Mango Disease Management

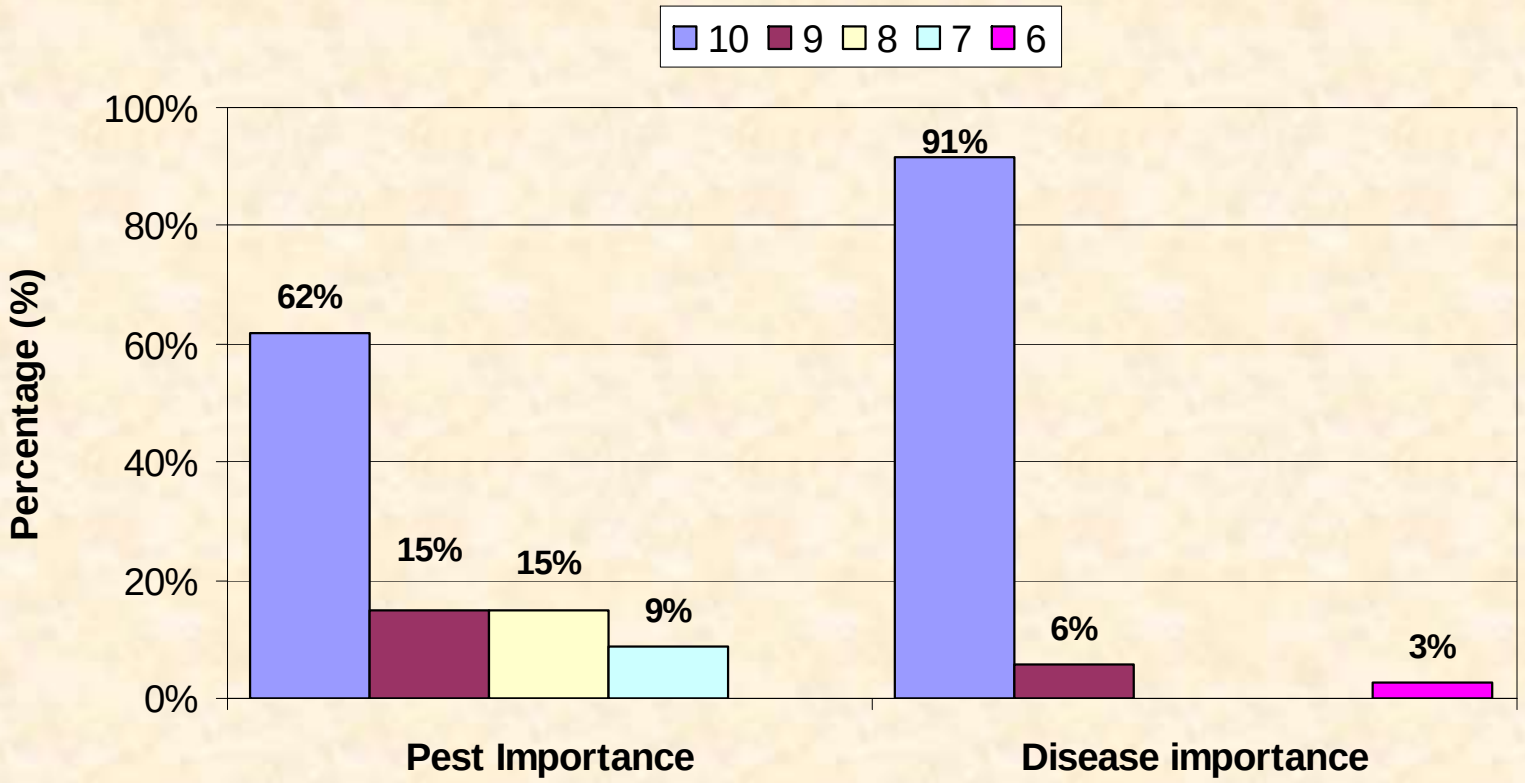
through

Inoculum Reduction Strategies

Chrys Akem
Principal Plant Pathologist
DPI&F

IPM Project Survey - 2004

Pest and Disease Importance to Industry



Importance of Disease

- An important and critical part of the mango production system
- Need to be managed to achieve profitable production
- Need to do so in a Sustainable way with less impact on production Costs, the fragile Environment and our Health

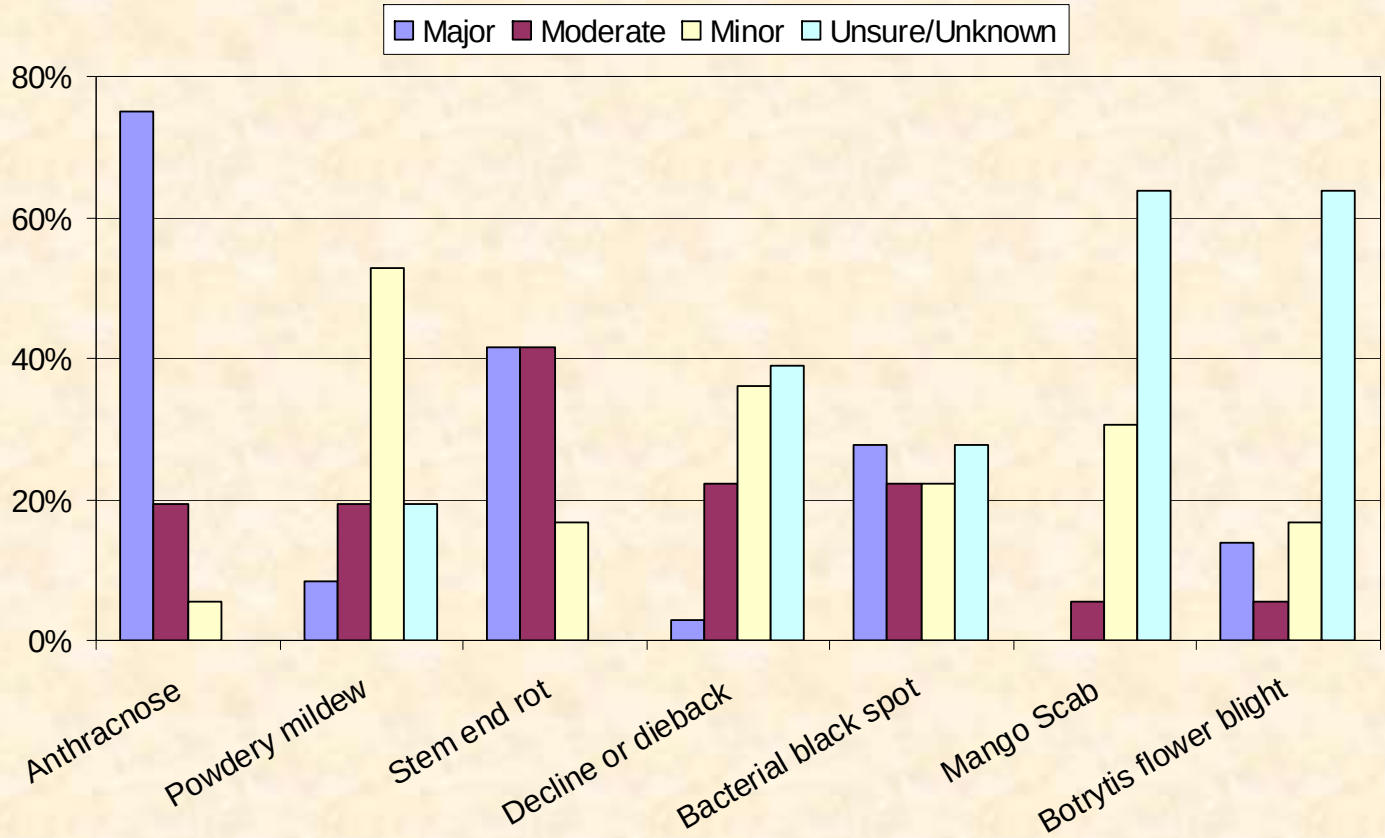
DPI&F Current Research Focus

- Genetic resistance screening
- Plant activators evaluations
- New fungicides assessments
- Inoculum reduction strategies

Outline of Presentation

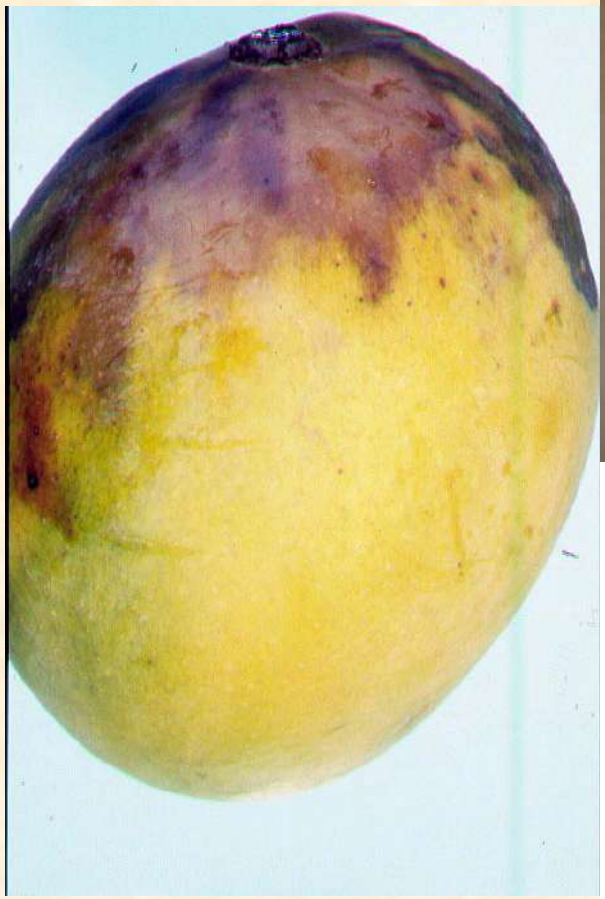
- What the major disease issues are
- How far we have come with them
- **Where we are at the present**
- What the future looks like

IPM Project Survey
Importance of Different Mango Diseases



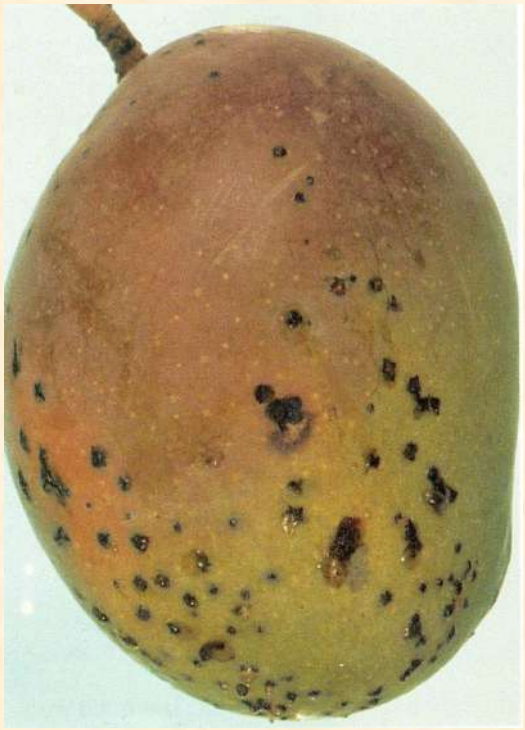
Our Major Disease - Anthracnose

Another Major - Stem End Rots



An Emerging one - Dendritic spots

The Minor Ones



Bacterial Black spot

Powdery mildew

Mango scab

The Real Issue

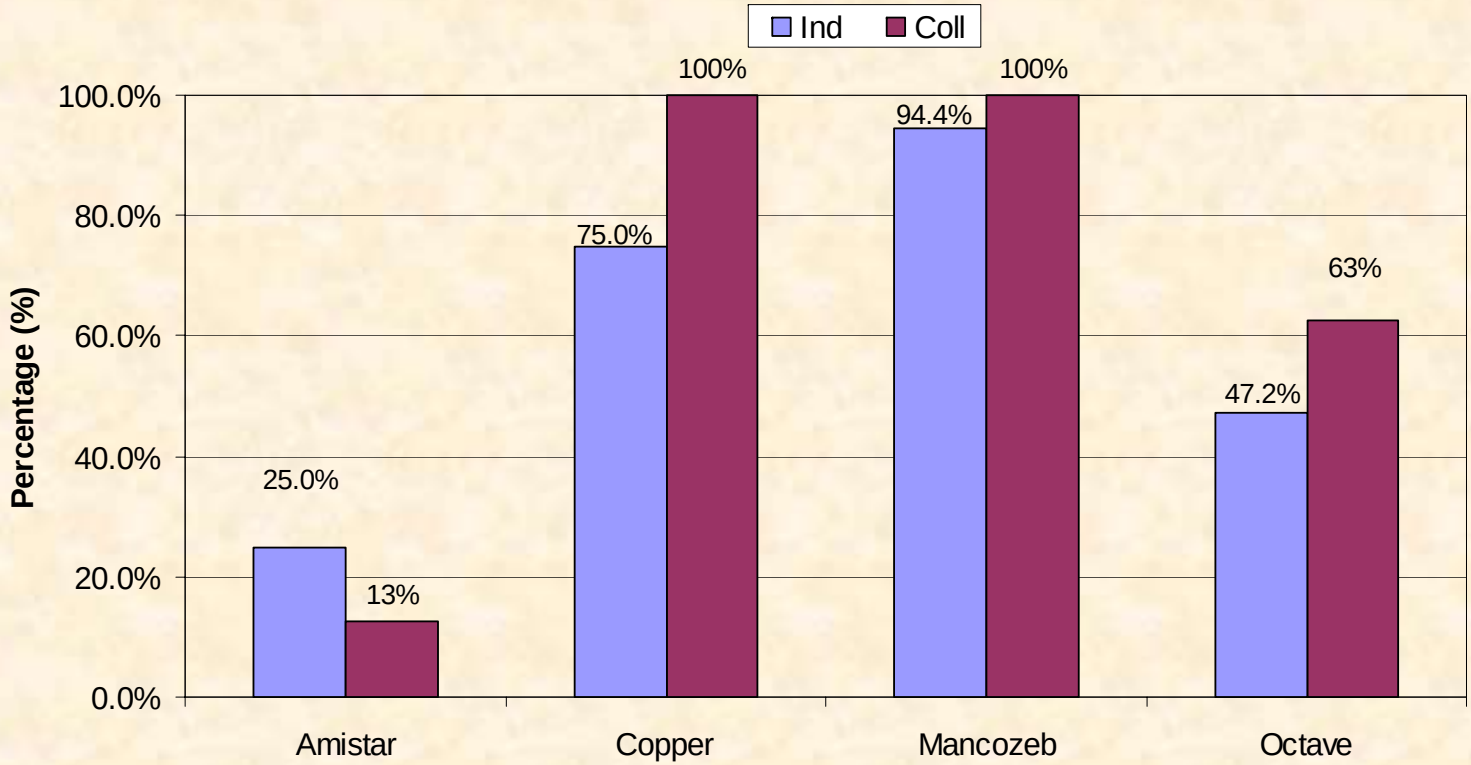
Shelf-life in mangoes is mainly limited by 2 important postharvest diseases;

Anthracnose and **Stem-End-Rots**

The routine process

Control of these diseases is largely based on the use of synthetic fungicides

IPM Project Survey – Fungicide Use - 2004



Field Control Options

Fungicide Sprays

- Mancozeb
- Copper
- Octave
- Amistar

Postharvest Control Options

Fungicide Dips

- Sportak
- Spinflo
- Hot water dips

Postharvest fungicides have served the industry well, but there is an uncertain future - Chemical companies withdrawing; More MRL restrictions on target markets, etc.

Implications

- Have to start planning into the future
- See what we can do better to reduce total dependence on these chemicals
- **Reality is to act like they may not be available in the long run**
- Go back to the orchards and see how we can do things better; start coming off the "Chemical Dependency Syndrome".

Current Concerns with Pesticide use

- Overuse – Routine calendar sprays
- Increasing costs of new ones - Amistar
- Environmental concerns - Cu
- Resistance development - Systemics
- Export market restrictions

  - Dictation of what to use

  - MRLs limitation

The Ultimate Goal from 2004 Review

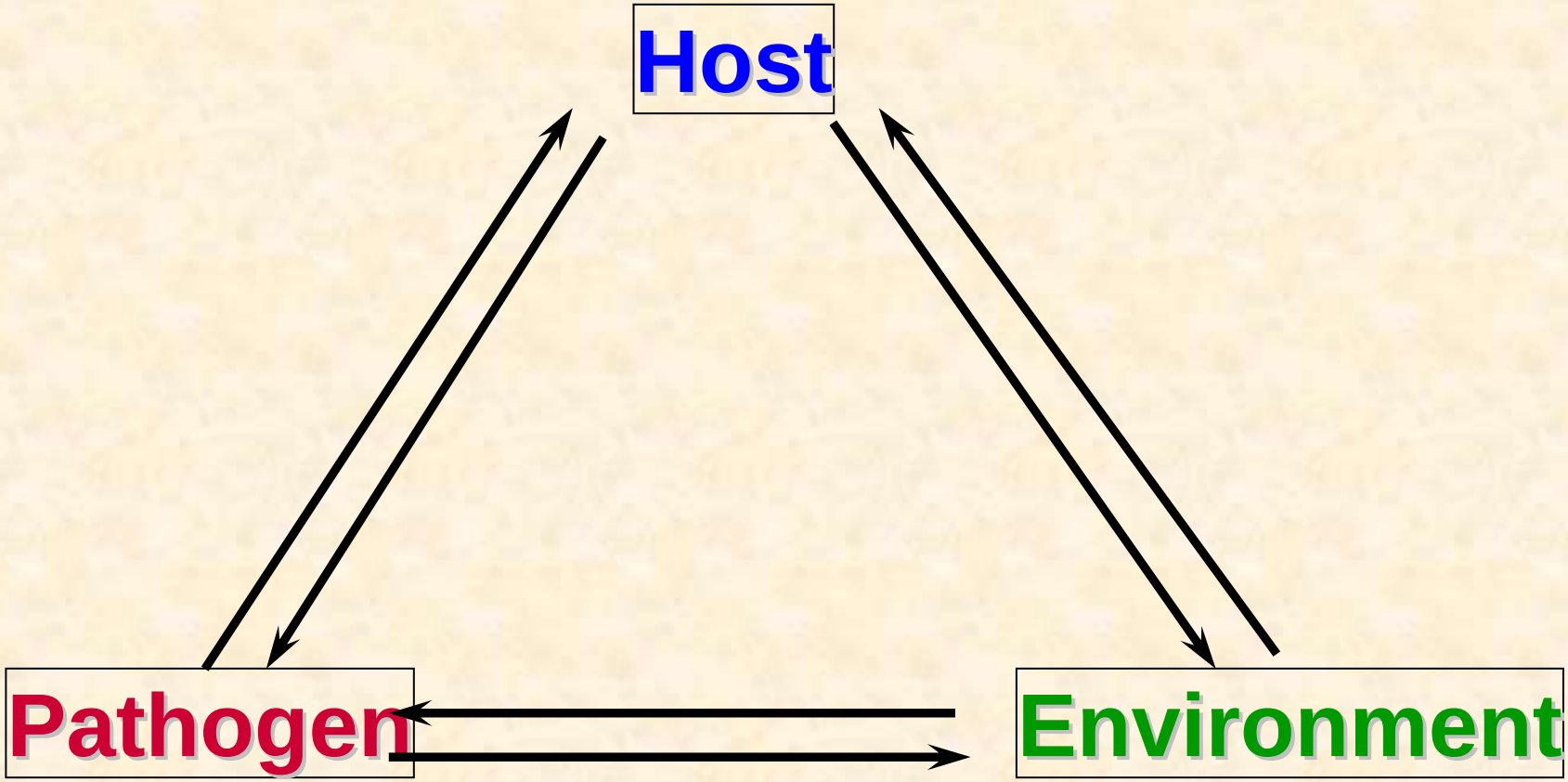
For Disease Management:

"To have an in-field disease management strategy that ensures that the fruit is robust enough to have up to 40 days shelf life and does not require any post harvest treatment."

Disease Management Involves

- Exclusion
- Protection of the host
- Inhibiting pathogen development
- Reducing inoculum levels

Will Need to Consider "New" Options



Re-focusing on the Host

- Resistance
- Healthy tree growth
- **Orchard sanitation**

Disease Spread in the Orchard

Integrated Progression

- Disease Control
- Disease Management
- Integrated Disease Management
- Integrated Pest Management
- **Integrated Crop Management**

Integrated Crop management

- *A Holistic Approach that considers:*
  - Crop protection (IPM)
  - Crop nutrition
  - Irrigation practices
  - Other Crop production practices
  - Environmental impacts

Integrated Crop Management (ICM)

- The ultimate goal is:

  - **Increased Yields and**
  - **Long-term Sustainability of Production**

- **ICM = Sustainable Crop Management**

  Applying as little input as possible, but as much as needed.

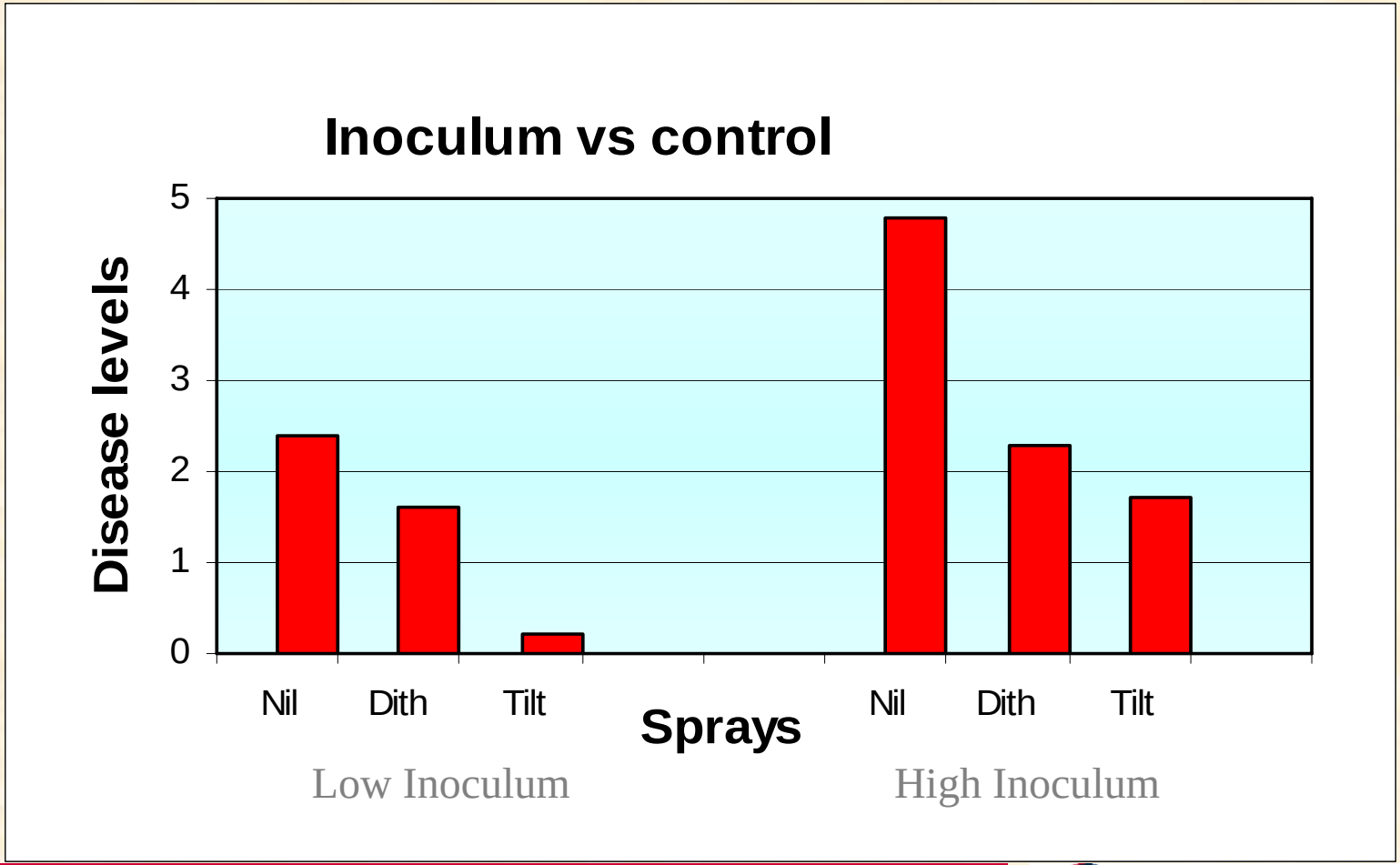
The Way Forward - 1

1. Back to Basics of Orchard Hygiene

- **Role of Inoculum Reduction**

  - **Effect of low levels of inoculum on minimum sprays**

Effect of Inoculum levels on control



Not Really a New Concept

Going back to the Basics of

Orchard Sanitation

- Use pruning as a disease management tool
- Continue to do so regularly and routinely
- Remove all dead branches, old fruit, flower panicles etc.
- Move prunings into the inter-row to mulch

  > not a good idea to put on base of the tree.
- Prune early to enable material to rot
- Go back and thin all inner shoot growths
- Skirt trees to limit contact with soil

Delivery

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Pruning to reduce size and disease inoculum

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Experimental Approach

- Mechanical pruning of trees at end of cropping season
- **Total Reduction** – Clearing of all dead twigs, branches and leaves on and under the trees; continue periodically
- **Partial Reduction** – One time clearing of all dead twigs, branches and leaves on tree
- **None** – Pruning with no further clearing of dead twigs, branches and leaves
- **Sprays** – Supplementing with some sprays

Delivery

Department of Primary Industries and Fisheries

Integration with sprays

1. Minimal

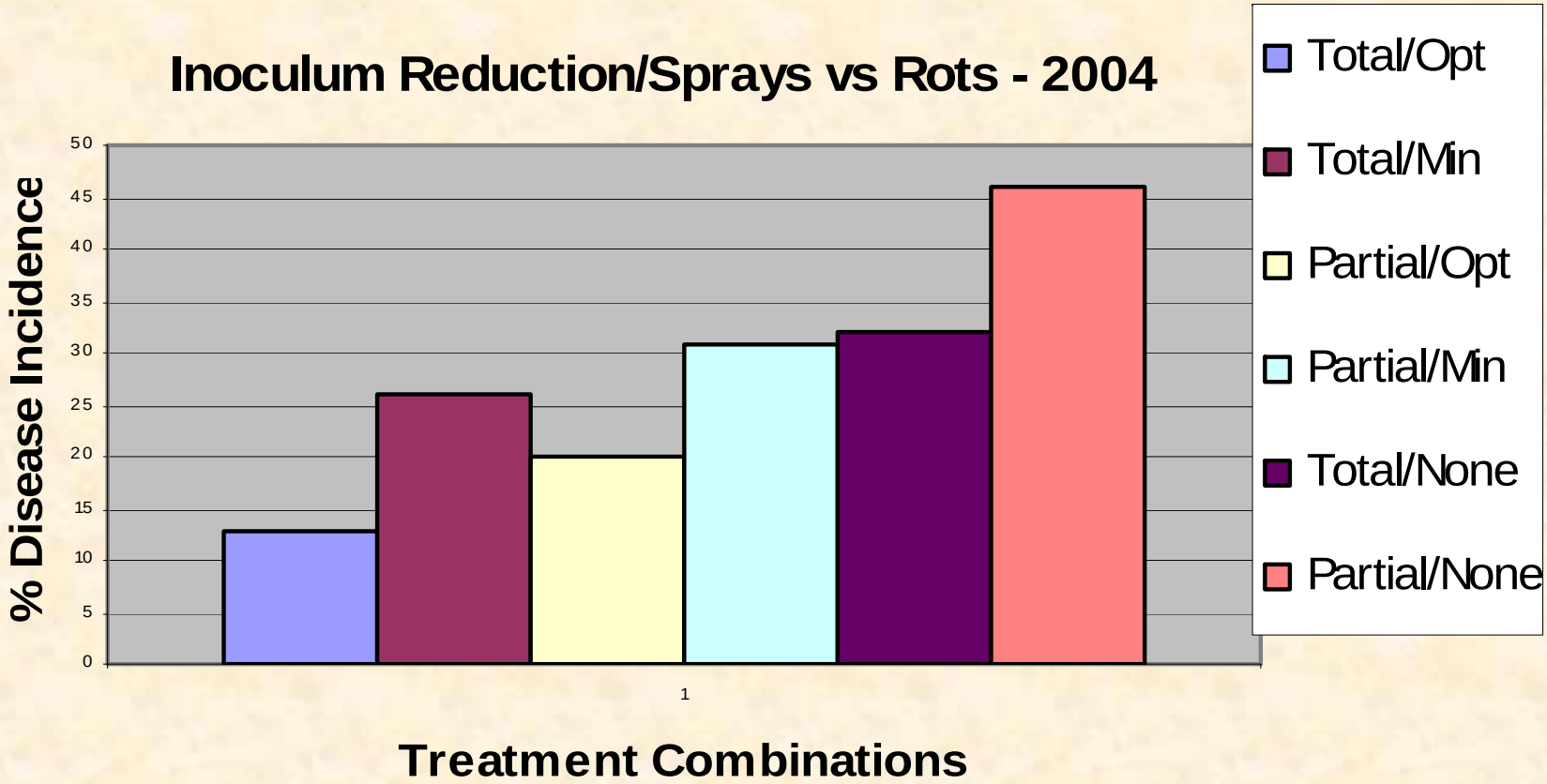
- First flush - Mancocide
- Second Flush - Mancozeb
- Flowering - Octave
- Fruiting - Mancozeb
- Harvesting – Amistar

Integration with sprays

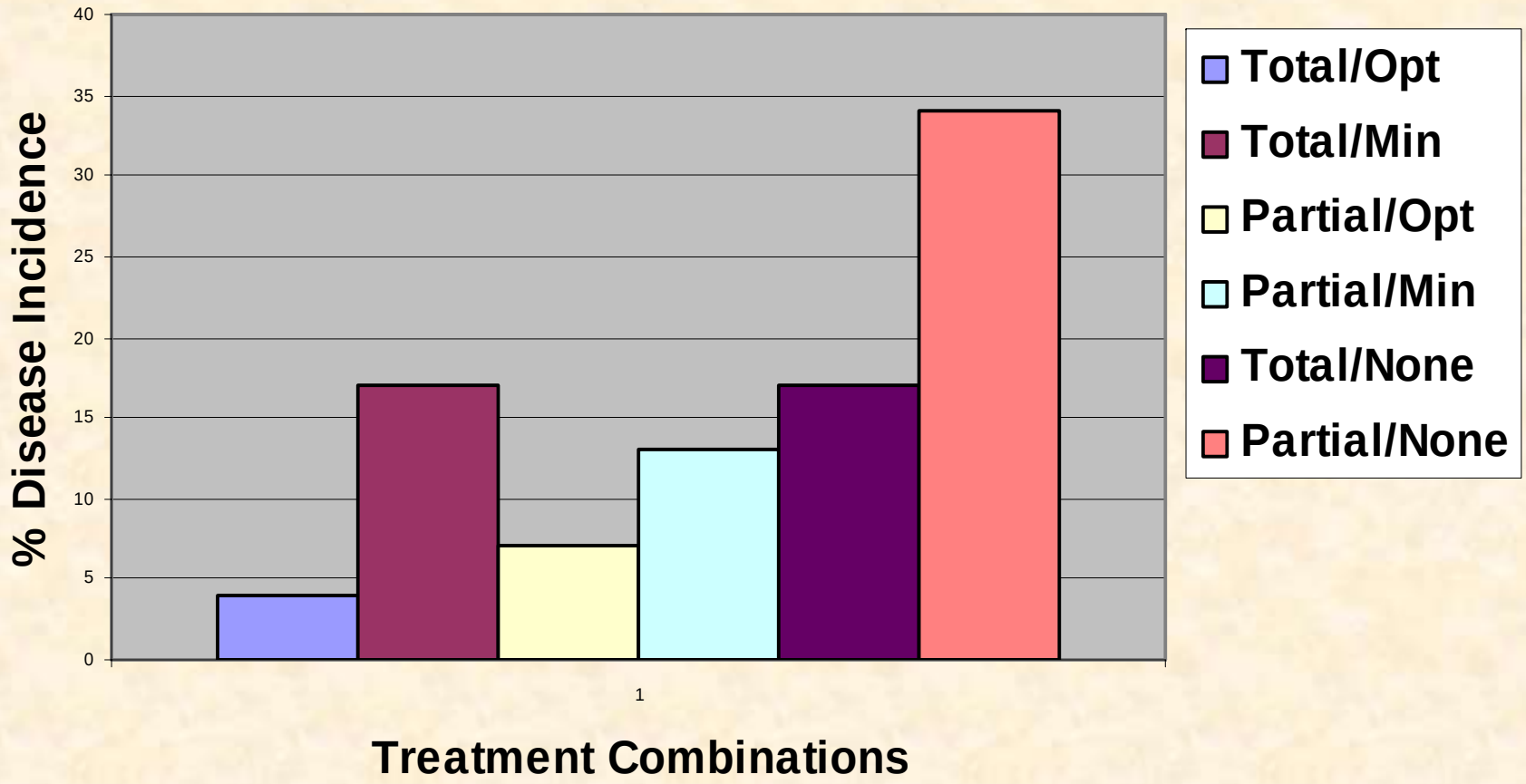
2. Optimal

- First Flush – Mancocide (Mancozeb + Cu)
- Second Flush - Mancozeb
- Pre-Flowering - Mancozeb
- Full Bloom - Octave
- Fruit initiation – Mancozeb/Amistar
- Fruit Expansion - Mancozeb
- Fruit maturation - Amistar

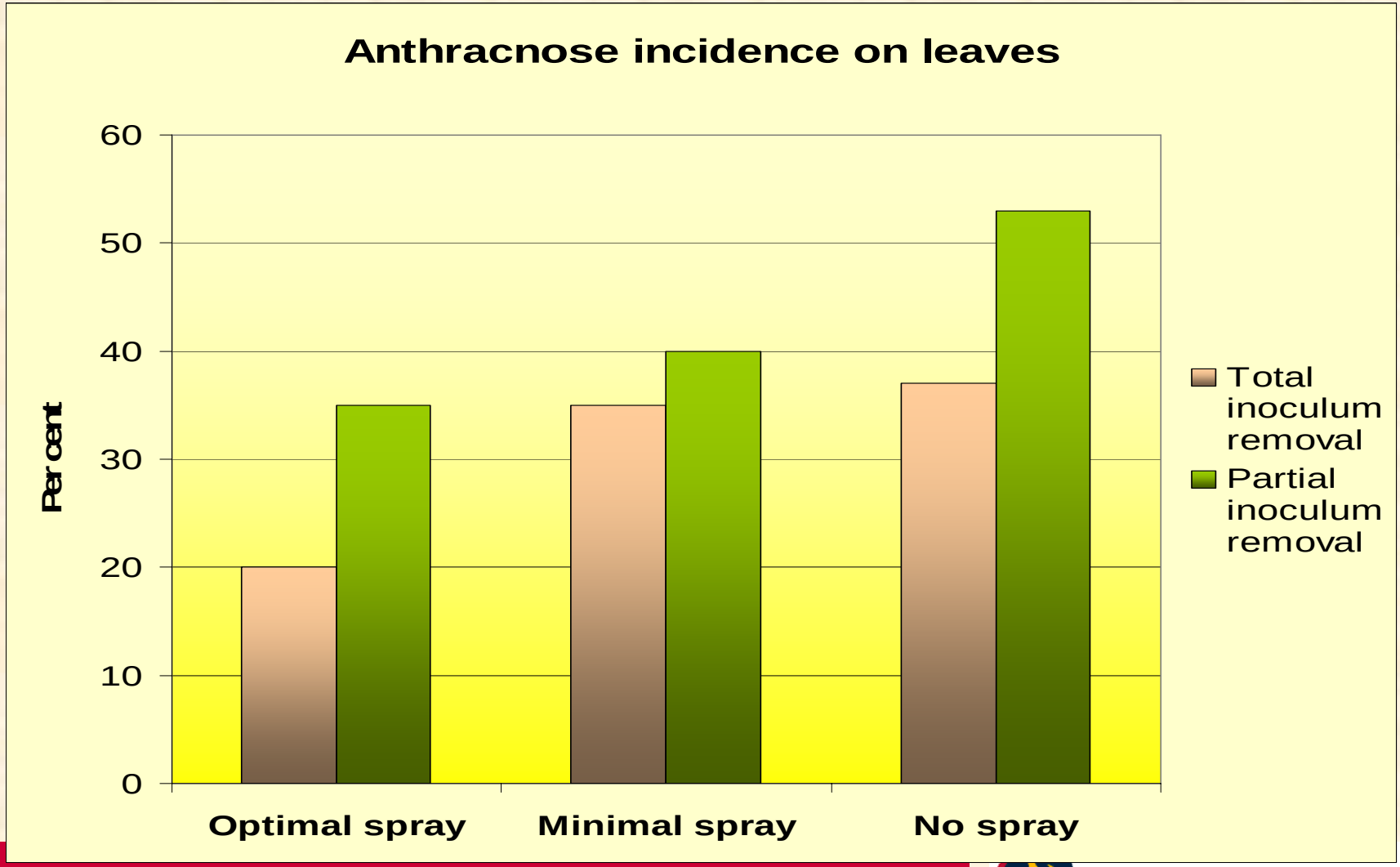
Incoculum Reduction/Sprays vs Rots



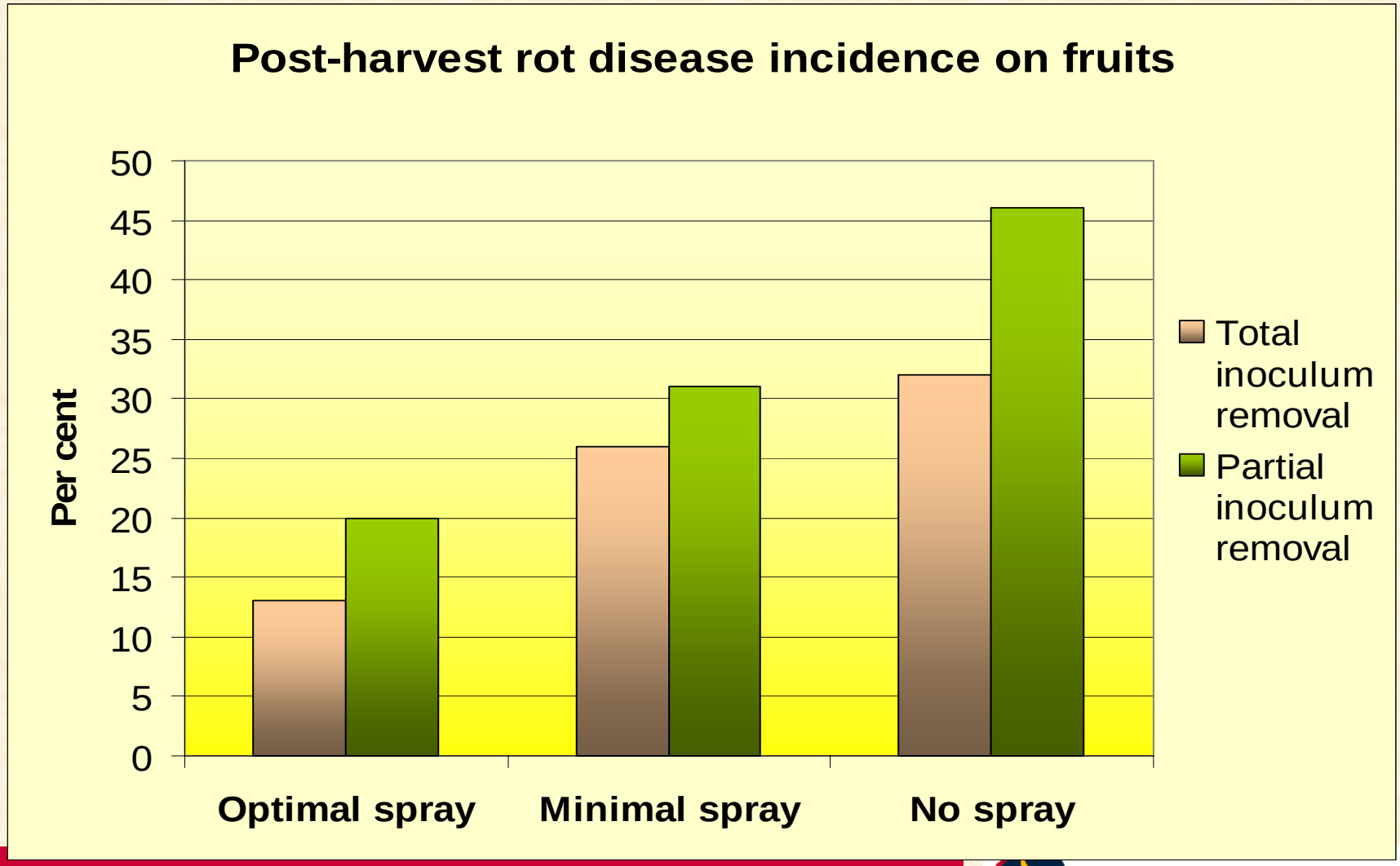
Inoculum Reduction/Sprays vs Anthracnose DI



Inoculum Reduction



Inoculum Reduction

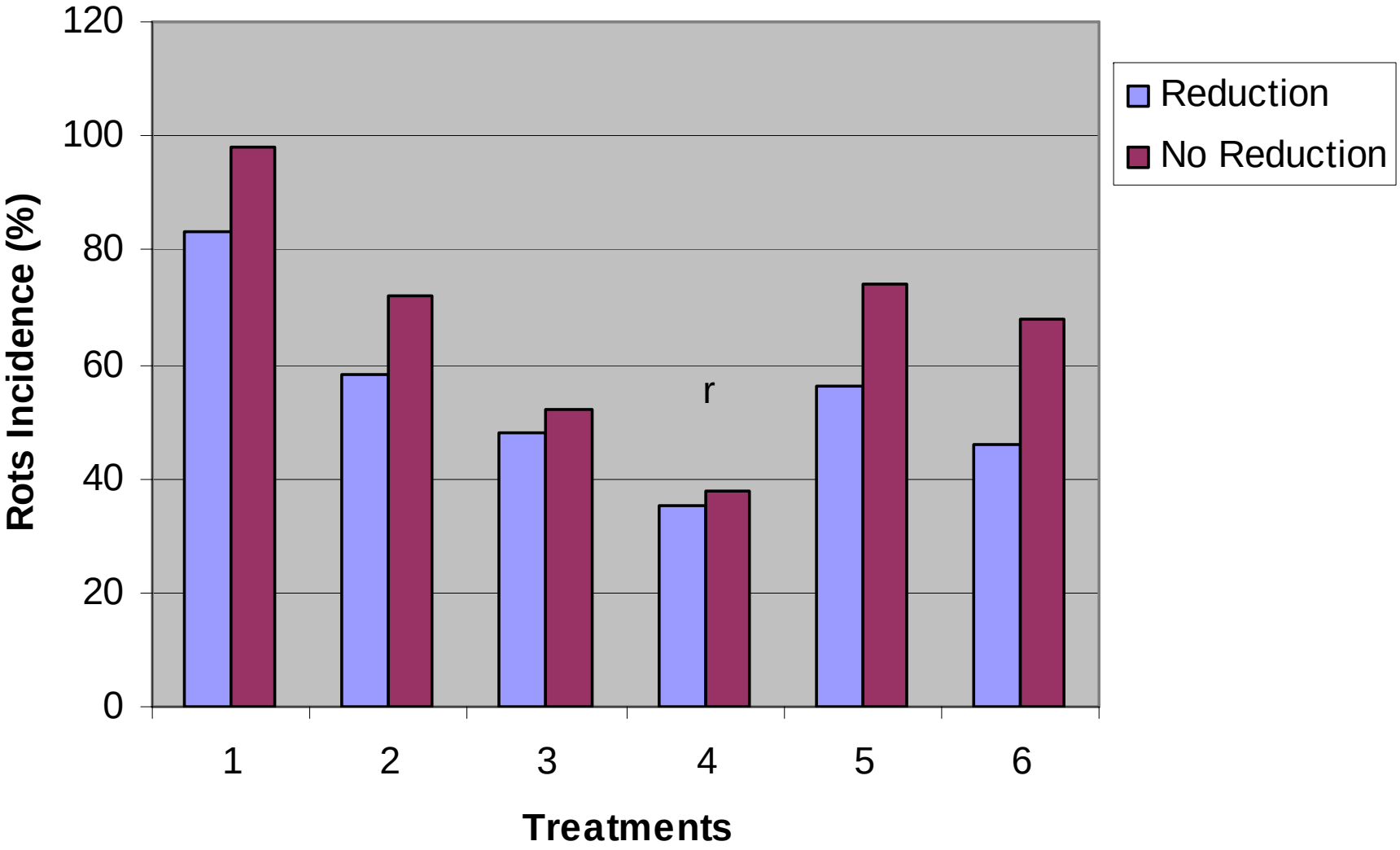


A Step Further - Searching for a systemic at flush

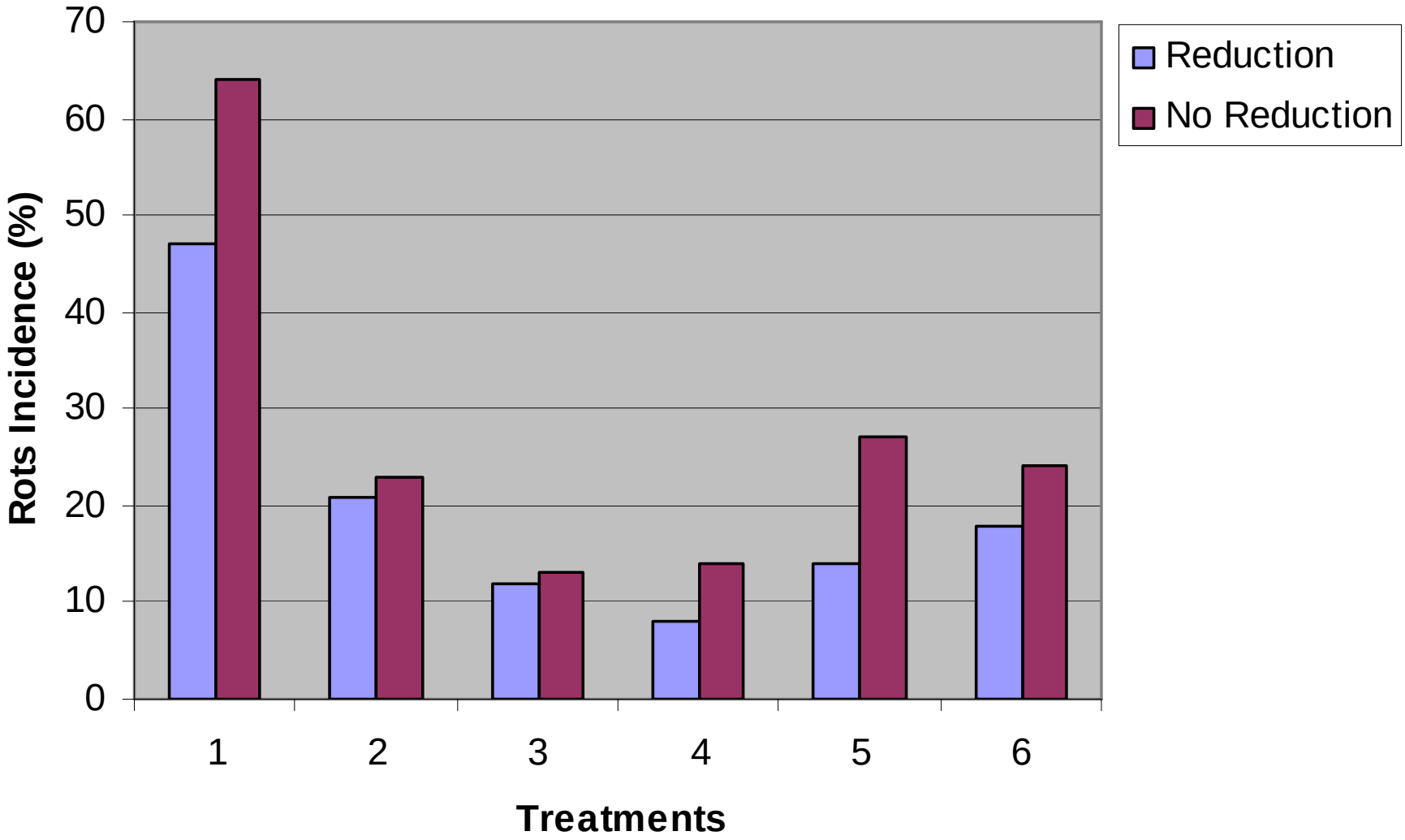
2007 Season Trial Treatments

	March	April	May	August	September	October	November
Treatments	**FLUSH**	**FLUSH**	**FLUSH**	**Flowering**	**Fruit Set**	**Develop/ ment**	**B4 Harvest**
1 (Nothing)	**C**	**O**	**N**	**T**	**R**	**O**	**L**
2 (S-Min)	Mankocide			Octave	Mancozeb		Amistar
3 (S-Max)	Mankocide	Mancozeb		Octave	Mancozeb/ Amistar	Mancozeb	Amistar
4 (S-Max)	Mankocide	**Bravo (Rover)**		Octave	**Bravo/** Amistar	**Bravo**	Amistar
5 (D-Min)	Mankocide	**Tilt**	Mancozeb	Octave	Mancozeb		Amistar
6 (D-Max)	Mankocide	**Tilt**	**Mancozeb /Tilt**	Octave	Mancozeb		Amistar

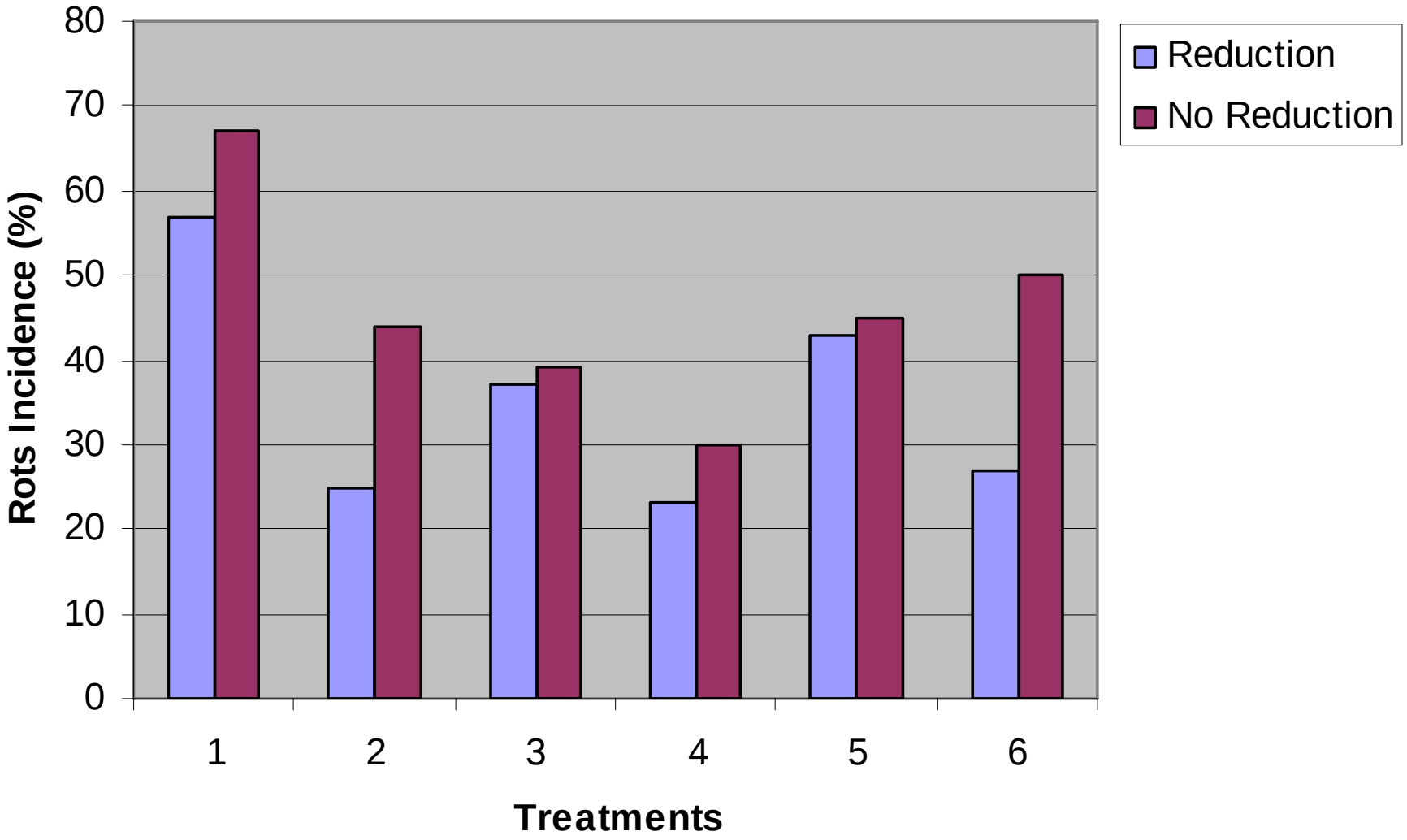
Inoculum Reduction Effects on Fruit Rots



Inoculum Reduction Effects on Anthracnose



Inoculum Reduction Effects on SER






Adopting in silence - FNQ

Testifying to Adoption Results - NQ

"I spent a lot of money in the early part of the season implementing the inoculum reduction practices in a couple of blocks in my orchard;

The results have been spectacular, more premium fruit from that block than all the others. It has already paid off. I will continue with all the orchard" - AJ

Above Quote from a Satisfied Burdekin Grower - December 2007

More Adoptions with own adjustments

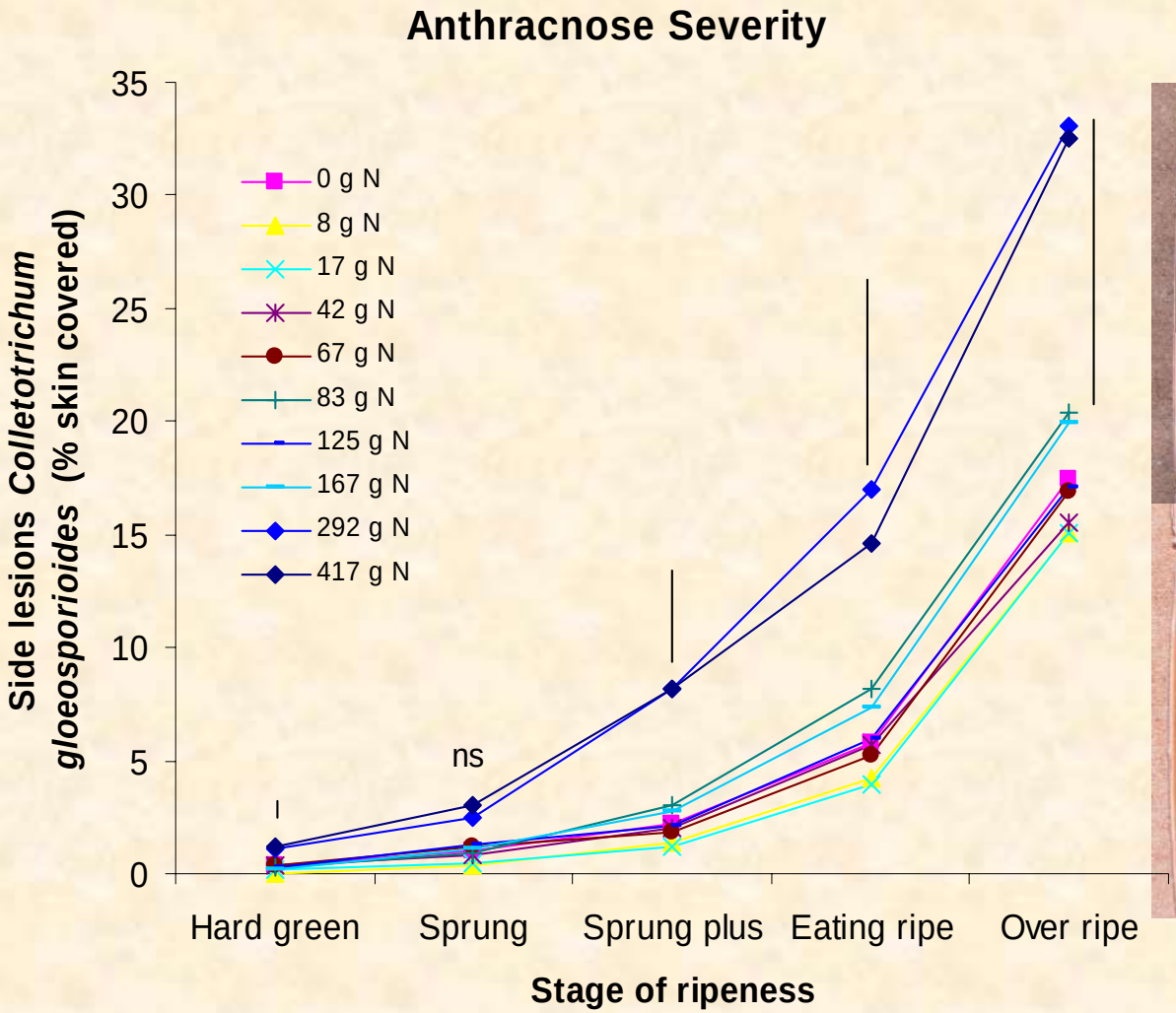
The Way Forward - 2

2. Plant Nutrition

- Judicious Fertilizer Use

  - Influence of nitrogen and other nutrients on yields and disease levels.


The links between nitrogen and postharvest diseases of mango.



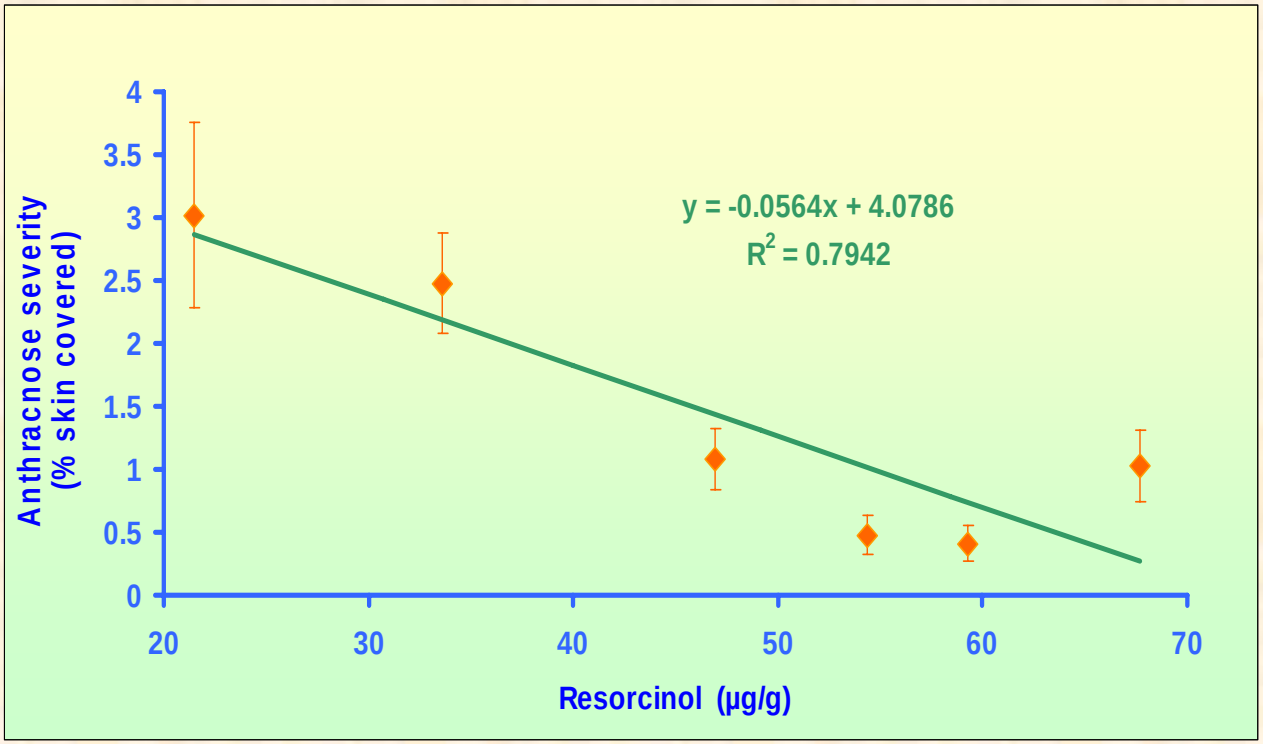
No nitrogen

417 g nitrogen

- Applied nitrogen rates above 292 g N tree^{-1} significantly increased anthracnose incidence and severity

Nitrogen fertilizer effects

- Anthracnose severity increases with increasing N fertiliser and skin N



- Anthracnose severity decreases as resorcinol increases

The Way Forward - 3

3. Plant Defenses

- Activating Plants Natural Defenses

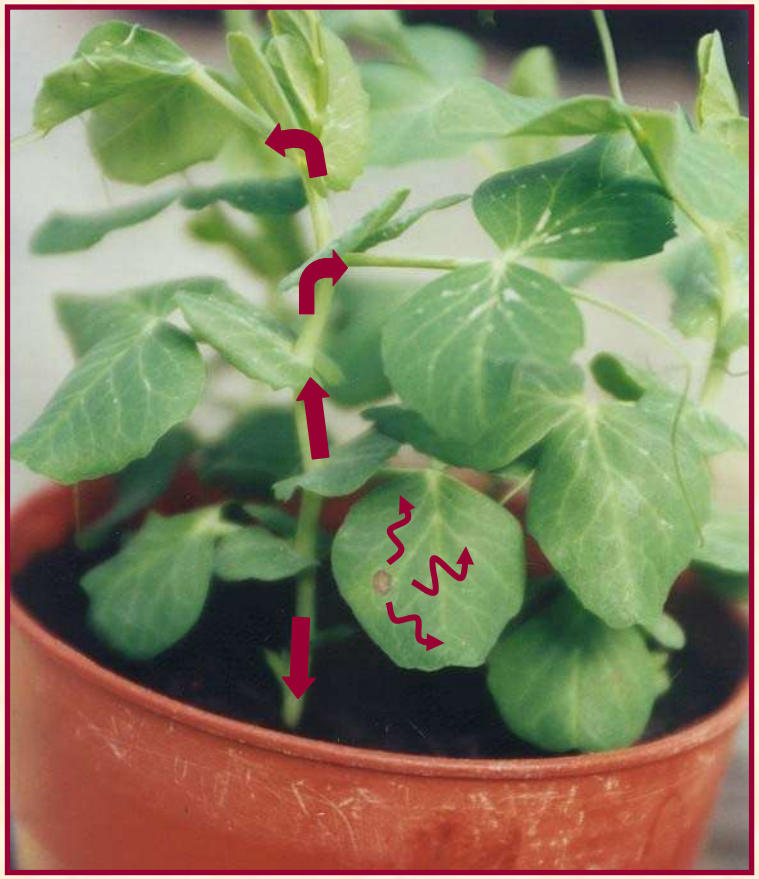
  - A relatively new approach in disease management

  - Not intended to be a stand-alone approach

Induced Resistance

1. Resistance "activator"

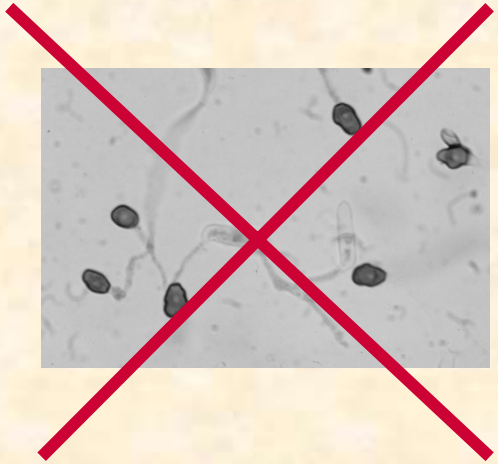
2. Pathogen attack



3. Induction of defences & signalling

4. Systemic protection

Induced resistance targets the plant, not the pathogen



Induced Resistance

- **Brought about by use of ACTIVATORS**

➢ **Activators are NOT Pesticides**

➢ **They need time to start working;**
apply before infection occurs

➢ **Resistance is non-specific; many plants protected against many pathogens**

SILICON Branch Injection use in AVOCADO

Treatment	Shelf life (days)	Anthracnose (%)	
		Severity	Incidence
UNTREATED	13.28	17.7	52.5
SILICON	15.15 ***	3.7 **	24.2 ***

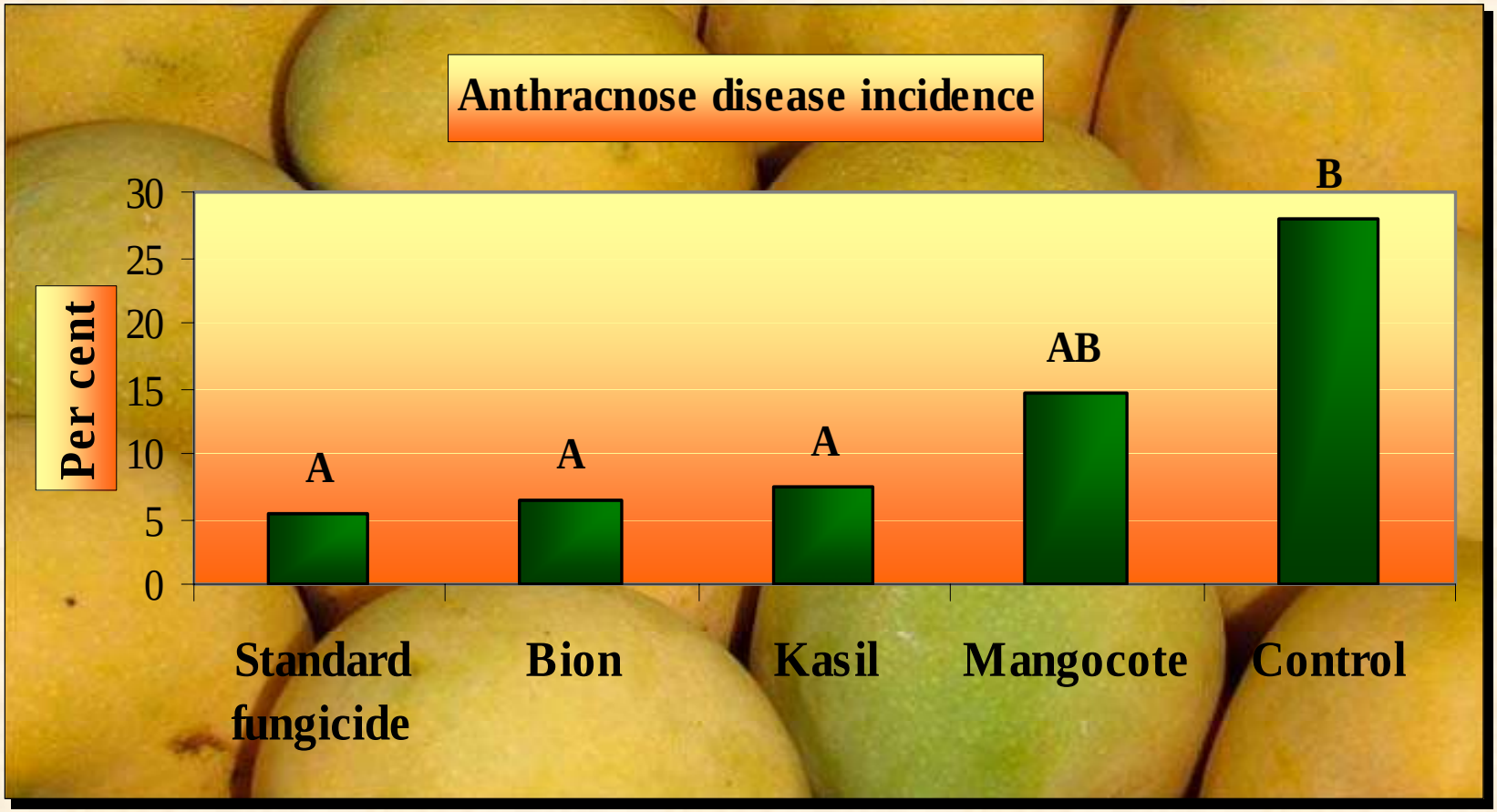
Alternatives to fungicides - Activators

- Silicon (Kasil)
- Kaolin products (Mangocote)
- Bion

Typical Field Treatments

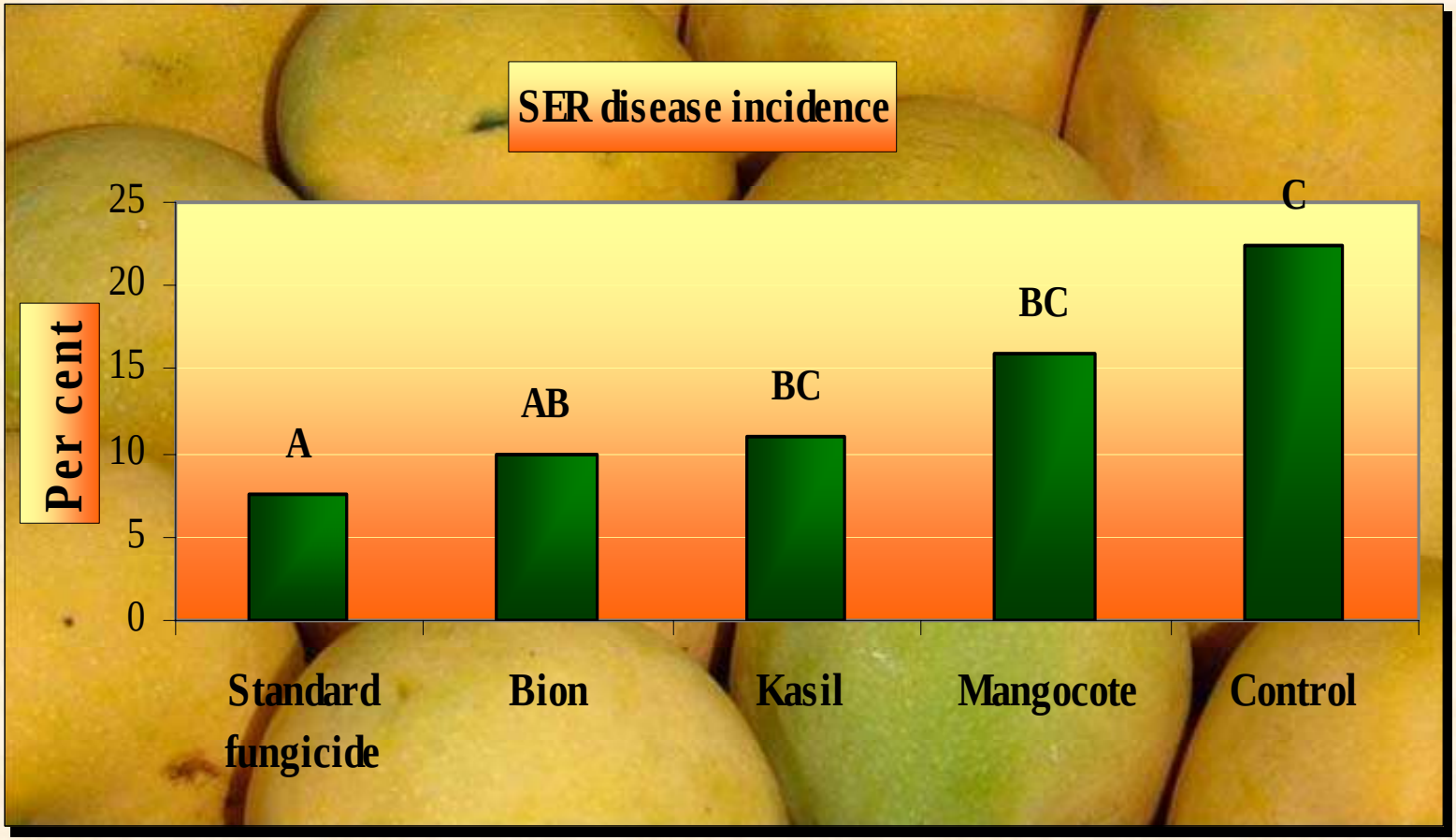
1. Bion – 3 Field sprays
2. Silicon (Kasil) – 3 Field Drenches
3. Mangocote – 3 Field sprays
4. Standard fungicide treatment – 5 total sprays
5. Combination – 5 different treatments
6. Control – Nothing applied

Anthracnose incidence on R2E2



Treatments with the same letter are not significantly different at the p = 0.05 level.

SER incidence on R2E2



Treatments with the same letter are not significantly different at the p = 0.05 level.

Combination effects on all rots incidence on KP

	Percentage Disease incidence				
Treatment	SER	Anthracnose	Dendritic spot	Other	All rots
K-B-K-A	25	3 ab	3	2	31 a
Mz-K-B-A	35	1 a	7	4	42 ab
M-A-Mz-A	34	4 ab	18	4	50 abc
B-K-B-A	46	4 ab	8	4	55 bc
P-B-K-B	44	10 bc	16	3	56 bc
B-K-B-P	47	20 cd	7	3	60 bc
Control	51	25 d	7	9	71 c

Treatments with the same letter are not significantly different at the p = 0.05 level

K = Kasil, B = Bion, A = Amistar, Mz = Mancozeb, M = ManKocide, P = ProAct

In Conclusion

- **Our Ultimate Aim is to Develop a Holistic Systems Approach to Manage Diseases**

➢ Field Activities focusing on

Integrated Crop Management

➢ Post harvest - Shed to Market

Supply Chain Solutions for Longer Shelf life

The Integrated Crop Management Approach

- ***A Holistic Approach that considers:***

  - Crop protection (IPM)
  - Crop nutrition
  - Soil water management
  - Other crop production practices

- ***The ultimate goal is to:***

  - Increase Yields and obtain Long-term Sustainable Production

- **ICM = Sustainable Crop Management**

  Applying as little input as possible, but as much as needed.

Acknowledgement with Thanks

- **Tropical Pathology Team:**
  - Gerry MacManus, Zoe Baron, Paula Boccalatte, Kerry Stockdale, Elio Jovicich, Chrys Akem

- Our Research Focus is on the Management of
  - Mango and Vegetable Diseases

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Thank you

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