TRANSFER OF DISEASE MANAGEMENT TECHNOLOGY TO THE CANNING PEACH INDUSTRY IN HAWKE'S BAY

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ABSTRACT

A technology transfer project jointly funded by industry and government commenced in 1995 to implement integrated fruit production methods in the canning peach and fresh summer-fruit industry in Hawke's Bay. A suite of decision aids was used to assist growers in weather-based fungicide spraying aimed to minimise fungicide inputs while achieving consistent disease suppression. The main diseases were brown rot and peach rust. Most of the 13 participating growers achieved good results despite unusually wet summers in both 1995/96 and 1996/97. Their crops received minimal fungicide inputs that were well timed and most had low disease levels at first pick. However, some crops had unacceptable levels of disease. The reasons for this and ways to prevent disease re-occurrence are discussed.

Keywords: integrated disease management, peach, brown rot, rust, fungicides, New Zealand

INTRODUCTION

The canning peach industry in Hawke's Bay involves about 140 orchards which annually produce about 6000 t of Golden Queen peaches for the processor Heinz-Wattie Ltd. Current average yields are 25-30 t/ha, but yields of 45 t/ha are required to maintain profitability for growers. Brown rot (*Monilinia fructicola* (Wint.) Honey), botrytis rot (*Botrytis cinerea* Pers.: Fr.) and peach rust (*Tranzschelia discolor* (Fuckel.) Tranzschel & Litv.) can cause significant losses of crop from year to year. Heinz-Wattie's environmental policy aims for integrated fruit production methods with minimal pesticide inputs, meaning that Golden Queen growers must abandon disease and pest management programs based on regular pesticide applications and adopt minimal-spraying strategies (Lo *et al.* 1995; Tate *et al.* 1995).

In 1995-96 a three year technology-transfer program, jointly funded by industry and Government was commenced. The aim was to incorporate integrated fruit production methods into canning peach production, reduce pesticide inputs and lift orchard yields of Grade 1 canning fruit, thereby making the industry more competitive. This paper discusses our experience in transferring disease management technology, while pest management is the subject of a separate paper (Lo *et al.* 1997).

METHODS

The project commenced in July 1995 with five Golden Queen peach growers and was expanded in 1996/97 to include a further seven growers plus one fresh-market peach and nectarine grower. The whole industry was kept informed of progress through field-day presentations and industry newsletter articles.

All participants were coached in pre-infection spraying for primarily brown rot, botrytis rot (*Botrytis cinerea*) and peach rust and in recognition of fungus inoculum and disease symptoms. Integrated disease management was based on pre-infection spraying, aided by daily infection period (IP) forecasts, spore and fungicide resistance monitoring

information and spray warnings, provided as a commercial service by Crop Health Services. This was backed up by post-infection spraying when IPs were missed and eradication was possible, and cultural operations such as pruning out diseased wood. To identify past IP events, weather data (leaf wetness, rainfall and air temperature) from HortResearch weather stations at Twyford, Pakowhai, Longlands, Havelock North and Whakatu were downloaded daily and infection models for each disease run (Tate *et al.* 1995). Spraying guidelines which gave minimal-spray options for expected weather/disease/growth stage scenarios were also provided.

In 1995/96, 10 marked trees in each block were monitored by HortResearch, initially for percent open flowers and the presence of *M. fructicola* apothecia at ground level during blossom, and subsequently for all disease symptoms at each susceptible growth stage. IP forecasts, actual IP events monitored at the five weather stations and spray warnings were faxed daily to participants. Details of sprays applied by each participant were faxed to the authors and group summaries of sprays applied and disease levels return-faxed to participants at intervals. Ongoing coaching occurred during fortnightly orchard monitoring and one-on-one telephone discussions. Just prior to first harvest all marked trees were assessed by counting number of rotting or spotted fruit and converting to percent diseased fruit (total fruit were estimated by counting all fruit on several trees). After harvest each grower's performance was analysed in detail and discussed at a group feedback session.

In the second year the original five orchards were again monitored by HortResearch while the eight new growers were supplied with monitoring sheets and trained to monitor their own blocks for tree growth stage and disease. All participants received daily IP forecasts, advice on monitoring methods and regular feedback on: (i) weather factors, (ii) IP events in relation to IP forecasts, spray timing and presence of fungus inoculum or disease symptoms, (iii) impending disease risk, (iv) a tally of sprays applied since budburst, (v) advice on disease management measures to take and (vi) comments on performance. This faxed feedback occurred weekly over the blossom period and monthly thereafter.

Spraying guidelines, a wall spray-chart and tree growth-stage numbering system were developed as decision aids. Spray timing was rated from poor to excellent (Table 4). After harvest a summary of relative performance of all participants was sent out.

RESULTS

Rainfall and disease incidence

Rainfall over the blossom period was one third of normal in both 1995 and 1996, and also over shuck-fall and early fruit development in 1996 (Table 1). Then, 2-3 times the normal rainfall occurred in January and February in 1996 and 1997. The first week of March (mid harvest) was also very wet in both seasons. These patterns contributed to low blossom blight (*M. fructicola*) in both years, increased botrytis in 1996 and greatly increased peach rust and brown rot over normal levels in both years.

TABLE 1: Monthly rainfall (mm) recorded at the HortResearch, Lawn Road weather station.

Month	Growth stage	Infection risk ¹	1995-96	1996-97	12 year mean
Sep.	blossom	blossom blight	22	19	66
Oct.	shuck-fall	botrytis	52	16	51
Nov.	fruit developm.	leaf rust	34	17	59
Dec.	pit hardening	peach rust	30	144	39
Jan.		peach rust	96	75	36
Feb.	pre-harvest	brown rot	116	97	52
Total rainfall			349	368	303

¹Diseases most influenced by wet weather at each growth stage.

IP incidence

During September in 1995 and 1996, 2-4 blossom blight IPs requiring separate sprays were recorded at the five weather stations, and three botrytis IPs occurred during late bloom in 1995 only (Table 2). From November to February in both seasons, 3-7 rust and 4-10 brown rot IPs occurred, with almost twice the number of brown rot and rust IPs requiring separate sprays occurring in 1996-97 compared to 1995-96.

TABLE 2: Mean number (and range) of infection periods (IPs) requiring separate spray applications¹ recorded at five weather stations.

Month	Brown rot IPs		Botrytis IPs		Peach rust IPs	
	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97
Sep.	3.0 (2-4)	3.1 (2-4)	1.0 (1)			
Oct.			2.0 (2)			
Nov.						1.0 (1)
Dec.		1.0 (1)			1.8 (1-2)	3.0 (3)
Jan.	1.0 (1)	4.0 (4)			2.4 (2-3)	2.0 (2)
Feb.	3.0 (3)	4.8 (4-5)				1.0 (1)
Totals	7.0 (6-8)	12.9 (11-14)	3.0 (3)	0	4.2 (3-5)	7.0 (7)

¹ Closely-spaced IPs were counted as one.

IP forecasting accuracy

On average, 17.8 IP events were recorded in 1995/96, with 90% of them being predicted (Table 3). In 1996/97, 27.3 IPs were recorded with 77% predicted. This was well above the 70% target, below which pre-infection spraying is considered impractical. A few false alarms were also broadcast and 1-2 important IPs were not predicted each season.

TABLE 3: Prediction of infection periods (IPs) identified at five weather station sites from 1 September to 28 February.

Disease	1995-96 IPs			1996-97 IPs		
	recorded	predicted	%	recorded	predicted	%
brown rot	7.2	6.4	89	16.5	13.0	79
botrytis rot	2.8	3.2	100	0.0	0.0	100
peach rust	7.8	6.4	82	10.8	8.0	74
Total IPs	17.8	16.0	90	27.3	21.0	77

Spray inputs and timing for each disease

Mean rating for brown rot spray timing by participants in 1995-96 was 3.3 (good to excellent), with 6-8 sprays applied and less than 1% brown rot resulting at first pick on any block (Table 4). This met project specifications. While more brown rot IPs requiring separate sprays occurred in the second year, less sprays were applied. Consequently five blocks had more than 1% brown rot by first pick, the worst being 5.8%. These participants either: (i) missed the first blossom IP on 2 September (resulting in brown rot twig blight) and did not counter this with mid-season brown rot sprays, (ii) had high levels of split fruit or (iii) applied insufficient pre-harvest sprays.

Although spray timing scores for botrytis were variable in both years, little disease developed in the first season and none in the second season when no IPs were recorded (Table 4). Botrytis rot at harvest 1996 appeared to be due to poor timing of late-bloom botrytis fungicides such as thiram.

Peach rust spray timing was also good in 1995/96 with less than 1% fruit spotted at harvest, while in the second season more sprays were applied but at a lower accuracy. One block had a rust epidemic (31% deep fruit spotting) while two others had greater than 1% fruit spot at harvest.

TABLE 4: Mean number (and range) of spray applications, accuracy of timing and fruit disease at first pick.

Disease	1995-96			1996-97		
	Mean no. of sprays	Timing scores ¹	% fruit diseased	Mean No. of sprays	Timing scores ¹	% fruit diseased
brown rot	7.0 (6-8)	3.3 (3.2-3.6)	0.6	5.7 (4-7)	3.1 (2-3.3)	1.4 (0-5.8)
botrytis rot	1.0 (0-2)	2.5 (1-4)	0.6	0.9 (0-2)	2.6 (1-4)	0.0 (0-0.2)
peach rust	3.8 (1-6)	3.0 (2-3.7)	0.4	5.5 (4-9)	2.7 (2-3.6)	4.8 (0-31)
other ²	ND ³	ND	1.6	ND	ND	0.9

¹ 1 = poor (missed IP, unnecessary/wrong fungicide applied, sprayed >7 days before IP started or after IP with non-eradicator); 2 = mediocre (sprayed 5-7 days before IP started or 3 or more days after IP with eradicator); 3 = good (sprayed 3-4 Days before IP started or within 2 days after IP with eradicator); 4 = excellent (sprayed 0-2 days before IP started or within 1 day after IP with eradicator).

² Powdery mildew, rhizopus rot, fusarium rot and bacterial spot.

³ ND = not determined.

Fungicide inputs

Fungicide inputs in the first season generally stayed within the maxima allowed by the processor (Table 5). Exceptions were demethylation inhibitors (DMIs) in three cases where triforine was used for rust eradication. In the second season these maximums were exceeded more often, ziram twice, DMIs four times and sulphurs once. However, these fungicide inputs were generally considered appropriate for the very wet conditions experienced.

TABLE 5: Mean number and range of sprays applied for each fungicide type.

Fungicides	Maximum sprays ¹	1995-96		1996-97	
		Mean	Range	Mean	Range
thiram	4	1.4	0-3	2.6	0-6
ziram	1	0.6	0-1	1.2	0-5
chlorothalonil	1	0.2	0-2	0.1	0-1
DMIs ²	3	3.4	3-4	3.2	1-5
sulphurs	4	2.8	1-4	3.0	0-7
dicarboximides	3	2.6	2-3	1.8	0-3

¹ Maximum sprays allowed by processor.

² Demethylation inhibitors.

DISCUSSION

Minimal fungicide usage leaves little room for error and requires good spray timing, which depends on consistent IP prediction, accurate weather monitoring, good understanding of disease cycles and early recognition of symptoms. In one case the participant's sprayer failed to protect from rust due to incomplete coverage directly above the sprayer in the alleys. In several cases participants failed to apply the two blossom DMI sprays considered necessary for suppressing over-wintered rust cankers, and then failed to follow up with early sulphur sprays. Others missed early bloom spray warnings, resulting in brown rot twig blight development. These then omitted to apply mid-season brown rot sprays. Others narrowly missed disease epidemics by applying too few sprays during pre-harvest. However, most sprayed effectively and minimised fungicide use. The most efficient participants had smaller blocks of 2-3 ha, were focused, had adequate spraying resources and were less diversified, with fewer alternate crops such as apples and vegetables.

Communication with participants was intense at the start of the season through several different media and detailed, faxed feedback at weekly intervals. However the faxed feedback did not appear to get the message through to all participants. In hindsight the group could have met regularly to discuss progress on each orchard and to learn from each other, but attendance would have been difficult for some.

Participants who missed key IPs, exposing their blocks to infection, should have received individual follow-up instead of assuming they would heed the warnings sent by fax. While most participants either had proficiency in weather-based spraying or regularly communicated with the authors, others did not. Several had managers taking care of the spraying, which may have contributed to spray timing errors. The group of five who had their blocks monitored by HortResearch should perhaps have conducted the monitoring themselves to ensure proficiency in the required skills.

After 1998, all Golden Queen growers will have to operate within fruit production guidelines set by the processor. This means growers will have to be proficient in weather-based spraying and monitoring techniques or be prepared to pay for an appropriate service. To better prepare the industry and prevent re-occurrences of disease epidemics, a detailed protocol needs to be developed for next season.

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