Domestic market access for table grapes

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Department of Employment, Economic Development & Innovation

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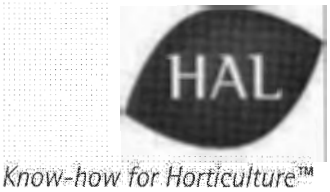

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Media Summary

New fruit fly control assures future market access for Queensland tablegrapes.

Queensland tablegrape growers can be assured of access for their fruit this coming season to interstate markets following confirmation of the effectiveness of a new fruit fly control practice.

Research viticulturist with Horticulture and Forestry Science, David Oag, said the new practice for controlling Queensland fruit fly in tablegrapes will enable Queensland growers to continue selling fruit into southern states.

Results of a two year research study has quantified the effectiveness of protein baiting with culling and inspection of fruit during harvest in ensuring tablegrapes sent to fruit fly sensitive domestic markets is free of Queensland fruit fly.

The Queensland tablegrape industry produces early season fresh grapes worth $60M annually. Mr Oag said, "most of the crop is sent the southern markets of Melbourne, Adelaide and Sydney, so access to these markets is vitally important for the ongoing success of the Queensland industry".

Queensland tablegrapes historically were sent to these markets without a need for treatments against fruit fly. However, Queensland tablegrapes consigned to the fruit fly sensitive markets of Adelaide and Melbourne must now be treated against fruit fly.

The protein baiting technique has a number of advantages over conventional insecticide sprays in that only a very small amount of chemical is used, the fruit is not sprayed and the bait does not disrupt integrated pest management programmes used in the vineyard, Mr Oag said.

The protein baiting technique can also be used in fruit fly quarantine zones in southern Australia following a seasonal fruit fly incursion to enable growers to continue to market their fruit, Mr Oag said.

Biosecurity authorities in Victoria have accepted protein baiting as an effective fruit fly treatment, ensuring on-going access to the Melbourne market for Queensland tablegrapes.

The project was jointly funded by the individual members of Grape Connect, Horticulture Australia Ltd and the Queensland Government.

Technical Summary

The change in status of tablegrapes to a fruit fly host requiring treatment and introduction of conditions for entry into the Victorian market, necessitated the validation of protein baiting with harvest culling and inspection as an effective protocol for preventing fruit fly infested product reaching sensitive domestic markets. Biosecurity Queensland negotiated an interim arrangement to enable the continued entry of Queensland tablegrapes under the Interstate Certification Assurance (ICA-20) system.

Field trials were conducted over two growing seasons to quantify the effectiveness of protein baiting with harvest culling and inspection. Menindee Seedless and Red Globe are the two most widely planted varieties in the Queensland industry. The early and late season harvest time of Menindee Seedless and Red Globe, respectively, provided a short and long in-field exposure to Queensland fruit fly (QFF) attack.

A field trial of each variety was undertaken in each of the three major tablegrape production districts in Queensland (Emerald, Mundubbera, St George). Where the level of infestation is expected to be very low it is necessary to collect and inspect a large number of bunches to produce a statistically valid result with a high degree of confidence.

The objective was to collect 9,000 bunches per variety per season, comprising 3,000 preharvest bunches and 6,000 bunches of commercially packed fruit. The preharvest bunches reflect the level of control achieved with the in-field protein baiting, whilst the packed fruit sample reflects final infestation level following harvest culling and inspection. In season 2008/09, the actual number inspected was 2,347 preharvest and 7,309 packed bunches of Menindee Seedless, and 3,137 preharvest and 7,757 packed bunches of Red Globe. In season 2009/10, the actual number of bunches inspected of Menindee Seedless was 2,683 preharvest and 4,939 packed, along with 3,045 preharvest and 7,779 packed bunches of Red Globe. The number of bunches amounted to over 9 tonne of fruit in both seasons.

Zero infested berries were detected in 2009/10 across both the preharvest and packed sample of both varieties. In the first season (2008/09), a very low level of infestation (single berries) was recorded across all the Red Globe trials and two of the five Menindee Seedless trials. The infestation across all Red Globe trials probably reflects the longer in-field exposure time of fruit to QFF attack. The zero infestation and no repeat of the high infestation at the Emerald 3 trial in the second season would appear to indicate greater precision in application of the control treatment as growers develop experience.

The study has demonstrated the effectiveness of protein baiting with harvest culling and inspection for the control of QFF in tablegrapes. As a result, biosecurity in Victoria has accepted on-going market access for Queensland tablegrapes under

ICA-20. The results are also relevant to the tablegrape industry within fruit fly quarantine zones and have already been used following a QFF incursion in the Sunraysia.

Introduction

The Queensland table grape industry has a farm gate value of $60 million per annum and extends from the tablelands of tropical north Queensland, through the central highlands (Emerald) to the south-west (St George). The harvest season is predominantly November to mid-January supplying early season fresh grapes. The bulk of the crop is consigned to Melbourne, Sydney and Adelaide, which makes interstate trade extremely important.

Until recently, tablegrapes were recognised as a fruit fly host not requiring treatment for entry to fruit fly sensitive domestic markets. However, tablegrapes are known to be a host (albeit a very poor one) for Queensland fruit fly (*Bactrocera tryoni*) and now require treatment of product originating from fruit fly endemic areas. Methyl bromide fumigation and cold disinfestation are the treatment options currently available but neither is economically feasible for maintaining domestic market access.

There is currently no alternative market access protocol approved for table grapes. In 2007/08, Victoria imposed new entry conditions for Queensland tablegrapes so as to protect the fruit fly free status of quarantine zones within the state. To maintain market access and trade in the valuable Queensland tablegrape crop, Biosecurity Queensland successfully negotiated acceptance of a preharvest protein bait spray with harvest culling and inspection (ICA-20), as an alternative to methyl bromide and cold disinfestation. This was an interim arrangement for two years to allow time for data demonstrating the effectiveness of the bait spray protocol to be collected, through the field trials undertaken in this project.

The field control measures currently employed to protect tablegrapes in areas where fruit fly is endemic include dimethoate and fenthion cover sprays, protein baiting and male annihilation technology (MAT). Many growers employ a combination of these control measures. Growers using protein baiting will occasionally apply a cover spray when seasonal weather conditions are favourable for an increase in QFF numbers. Cover sprays are the preferred control measure in many small vineyards because of the practicality and ease of application.

The insecticides dimethoate and fenthion currently registered for use as cover sprays to control fruit flies are under review by Australian Pesticide and Veterinary and Medicines Authority (APVMA). It is anticipated the withholding period (WHP) for both chemicals will be lengthened considerably, in which case both chemicals will no longer be feasible control options in tablegrape production. This will leave growers with no effective, registered chemical for use as a cover spray to control fruit flies and reduces the control options available within ICA-20 to protein baiting only. The loss of insecticides for cover spraying and identifying an effective replacement chemical is now a serious, immediate future issue for tablegrape growers in fruit fly endemic and quarantine zones, as well as biosecurity organisations.

Since the introduction of the new entry conditions in Victoria there have been no detections of fruit fly infested fruit, illustrating the effectiveness of current vineyard practices. Nevertheless, there was no quantitative evidence to support these inspection and culling practices as risk reduction measures in a systems approach to achieving fruit fly free product. The data collected from field studies undertaken in this project clearly substantiates the effectiveness of protein bating with harvest culling and inspection, enabling the continued trade of tablegrapes from fruit fly endemic production areas into fruit fly sensitive domestic markets. The protocol will also enable the sale of tablegrapes from a quarantine zone following a fruit fly incursion.

Research Study

Field trials

Field trials were established for the varieties Menindee Seedless (white, early) and Red Globe (red, late) in each of the major production districts (Emerald, Mundubbera and St George). These varieties are the most widely planted throughout the Queensland industry, accounting for more than 70% of the planted tablegrape area and hence providing the greatest opportunity for field trial sites. The early (Menindee Seedless) and late (Red Globe) harvest provided short and long exposure periods for infestation of fruit by fruit fly.

Each trial was a 1 ha plot (approximately) within a larger block of vines in each vineyard. To reduce the risk of losing data (i.e. crop damage or loss), the preference was for two field trials of each variety in each district. This was achieved for Menindee Seedless in Emerald and Mundubbera, and Red Globe in Emerald. Only a single trial per district was possible for Red Globe at St George and Mundubbera, and Menindee Seedless at St George.

Fruit fly control treatment

The bait spray programme was the only fruit fly control measure applied to the vines within the trial plot. The protein bait spray formulation used at all trial sites was 2L Mauris Pinnacle Protein Lure mixed with 435 ml Hy-Mal® (1150 g/L maldison) per 100 litres of water applied at 15-20 litres per hectare.

Fruit fly traps containing a Q Fly Wick (Bugs for Bugs) were used to monitor fly numbers with multiple traps positioned outside the vineyard block and two traps installed within the trial plot (Figure 1). Each grower co-operator had the task of emptying the traps on a weekly basis and applying the bait spray.

Figure 1. Fruit fly monitoring trap in vines.

Whilst several of the co-operating growers used male annihilation technology (MAT) devices elsewhere in the vineyard, all trial plots did not contain MATs. A 50 metre buffer zone free of MATs was maintained around each trial plot. MATs include Crop Care Amulet® Cue Lure (3.4g/kg fipronil, 94g/kg 4-(p-ACETOXYPHENYL)-2-BUTONAONE) and Bugs for Bugs Q Fly Wick (0.5ml/wick MALDISON, 1.0ml/wick 4-(p-ACETOXYPHENYL)-2-BUTONAONE).

During the initial project planning it was discovered that vine crops (ie grapes and passionfruit) were not included on the Hy-Mal® label and that the bait spray rate only specified tree crops. Successful negotiations by the original project leader (Dr Annice Lloyd) with the chemical company resulted in a permit (PER 10805) for Hy-Mal® being issued in time for commencement of the field trials.

Fruit samples

The objective was to collect and assess a total of 18,000 bunches per season from across the two varieties and three districts. The 9,000 bunches per variety consisted of 1000 bunches collected immediately prior to the start of harvest, plus 2,000 bunches of commercially packed fruit, for each of the three districts. The preharvest sample reflects the level of fruit fly control achieved from the bait spray, whilst the packed fruit sample reflects the additional control achieved from culling and inspection of fruit as part of the harvest process.

Figure 2. Preharvest bunch samples in individual plastic bunch bags.

The preharvest bunch samples were collected before any fruit was harvested from the vines in each trial plot. The sampling rate was one bunch from every second vine across the trial, where the sample required was 500 bunches per trial (i.e. two trials of the same variety in the one district). Bunches were randomly collected from across the canopy of a single vine (i.e. outside or inside of the canopy, near or far side of the row, and laterally along the row/vine canopy). Each bunch was placed in a plastic bunch bag (Figure 2) to contain any loose damaged berries, possibly from fruit fly infestation.

To fit in with the operational practices at each farm, several systems were used for randomly collecting the required number of cartons of packed fruit from across the trial plot. In all trials the commercially packed fruit had been visually inspected and "cleaned" of damaged berries by the vineyard workers as part of the harvesting process. The packed fruit sample was not subjected to the end-point inspection set out in ICA-20.

Grape incubation and fruit fly assessment

Fruit samples were handled as per industry current practice following harvest, namely transferring from the vineyard to a cool room as soon as possible after harvest and cooling to attain a pulp temperature of 2°C. Cartons of fruit were palletised and transported, as part of a larger consignment to the wholesale market, in a refrigerated (2°C) truck to the Department of Primary Industries laboratories at Indooroopilly.

Cartons of fruit were unloaded upon arrival and individual bunches set-up for incubation. During the peak of the harvest season when all the incubation rooms were full it was necessary to temporarily store fruit samples in a cool room at 10°C. Samples were stored for up to three weeks in season 2008/09 and only two weeks in season 2009/10. It is believed that this temperate and duration would not kill fruit fly larvae but only slow larval development.

Information for each consignment of fruit including variety, property name, vineyard block and number of cartons in the fruit sample was recorded during the setup of fruit for incubation. Individual bunches of grapes were weighed and placed on a piece of cardboard apple tray in a plastic container (4 litres), which was then covered with a ventilated gauze lid. Fruit samples were held in a constant temperature room at 26°C and 70% relative humidity for 7-10 days. This time was sufficient to allow growth and development of fruit fly larvae that may be present in the fruit.

Figure 3. Setup of individual bunch sample.

Figure 4. Incubation room full of individual bunch samples.

Figure 5. Inspecting fruit after incubation. Note the knife and cutting board for dissecting single berries.

Following completion of the incubation period, each bunch was individually assessed for fruit fly infestation by external visual examination. Suspect berries containing potential stings or rotten segments were cut open to verify the presence of fruit fly larvae. Larvae found were retained and incubated for confirmation as fruit fly and

species identification by trained staff. The number of infested bunches and number of larvae per bunch were recorded.

Industry communication

Communication to Queensland tablegrape growers details of the fruit fly control options available within ICA-20, including details of the bait spray formulation being tested in the field trials, was vitally important for ongoing interstate market access of Queensland tablegrapes to Victoria as well as the success of the field study. Regional industry meetings were held before the start of the field trials to explain the project work and a Biosecurity Queensland officer was in attendance to explain the details of ICA-20.

Results and Discussion

2008/09 Season

At less than two Queensland fruit flies per trap per day (Figure 3) across all trials and districts, for traps located within and surrounding the vineyard, the fruit fly population pressure is relatively low. The low fruit fly numbers reflect the often dry conditions of the inland tablegrape producing districts of Queensland. Substantially higher fruit fly numbers occur in coastal areas where conditions are more favourable to fruit flies.

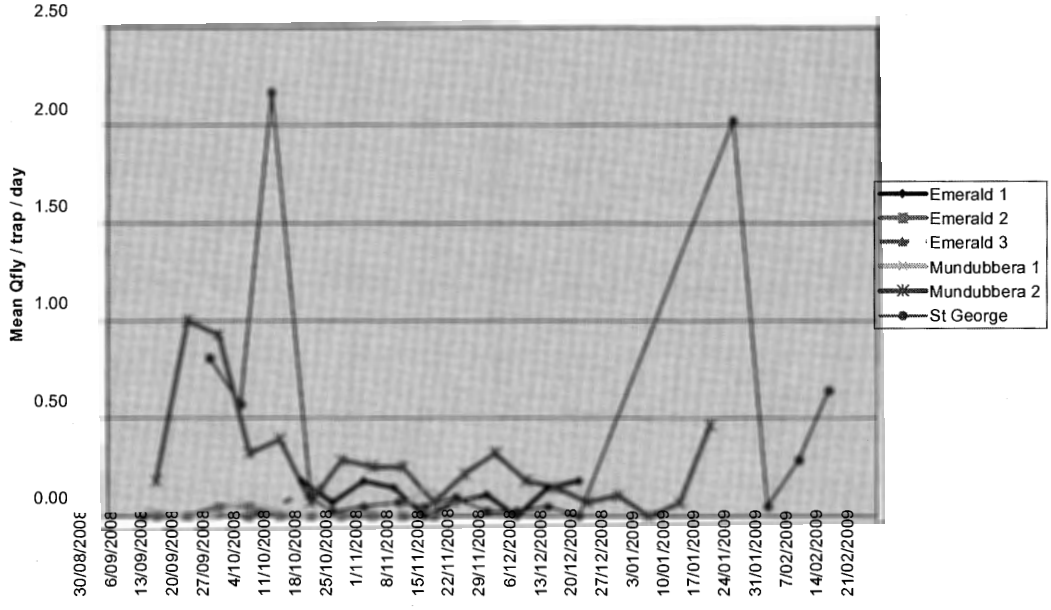

Figure 6. Mean number of Queensland fruit fly per trap per day across all trials and districts during season 2008/09.

The only vineyards to record trap counts of any number were the Mundubbera 2 and St George trial sites (Figure 6).

Fruit fly trap counts are not a reliable prediction of infestation levels in grape bunches. This was evident at Emerald 3 where trap counts were near zero and no flies were trapped after 18 October yet the highest number of infested berries was recorded in the preharvest "pick" sample of Menindee Seedless (Table 1). Conversely, two peaks and the highest QFF trap counts were recorded at the St George vineyard, yet only one Menindee Seedless berry (Table 1) and two Red Globe berries (Table 2) were infested.

It is important to note that the Q Fly Wick within the trap attracts the male fly whilst it is the female fly that stings the berry. In the Emerald 3 vineyard it was observed the infested bunches were confined to the first panel of rows. It appeared this localized damage at the end of rows was due to a fruit fly incursion from one direction and only into the edge of the vineyard.

Table 1. Vineyard location, number of bunches collected and calculated percent infestation rate for the preharvest "pick" sample and packed fruit sample of Menindee Seedless in season 2008/09.

Variety	District/ Vineyard	Sample type	No. Bunches	No. infested bunches	No. infested berries	% Bunches infested	Upper % bunch infestation (95% confidence)
Menindee Seedless	Emerald 3	Pick	507	22	34	4.34	6.196075
		Pack	1273	13	15	1.02	1.623574
	Emerald 2	Pick	482	0	0	0.00	0.621515
		Pack	1302	0	0	0.00	0.230084
	Mundubbera 2	Pick	711	0	0	0.00	0.421336
		Pack	1178	0	0	0.00	0.254304
	Mundubbera 1	Pick	512	0	0	0.00	0.585098
		Pack	1250	0	0	0.00	0.239656
		Total pick	1223	0	0	0.00	0.244947
		Total pack	2428	0	0	0.00	0.123381
	St George	Pick	1035	1	1	0.10	0.458271
		Pack	2306	0	0	0.00	0.129909

Table 2. Vineyard location, number of bunches collected and calculated percent infestation rate for the preharvest "pick" sample and packed fruit sample of Red Globe in season 2008/09

Variety	District/Vineyard	Sample type	No. Bunches	No. infested bunches	No. infested berries	% Bunches infested	Upper % bunch infestation (95% confidence)
Red Globe	Emerald 1	Pick	487	2	2	0.41	1.292628
		Pack	1243	1	1	0.08	0.381585
	Emerald 3	Pick	487	0	0	0.00	0.615133
		Pack	1214	42	46	3.46	4.474720
	Mundubbera 2	Pick	1033	0	0	0.00	0.290000
		Pack	2573	1	1	0.04	0.184341
	St George	Pick	1130	2	2	0.18	0.557088
		Pack	2727	0	0	0.00	0.109853

Table 3. Calculated percent infestation rate of Menindee Seedless bunches for the preharvest "pick" sample and packed fruit sample in season 2009/10.

Variety	District /Vineyard	Sample type	No. Bunches	No. infested bunches	No. infested berries	% Bunches infested	Upper % bunch infestation (95% confidence)
Menindee Seedless	Emerald 2	Pick	678	0	0	0.00	0.441844
		Pack	1250	0	0	0.00	0.239656
	Emerald 3	Pick	534	0	0	0.00	0.560993
		Pack	946	0	0	0.00	0.316670
	Mundubbera 2	Pick	966	0	0	0.00	0.310114
		Pack	1614	0	0	0.00	0.185607
	St George	Pick	505	0	0	0.00	0.593208
		Pack	1129	0	0	0.00	0.265341

Table 4. Calculated percent infestation rate of Red Globe bunches for the preharvest "pick" sample and packed fruit sample in season 2009/10.

Variety	District /Vineyard	Sample type	No. Bunches	No. infested bunches	No. infested berries	% Bunches infested	Upper % bunch infestation (95% confidence)
Red Globe	Emerald 3	Pick	523	0	0	0.00	0.572792
		Pack	1168	0	0	0.00	0.256481
	Emerald 1	Pick	517	0	0	0.00	0.579439
		Pack	1412	0	0	0.00	0.212160
	Mundubbera	Pick	747	0	0	0.00	0.401031
		Pack	3198	0	0	0.00	0.093674
	St George	Pick	1258	0	0	0.00	0.238132
		Pack	2001	0	0	0.00	0.149710

Zero infested berries were recorded in the preharvest fruit sample from three of the five Menindee Seedless trials, whilst only a single infested berry was found at the St George trial. A rather high number of infested berries was detected in bunches of the preharvest sample collected from the Emerald 3 vineyard. A localized infestation was observed at the end of rows and this is likely to explain the infestation level recorded. This was the closest point in the vineyard to a neighbouring house (300m) with several untreated fruit trees in the garden.

Infested berries were recorded in all four Red Globe trials, albeit at extremely low infestation rates of only one or two berries. It is possible the infestation of Red Globe is a result of the later harvest time and hence longer period of exposure of the berries to fruit fly attack.

As was the case with Menindee Seedless(Table 1, St George and Emerald 3), the harvest process of culling damaged berries reduced the level of infested berries in the sample of packed product (Table 2, St George and Emerald 1). The end-point inspection within ICA-20 is another opportunity for infested berries to be detected and prevented from reaching a fruit fly sensitive market. The sample of packed product was not subjected to an end-point inspection and as such, is realistically an overestimate of the actual probability of infested berries reaching a fruit fly sensitive market.

2009/10 Season

Monitoring detected fruit flies at the Mundubbera and St George trials throughout most of the growing season, whereas nil flies were detected at either Emerald trial across the entire season. The population pressure was again low at less than two flies per trap per day on average (Figure 7) and reflects the QFF pressure in the inland tablegrape growing districts of Queensland during relatively dry seasons.

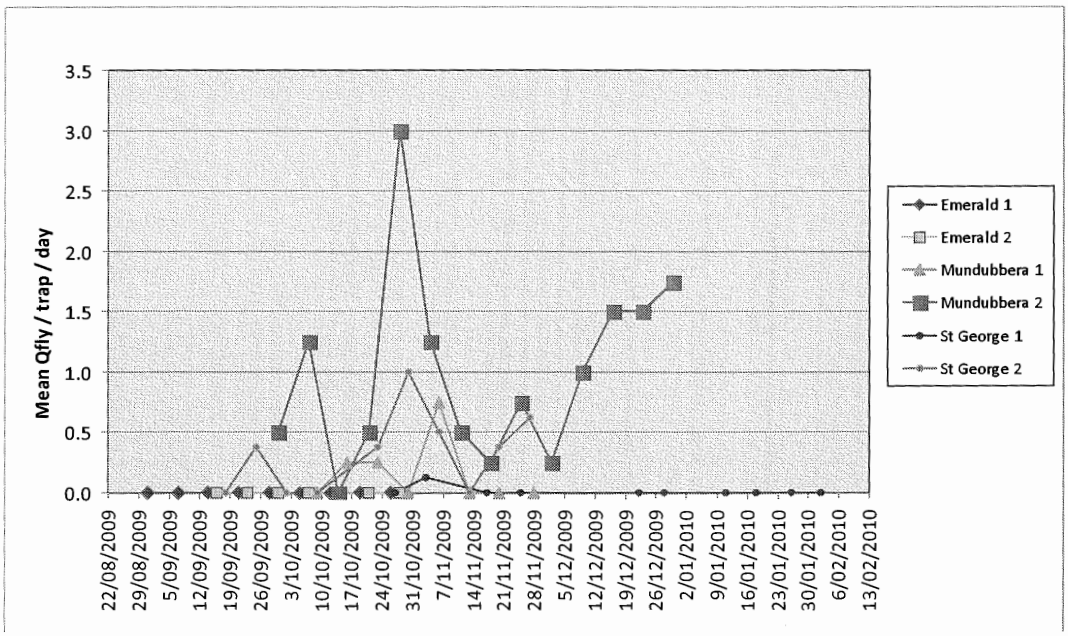

Figure 7. Mean number of Queensland fruit flies per trap per day recorded across all trial sites in season 2009/10.

The effectiveness of the bait spray in preventing fruit fly damage was demonstrated by the zero infested berries in the preharvest fruit sample. This result was achieved for both Menindee Seedless and Red Globe. The greater level of control achieved in the second season (2009/10), when the fruit fly pressure was very similar, is probably due to the growers being more experienced in applying and managing the timing of the protein baits.

Following the Domestic Quarantine Market Access Working Group meeting (27-29 April 2010), Victoria accepted protein baiting with harvest culling and inspection as an effective fruit fly control measure for ongoing market access. South Australia has also changed entry conditions to allow tablegrapes from Queensland entry under ICA-20.

Conclusions and Recommendations

The field study clearly demonstrated that effective control of Queensland fruit fly can be achieved in tablegrape vineyards with the protein bait spray technique. The results substantiated the preharvest control and harvest culling and inspection protocol of ICA-20, which enables interstate access into fruit fly sensitive domestic markets.

Nevertheless, other emerging issues now threaten the ongoing access for tablegrapes into fruit fly sensitive markets. Research in a number of key areas is essential for maintaining and preserving future market access and hence the value of the tablegrape industry.

- *Efficacy testing of existing registered insecticides against QFF to identify potential replacements for dimethoate and fenthion.* Dimethoate and fenthion are the most important chemicals for cover spraying to control QFF and are currently under review by APVMA. It is anticipated the withholding periods for both chemicals will be greatly increased to 21 days and 56 days for fenthion and dimethoate, respectively. Such lengthy withholding intervals would render dimethoate and fenthion no longer viable options for QFF control under ICA-20, and leave tablegrape growers with no chemicals for use as cover sprays.

- *Develop precision in our understanding of QFF response to major seasonal weather factors and behaviour within a vineyard to enable further improvements in managing QFF control.* It is possible that fruit fly behaviour and resultant level of fruit damage is influenced by vineyard size, hence requiring a different intensity of control treatment in a large monoculture vineyard compared to a small vineyard planting. Wet and humid conditions are favourable to the build-up of QFF numbers. Under such weather conditions the interval between protein bait applications is reduced from 7 days to as little as 3 days, however, managing the timing of bait applications is imprecise and potentially introduces a risk of fruit fly damage.

Technology Transfer

An update on the project was prepared for inclusion in the HAL Annual Table Grape Industry Report of 2008/09 and again for 2009/10.

Results from the first year of trial work were presented at the Grape Connect post harvest meeting, 26th February 2009.

The project leader provided an update on planned project work for the 2009/10 season at a meeting of St George Fruit and Vegetable Association, 20 August 2009.

Details of the project were included in a presentation at the 7th Australian Table Grape Industry Conference (16-18 Sept, 2009) by Cameron Tree on fruit fly and phylloxera procedures in Queensland for domestic market access.

A progress report on the 2009/10 season field trial results plus an outline of the next steps to finalise the project was presented at the Grape Connect post harvest meeting, 26th March 2010.

A report was tabled at the Domestic Quarantine Market Access Working Group meeting (27-29 April 2010) recommending the new treatment protocol be accepted by state biosecurity authorities for market access of Queensland tablegrapes.

Communication and extension activities have primarily involved informing growers of the bait spray control measure being tested and the conditions they must meet under the ICA 20.

The project team confirmed the omission of grapes in the registration for Hy-Mal for use in protein baits, initiated in the application for a permit and were instrumental in ensuring the product was registered for the proposed in tablegrapes.

References.

Queensland Government. 2008. ICA-20: Preharvest Treatment and Inspection of Table Grapes.
http://www2.dpi.qld.gov.au/health/4145.html