POMASA
Research results

Handré Viljoen

ExperiCo
Agri-Research Solutions

ISO 9001 : 2015 Certified

Content of talk

- PMG 01-24
  - Part 1: Conducted a full survey on commercial pack-houses
  - Part 2: Evaluated the effect of fungicide application timings on decay control and overall fruit quality of Wonderful pomegranates
- PMG 02-24
  - Develop a cold storage protocol to maintain the overall fruit quality of Wonderful pomegranates

Part 1 - Survey on commercial pack-houses

- Bin
- After Chlorine
- After Fludioxonil
- After Wax
- After Flooder
- Only Fludioxonil

We did a full Packhouse sanitation report

Evaluated the decay on Wonderful pomegranates after 6 weeks cold storage and after shelf-life

Survey on commercial pack-houses

Decay on Wonderful pomegranates at packhouse 1 after 30 days storage at various temperatures

Sample area	Evaluation stage	Parameters			
		Crown rot	'Black heart'	Surface decay	Total decay
		(% Incid.)	(% Incid.)	(% Incid.)	(% Incid.)
Bin	SOS	0.0	20.0	20.0	40.0
After Chlorine		0.0	20.0	0.0	20.0
After Fludioxonil		0.0	0.0	0.0	0.0
After Wax		0.0	20.0	0.0	20.0
Bin	EOS	0.0	0.0	0.0	0.0
After Chlorine		0.0	0.0	0.0	0.0
After Fludioxonil		0.0	0.0	20.0	20.0
After Wax		0.0	0.0	0.0	0.0

Survey on commercial pack-houses

Decay on Wonderful pomegranates at packhouse 2 after 30 days storage at various temperatures

Sample area	Evaluation stage	Parameters			
		Crown rot	'Black heart'	Surface decay	Total decay
		(% Incid.)	(% Incid.)	(% Incid.)	(% Incid.)
Bin	SOS	0.0	0.0	0.0	0.0
After Chlorine		0.0	0.0	0.0	0.0
After Fludioxonil		0.0	0.0	0.0	0.0
After Wax		0.0	0.0	0.0	0.0
Bin	EOS	0.0	0.0	0.0	0.0
After Chlorine		0.0	0.0	0.0	0.0
After Fludioxonil		0.0	0.0	0.0	0.0
After Wax		0.0	0.0	0.0	0.0

Survey on commercial pack-houses

Decay on Wonderful pomegranates at packhouse 3 after 30 days storage at various temperatures

Sample area	Evaluation stage	Parameters		
		Crown rot	'Black heart'	Surface decay
		(% Incid.)	(% Incid.)	(% Incid.)
Bin	SOS	80.0	80.0	20.0
After Chlorine		20.0	60.0	20.0
After Fludioxonil		0.0	0.0	0.0
After Flooder		0.0	20.0	0.0
After Wax		0.0	20.0	20.0
Only Fludioxonil		0.0	40.0	0.0
Bin	EOS	40.0	60.0	0.0
After Chlorine		40.0	40.0	0.0
After Fludioxonil		0.0	0.0	0.0
After Flooder		20.0	20.0	0.0
After Wax		0.0	0.0	0.0
Only Fludioxonil		0.0	0.0	0.0

Addendum 1

ExperiCo Agri-Research Solutions | ExperiCure™ Diagnostic Services

Pathogen identification report of Pomegranates - Packhouse 1 - PMG 01-24

Summary of evaluation 2024/08/20

Samples received
- 10 Pomegranates were received.

Processing of samples
- Fruit were surface sterilized with ethanol and left to dry, after which they were cut in half. Sections of the affected flesh were removed with a scalpel and plated onto potato dextrose agar plates. Plates were incubated at ± 23°C for 5-7 days, depending on growth.
- After incubation, various pathogens were detected on the PDA plates.

Results
- *Alternaria* spp. were detected on 80% of fruit evaluated. *Alternaria* causes Alternaria Fruit Rot (Black Heart) in pomegranates. Infections commonly occur following rain during flowering and early fruit development.
- *Penicillium* sp. (20%) and *Colletotrichum* sp. (10%) were also detected from fruit flesh.
- Other unknown fungal growth was detected from 10% of samples.

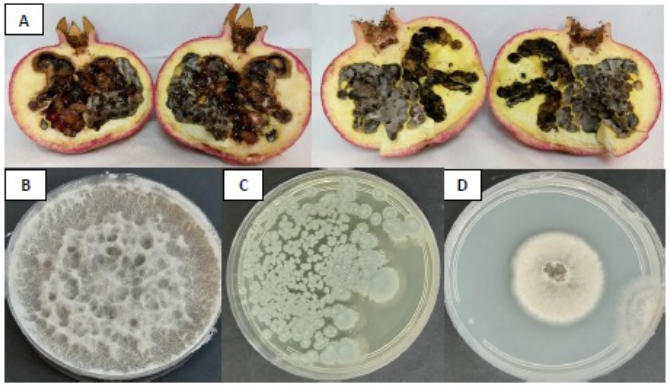

Figure 1: A) Fruit dissected for evaluation, B) *Alternaria* sp., C) *Penicillium* sp., D) *Colletotrichum* sp. isolated from fruit.

Declaration of indemnity: As we work with natural systems with a myriad of variables, no guarantees are implied or given. The information is intended as part of a Decision Support System (DSS) in the management of plant pathogens. Additional precautions should be taken if rainfall has or will take place a week prior to or within date of evaluation.

Addendum 3

ExperiCo Agri-Research Solutions | ExperiCure™ Diagnostic Services

Pathogen identification report of Pomegranates - Packhouse 2 - PMG 01-24

Summary of evaluation 2024/08/20

Samples received
- 12 Pomegranates were received.

Processing of samples
- Fruit were surface sterilized with ethanol and left to dry, after which they were cut in half. Sections of the affected flesh were removed with a scalpel and plated onto potato dextrose agar plates. Plates were incubated at ± 23°C for 5-7 days, depending on growth.
- After incubation, various pathogens were detected on the PDA plates.

Results
- *Alternaria* spp. were detected on 100% of fruit evaluated. *Alternaria* causes Alternaria Fruit Rot (Black Heart) in pomegranates. Infections commonly occur following rain during flowering and early fruit development.
- Possible *Cytospora* sp. was also detected on 8% of fruit evaluated and is known to cause postharvest fruit rot in pomegranates.
- Other unknown fungal growth was detected from 8% of samples.

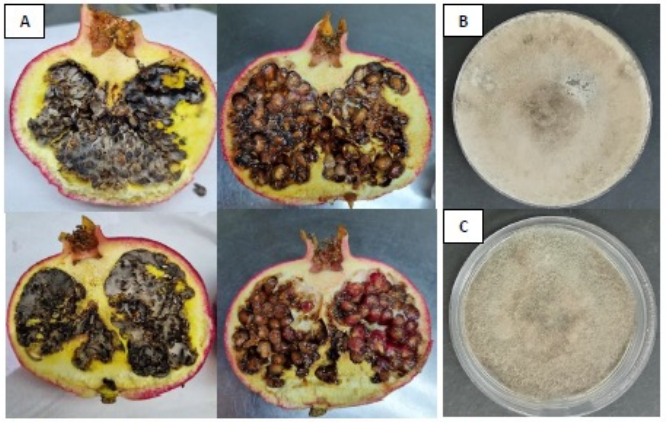

Figure 1: A) Fruit dissected for evaluation, B) *Alternaria* sp. and C) *Cytospora* sp. isolated from fruit.

Declaration of indemnity: As we work with natural systems with a myriad of variables, no guarantees are implied or given. The information is intended as part of a Decision Support System (DSS) in the management of plant pathogens. Additional precautions should be taken if rainfall has or will take place a week prior to or within date of evaluation.

Addendum 2

ExperiCo Agri-Research Solutions | ExperiCure™ Diagnostic Services

Packhouse sanitation report of
Packhouse 1 - RK0611 - Pomegranates - Wonderful

Summary of evaluation 2024/04/16

SURFACE SAMPLES

Water samples

- **2/2 of the water samples had moderate to high CFU values (Figure 1).** High CFU counts were detected from water samples of the chlorine bath or the fungicide bath (> 3 000 CFU/mL) and consisted of yeast and bacteria.

Swab samples

- **0/16 of the surface samples had moderate to high CFU values (Figure 2).** The highest CFU's were detected at the precooler from the floor at the start, the crate, the floor at the end, as well as from the belt in the packhouse, the wall at the start of the packhouse and the floor at the coldroom half pallets (150 - 1 389 CFU/cm²). CFU's detected included mostly yeast and *Penicillium*, with *Cladosporium*, *Alternaria*, *Aspergillus*, *Fusarium* and *Trichoderma* also being detected.

General

- Not all fungi identified to genus level include pathogens. **Pathogenic fungi can be expected from *Penicillium*, *Aspergillus*, *Alternaria*, *Botrytis* and other moulds.**
- Most of the samples showed yeast growth (Figure 1 and 2). This is not necessarily an indication of concern as many yeasts are closely associated with fruit without the occurrence of decay.
- To improve packhouse cleanliness, sanitation actions should be directed at areas with the highest CFU values.

ExperiCo Agri-Research Solutions | ExperiCure™ Diagnostic Services

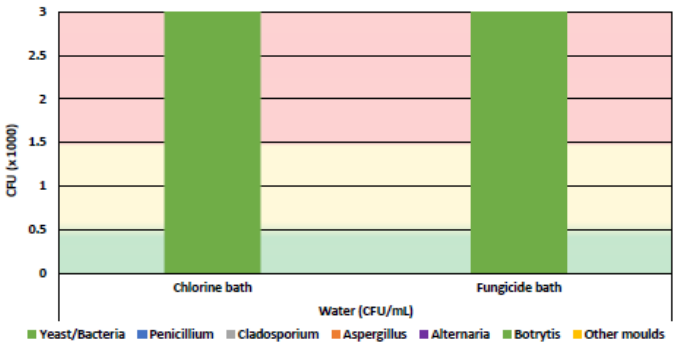

Figure 1: Colony forming units (CFU) from packhouse water samples

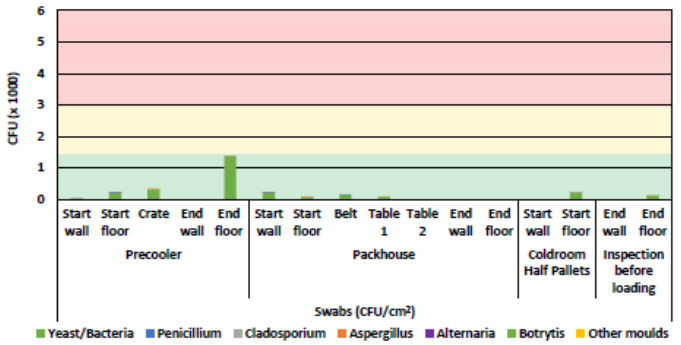

Figure 2: Colony forming units (CFU) from packhouse swab samples

Percentage of samples with moderate to high CFU values

Water	Surfaces
100	0

Declaration of indemnity: As we work with natural systems with a myriad of variables, no guarantees are implied or given. The information is intended as part of a Decision Support System (DSS) in the management of plant pathogens. Additional precautions should be taken if rainfall has or will take place a week prior to or within date of evaluation.

Tel: +27 21 887 1134 © Copyright www.experico.co.za

Part 2 - Small-scale trial to determine the efficacy of fludioxonil on decay control

Treatments:

- T1: UTC
- T2: 2 hours after harvest
- T3: 24 – 30 hours after harvest
- T4: Commercial packed reference sample: to compare efficacy to our fludioxonil drench in the laboratory with similar exposure times.

The fruit was packed for export and cold stored at 5 °C for 6 weeks followed by 7 days shelf life at 20 °C

Small-scale trial

Efficacy of fludioxonil on decay control when applied at different intervals after harvest on cold stored Wonderful pomegranates

Treatment	Evaluation stage	Parameters			
		Crown rot	'Black heart'	Surface decay	Total decay
		(% Incid.)	(% Incid.)	(% Incid.)	(% Incid.)
UTC	SOS	0.0	1.8	0.0	1.8
2 h after Harvest		0.0	3.6	1.8	5.4
30 h after Harvest		0.0	3.6	0.0	3.6
Commercial sample		0.0	0.0	0.0	0.0
Prob.>F[1]		-	0.4897	0.4074	0.4376
UTC	EOS	0.0	0.0	0.0	0.0
2 h after Harvest		0.0	3.6	0.0	3.6
30 h after Harvest		0.0	1.8	3.6	5.4
Commercial sample		0.0	0.0	0.0	0.0
Prob.>F[1]		-	0.2780	0.0955	0.0955

Summary

- In most cases, the fludioxonil treatments reduced crown rot and surface decay, however ‘Black heart’ decay remained an issue.
- Packhouse sanitation assessment indicated that the only CFU’s detected on the packhouse surfaces consisted of yeast and bacteria and were all in the acceptable range.
- The small-scale trial on the efficacy of fludioxonil on decay control applied at different timings indicated that timing was not that critical on this population of fruit
- But treating as soon as possible is still advised for adequate control of decay.

Develop a cold storage protocol to maintain the overall fruit quality

- Treatments:
  - T1: Forced-air cooling to 5 °C
  - T2: Forced-air cooling to 7.5 °C
  - T3: Step down cooling to 5 °C (→ 10 °C (24 Hours) → 7.5 °C (24Hours)→ 5.0 °C)
  - T4: Step down cooling to 7.5 °C (→ 10 °C (24 Hours)→ 7.5 °C)
- Fruit were cold stored for 6 weeks at the respective temperatures followed by 7 days shelf life at 20 °C

Population 1

Browning severity and decay incidence of population 1 on Wonderful pomegranates after 42 days cold storage at various temperatures

Treatment	Parameters[2]											
	Surface browning				Pulp membrane browning				Albedo browning			
	Rating 1 (%)	Rating 2 (%)	Rating 3 (%)	Total (%)	Rating 1 (%)	Rating 2 (%)	Rating 3 (%)	Total (%)	Rating 1 (%)	Rating 2 (%)	Rating 3 (%)	Total (%)
FAC to 5 °C	0.0	0.0	0.0	0.0	17.9	12.5	3.6	33.9bc	8.9	8.9b	0.0	17.9
FAC to 7.5 °C	0.0	0.0	0.0	0.0	10.7	1.8	0.0	12.5ab	3.6	0.0a	0.0	3.6
Step cooling to 5 °C	0.0	0.0	0.0	0.0	21.4	10.7	5.4	37.5c	12.5	8.9b	0.0	21.4
Step cooling to 7.5 °C	0.0	0.0	0.0	0.0	1.8	0.0	1.8	3.6a	5.4	0.0a	0.0	5.4
Prob.>F[1]	-	-	-	-	0.0606	0.1599	0.6400	0.0082	0.4758	0.0477	-	0.0680

Treatment	Parameters							
	Aril browning[2]				Incidence (%)			
	Rating 1 (%)	Rating 2 (%)	Rating 3 (%)	Total (%)	Crown Rot	Black heart decay	Surface decay	Total decay
FAC to 5 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FAC to 7.5 °C	0.0	0.0	0.0	0.0	0.0	5.4	7.1	12.5
Step cooling to 5 °C	0.0	0.0	0.0	0.0	0.0	1.8	1.8	3.6
Step cooling to 7.5 °C	0.0	0.0	0.0	0.0	0.0	7.1	0.0	7.1
Prob.>F[1]	-	-	-	-	-	0.2834	0.0740	0.1900

Population 2

Browning severity and decay incidence of population 2 on Wonderful pomegranates after 42 days cold storage at various temperatures

Treatment	Parameters[2]											
	Surface browning				Pulp membrane browning				Albedo browning			
	Rating 1 (%)	Rating 2 (%)	Rating 3 (%)	Total (%)	Rating 1 (%)	Rating 2 (%)	Rating 3 (%)	Total (%)	Rating 1 (%)	Rating 2 (%)	Rating 3 (%)	Total (%)
FAC to 5 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FAC to 7.5 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Step cooling to 5 °C	0.0	0.0	0.0	0.0	1.8	0.0	0.0	1.8	0.0	0.0	0.0	0.0
Step cooling to 7.5 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prob.>F[1]	-	-	-	-	0.4074	-	-	0.4074	-	-	-	-

Treatment	Parameters							
	Aril browning[2]				Incidence (%)			
	Rating 1 (%)	Rating 2 (%)	Rating 3 (%)	Total (%)	Crown Rot	Black heart decay	Surface decay	Total decay
FAC to 5 °C	0.0	0.0	0.0	0.0	0.0	14.3	7.1	21.4
FAC to 7.5 °C	0.0	0.0	0.0	0.0	1.8	8.9	10.7	21.4
Step cooling to 5 °C	0.0	0.0	0.0	0.0	0.0	7.1	10.7	17.9
Step cooling to 7.5 °C	0.0	0.0	0.0	0.0	0.0	1.8	0.0	1.8
Prob.>F[1]	-	-	-	-	0.4074	0.2619	0.1158	0.2362

Summary

- Different rapid and slow cooling procedures were tested as well as the impact of different holding temperatures during subsequent cold storage.
- We suspect that rapid cooling of pomegranates might damage the fruit cells and that this may manifest as surface and pulp membrane browning after cold storage.
- Step-down cooling to 7.5 °C had a positive effect in reducing pulp membrane and albedo browning, followed closely by pomegranates forced-air cooled to 7.5 °C.
- If “Black heart” decay can be controlled, these fore-mentioned treatments show potential for commercial application.
- However, these initial research findings need to be confirmed in more research

Thank You!

P O Box 4022
Idas Valley
Stellenbosch
7609

Tel : (021) 887-1134

www.experico.co.za

SABS
ISO 9001

ExperiCo
Agri-Research Solutions