moderately so 4=very much so
27. Thinking of all the things you had to manage or cope with, what aspect/s of the incursion created the greatest stress or strain for you? What was the hardest thing for you to deal with?	Open-ended (qualitative)

Social support and collective efficacy

28. How satisfied were you with the support you received from the following sources during the incursion… …your family and/or friends …people in your local community …other nursery businesses …the nursery industry association …government agencies and biosecurity officers	1=very dissatisfied 2=dissatisfied 3=neither satisfied nor dissatisfied 4=satisfied 5=very satisfied
29. Thinking about nursery businesses, government and people from the industry working together, how much do you agree that all of these groups worked effectively together to address problems associated with the incursion.	1=strongly disagree 2=disagree 3=neither agree nor disagree 4=agree 5=strongly agree

Business's reputation and relationships

30. How did your business' reputation change, if at all, as a result of the incursion?	1=reputation declined a lot 2=reputation declined somewhat 3=reputation remain unchanged

	4=reputation improved somewhat 5=reputation improved a lot
31. Thinking of your business' relationships with other production nurseries in the industry, overall, how did these relationships change, if at all, as a result of the incursion?	1=relationships deteriorated a lot 2=relationships deteriorated somewhat 3=relationships remain unchanged 4=relationships improved somewhat 5=relationships improved a lot
32. Thinking of your business' relationships with customers in your supply chain, overall, how did these relationships change, if at all, as a result of the incursion?	1=relationships deteriorated a lot 2=relationships deteriorated somewhat 3=relationships remain unchanged 4=relationships improved somewhat 5=relationships improved a lot

Positive outcomes from experience

33.. There may be positive outcomes that result from experiencing an incursion. To what extent did your… …business' knowledge of how to manage biosecurity incursions improve? …business' biosecurity practices and procedures improve? …business' connections with biosecurity experts improve? …business' management practices in general improve? …business secure new markets or gain a greater market share?	1=not at all 2=somewhat 3=moderately so 4=very much so

Awareness of biosecurity incursion incidence

34. Thinking about the last 5 years, how many other production nurseries are you aware of, that have been impacted by a biosecurity incursion?	_____

Perceptions of biosecurity incursions (hypothetical)

35. Thinking to the future, on a scale from 0% to 100%, how likely do you think it is that a biosecurity incursion will impact your nursery, either directly or indirectly, in the next 12 months? [interviewer may read: 0% means that it's not at all likely, no chance of happening	_____ %

50% means that there's a 50-50 chance of happening 100% means that it's certain, it will definitely happen]	
36. If a biosecurity incursion were to affect your nursery, either directly or indirectly, how negative do you think the impacts would be?	1=no negative impacts at all 2=slightly negative impacts 3=moderately negative impacts 4=very negative impacts 5=extremely negative impacts
37. How confident are you in your ability to manage the situation so that your business could continue to trade through a biosecurity incursion?	1=not at all 2=a little confident 3=moderately confident 4=very confident
38. To what extent do you agree that whether your business continues trading through an incursion is something that is entirely out of your control	1=strongly disagree (it's entirely within your control) 2=disagree (it's somewhat within your control) 3=neither agree nor disagree 4=agree (it's somewhat out of your control) 5=strongly agree (it's entirely out of your control)
39. Compared to other issues your nursery is dealing with in running the business, how important is it that your business spends time or invests in developing a biosecurity plan in case an emergency plant pest incursion occurs?	1=not at all important/ not a priority 2=low importance / low priority 3=moderate importance / medium priority 4=high importance / high priority
40. If your business was temporarily shut down due to a biosecurity incursion, how long do you think your business could remain closed for trading yet still survive in the long term?	1=a few days up to a week 2=a few weeks 3=one month 3=two months 4=three months 5=6 months or more

Potential supports

43. How interested would you be in the following options, to help your business in preparing for and/or in managing a biosecurity incursion? -information and/or training on how to manage your business through a biosecurity incursion -insurance cover (i.e., income protection, in the event of an incursion) -access to experts who can provide useful information and assistance on biosecurity related matters -access to information on managing personal and social challenges	1=not interested at all 2=slightly interested 3=moderately interested 4=very interested 5=extremely interested
44. Is there anything you can think of that government authorities could do to improve how they respond and assist production nurseries, during a biosecurity incursion?	Open-ended
45. Is there anything you can think of that nursery industry associations could do to improve how they respond and assist production nurseries, during a biosecurity incursion?	Open-ended
46. Is there anything you can think of that another type of organisation could do to improve how they respond and assist production nurseries, during a biosecurity incursion?	Open-ended
47. Is there anything you can think of that businesses themselves could do to prepare for, and respond to, a biosecurity incursion?	Open-ended

Thank you for answering all the questions. We now have just a few questions about you and your business. This information will help us describe the overall sample of participants.

1. Are you a member of a State or National nursery industry association?
   1=No
   2=Yes
   9=I'm not sure/I don't know/I prefer not to say

2. Are you accredited with any of the following?
   1=NIASA accreditation
   2=EcoHort certification
   3=BioSecure HACCP certification
   4=Other (please specify)
   5=None

3. What is your nursery's main plant type?
   1=Ornamental plants (trees, shrubs, palms, grasses, potted colour, seedlings, herbs, etc)
   2=Vegetable seedling stock
   3=Forestry stock
   4=Fruit and nut tree stock

5=Landscape stock
6=Plug and tube stock
7=Revegetation stock
8=Mine revegetation
9=Other (please specify)

4. What is your nursery's main horticultural market?
   1=Retail greenlife (Bunnings, Aldi, Garden centres, etc)
   2=Domestic and/or commercial/government landscape
   3=Interior-scapes/plant hire
   4=Vegetable growers
   5=Plantation timber
   6=Orchardists (citrus, mango, avocado, apples, nuts, etc.)
   7=Cut flower
   8=Revegetation (farmers, government, landcare etc.)
   9=Mine site rehabilitation
   10=Other (please specify)

5. What was the gross value of your production or trade in the financial year 2019-20?
   1=Turnover up to $200,000 per year
   2=Turnover between $200,000 and $500,000 per year
   3=Turnover between $500,000 and $1 million per year
   4=Turnover between $1 million and $2.5 million per year
   5=Turnover between $2.5 million and $5 million per year
   6=Turnover between $5 million and $10 million per year
   7=Turnover above $10 million per year

6. What proportion of your household income comes from your production nursery?
   0=None
   1=A small amount (less than 25%)
   2=A moderate amount (around 50%)
   3=A large amount (around 75%)
   4=All my income (100%)

7. What proportion of your nursery plants or stock are:
   - Sold within your region? ____ %
   - Sold elsewhere within your state? ___ %
   - Sold to other states in Australia? ___ %
   - Sold overseas? ___ %

8. What proportion of the plant materials your nursery buys is:
   - Purchased within your region? ___ %
   - Purchased elsewhere within your state? ___ %
   - Purchased from other states in Australia? ___ %
   - Purchased from overseas? ___ %

9. How many full-time equivalent staff (including yourself) does your nursery employ?
   _____FTE staff

10. What state or territory does your nursery operate in? _____

11. For how long have you operated your business? _____ years

12. What is your age group?
    - 18-24
    - 25-34
    - 35-44
    - 45-54
    - 55-64
    - 65 or over

You've now reached the end of the survey, but before I go, is there anything else you'd like to tell us about biosecurity incursions in the production nursery industry?

_____

Thank you for participating! Would you like the details of the project team and the ethics manager? Would you like to know who to contact for feedback?

The project team can be contacted via email at Elizabeth.V.Hobman@csiro.au or Barton.Loechel@csiro.au

The ethics manager can be contacted via email at Cathy.Pitkin@csiro.au or by phone on 07 3833 5693

References

Loechel, B. (2020). *Supporting production nursery businesses during a biosecurity incursion: Review of social and economic impacts and business continuity*. Report prepared for the Nursery & Garden Industry Queensland (NGIQ). CSIRO.

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