Fruit fly management in Pakistan

CABI Bioscience Pakistan

Imperial College, London

Funding from United Kingdom Department for International Development Renewable Natural Resources Knowledge Strategy Crop Protection Programme

Fruit fly management in Pakistan

John Mumford

Fruit fly management project

- **The fruit fly problem**
- **Research programme for management**
- **Options for future management**
- **A fruit fly management plan for Pakistan**

Fruit production in Pakistan

(FAO and Pakistan MFAL Databases)

- **All fruit 6.2 million tonnes 1998**
  - **up from 3.9 million tonnes 1990**
  - **39 kg/person/year**
- **Most fruits susceptible to some fruit flies**
  - **Citrus 2.1 million tonnes 1998**
  - **Mango .92 million tonnes 1998**
  - **Guava .45 million tonnes 1998**

Fruit exports from Pakistan

(Pakistan MFAL Database)

- **All fruit exports $55 million**
  - **fresh fruit is about 40%**
- **202,000 tonnes (3%)**
- **Average value about $272/tonne**
  - **average for all fruit is $148/tonne**
- **Substantial opportunity for additional exports with good quality**

Export and production problems

- **Export**
  - **Quality demands in high value markets in the Gulf and SE Asia**
  - **Pesticide residue rejections in SE Asia**
- **Production**
  - **Small scattered farms**
  - **Poor access to inputs, information, markets**
  - **Post-harvest handling losses up to 40%**

The fruit fly problem

- **Poorly managed fruit fly control**
  - **lack of control on poorer farms**
  - **cover sprays are not ideal**
- **Income reduced**
  - **commercial producers**
  - **farm labour**
- **Health problems**
- **Quarantine risk**

Income affected by fruit flies

- **$150 million/year lost production**
  - **despite control efforts**
- **50-90% of late season fruit affected, depending on variety**
- **Exports lost due to quarantine**
  - **added cost of post harvest treatment for export**

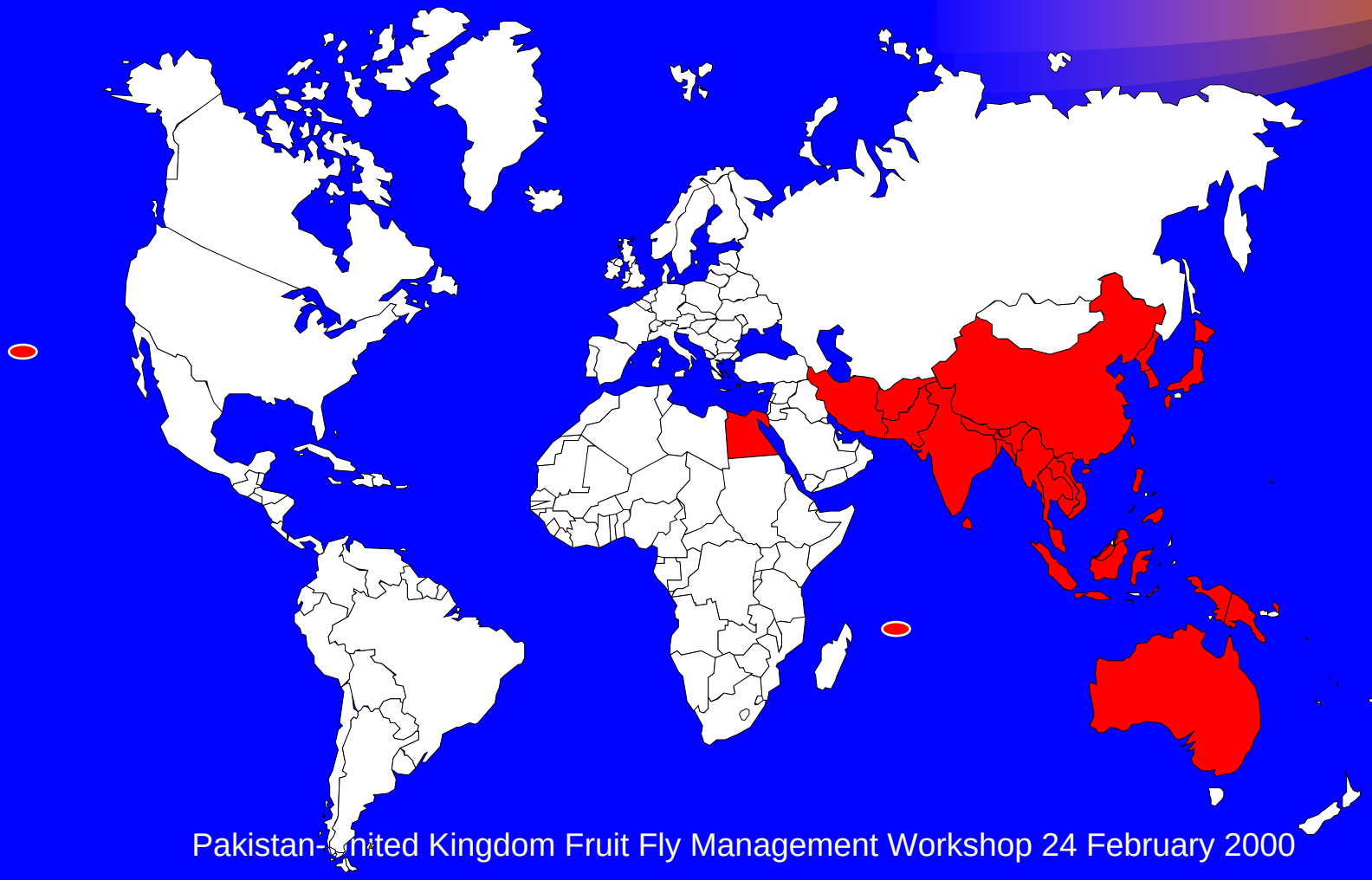
Health is affected by fruit flies

- **Children suffer from diarrhoea from eating infested fruit**
- **Pesticide residues and drift from cover sprays can cause illness**
- **Diet is poor with less fruit**

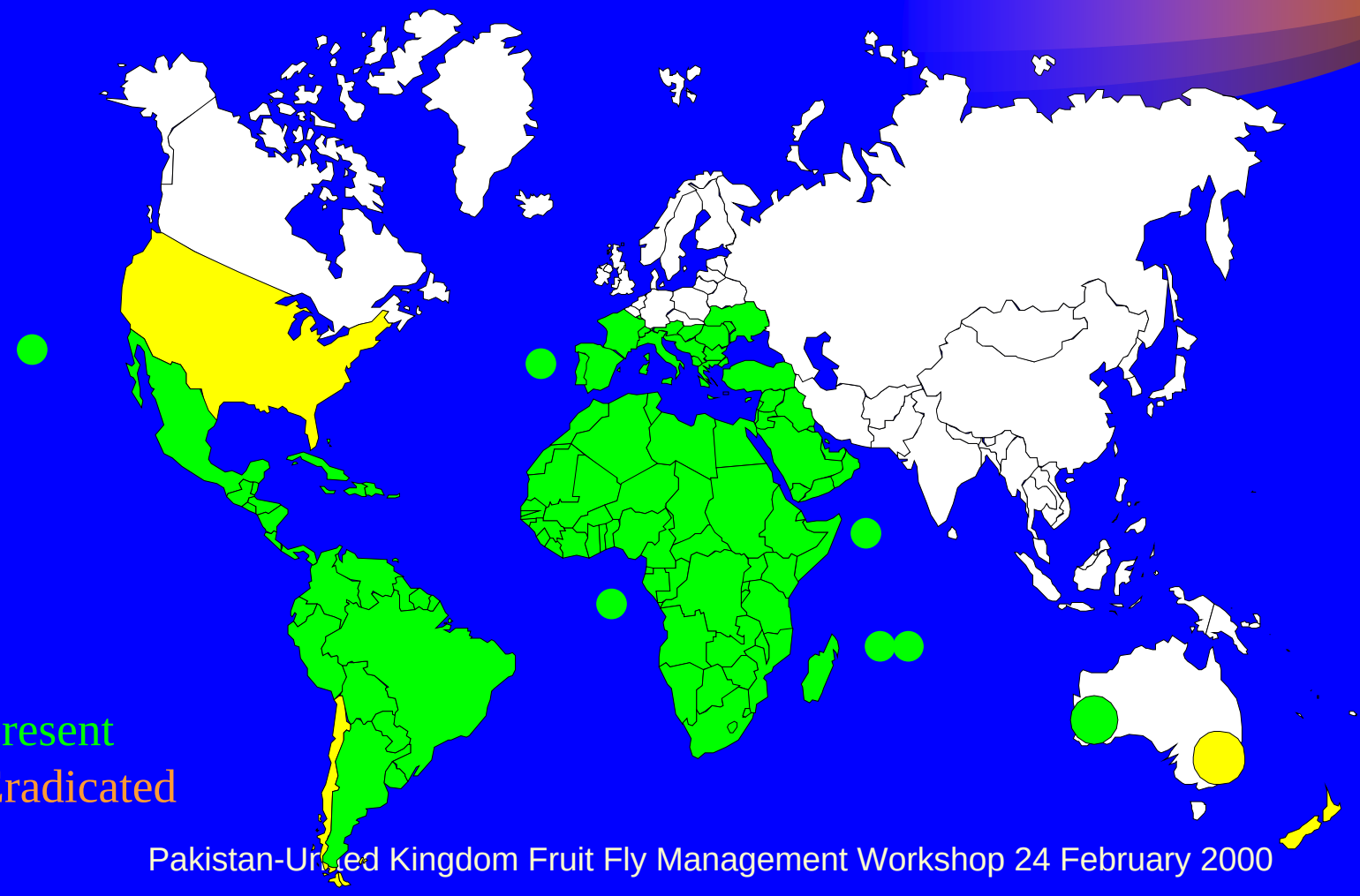
Quarantine risk from fruit flies

- **Fruit flies are the major quarantine pests**
  - **Europe, USA, Japan and Australasia**
- **Pakistan on the Mediterranean/Asian ecological border**
- **Egypt is a recent victim of an Indo-Pak fruit fly invasion ($100 million/year)**
- **Pakistan faces a risk both as an importer and an exporter**

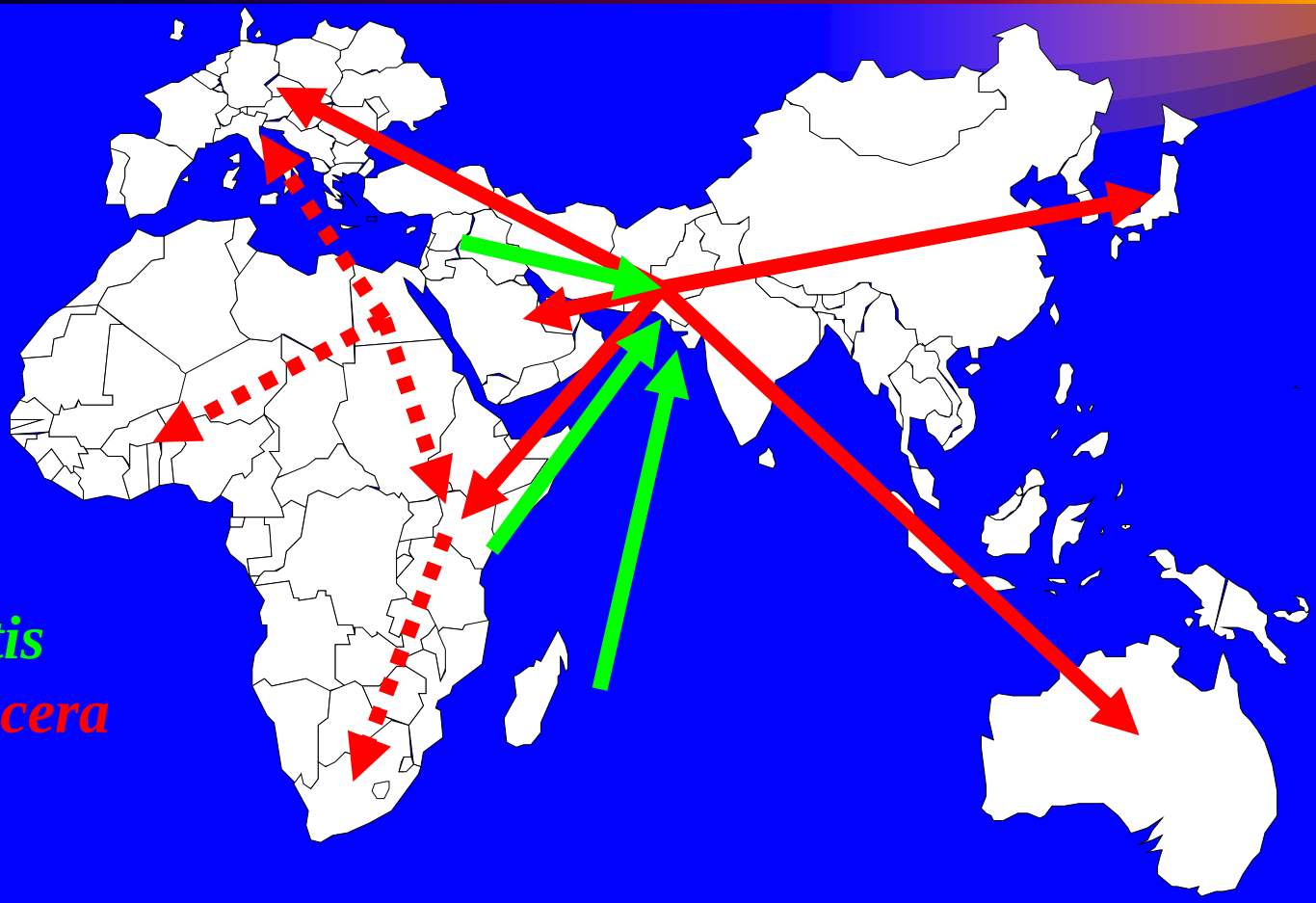
Bactrocera *fruit fly species*



Ceratitis *fruit fly species*



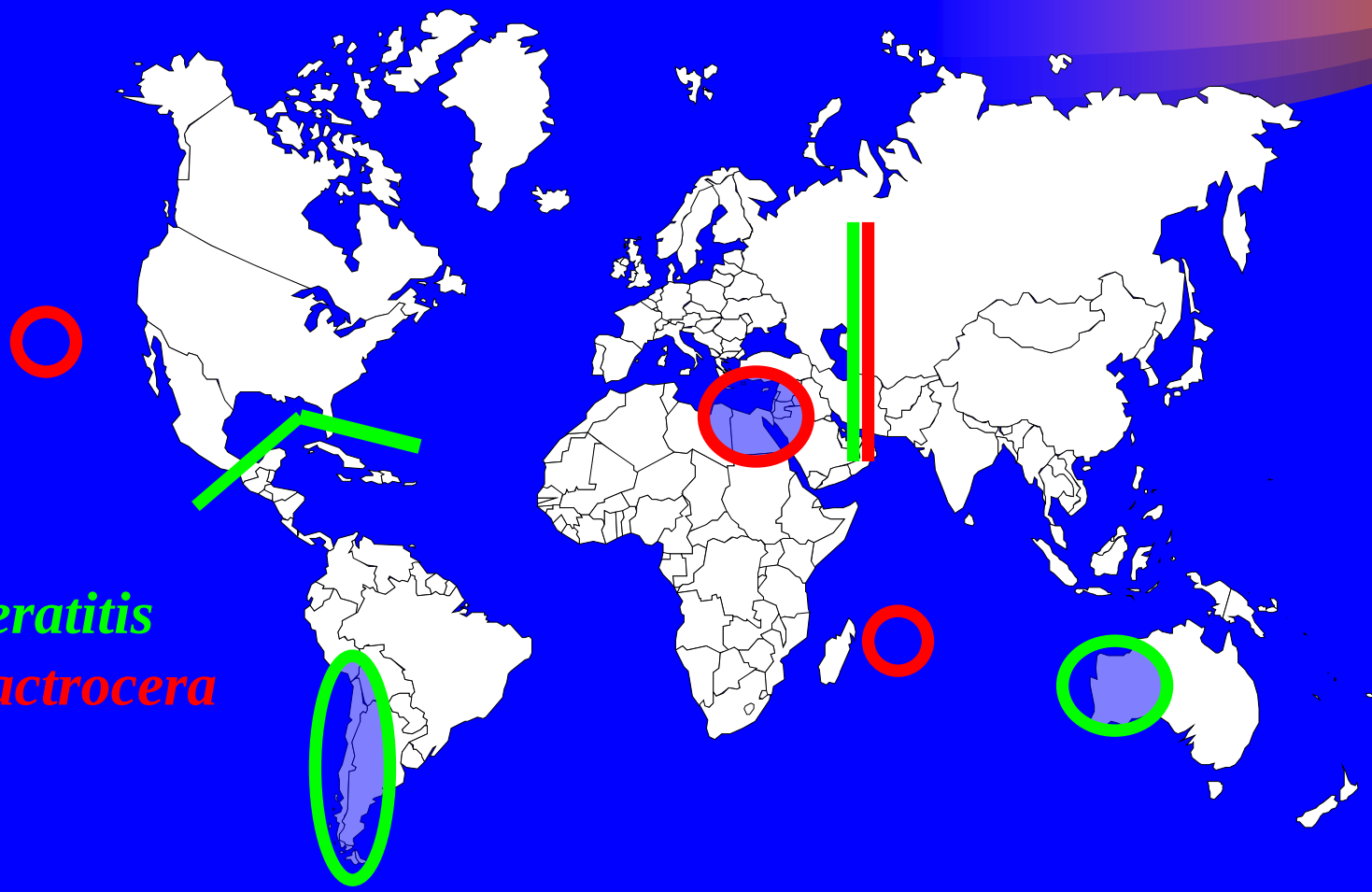
Fruit fly risk to/from Pakistan



Ceratitis

Bactrocera

The quarantine "front lines"



Research project and results

- **John Stonehouse**
- **Riaz Mahmood**
- **Qamar Zia**
- **Abdul Hai**
- **Muhammad Afzal**

Plan for fruit fly management

- **Objectives**
  - **commercial sector sales**
  - **village consumption**
- **Outputs**
  - **Bait and Male annihilation capacity**
    - **materials in the markets, use organised**
- **Activities**
  - **commercialisation, extension, NGO mobilisation, research, quarantine**

Pakistan-United Kingdom Fruit Fly Project 1998-2000: Introduction

John Stonehouse

A research project comprising two major components

- Programme of on-farm trials of innovative technologies in four locations
- Three focussed studies on the damage and control of fruit flies
  - Relationship between fly infestation and damage
  - Development of low cost protein baits
  - Optimisation of wood blocks for male annihilation

Farm-Level Assessment of Innovative Options for Fruit Fly Control in Pakistan

Riaz Mahmood

Opportunities for Fruit Fly Control

- Cover sprays
- Bait Application Technique (BAT)
- Male Annihilation Technique (MAT)
- Sterile Insect Technique (SIT)
- Biological Control

Fruit Flies of Major Economic Importance in Pakistan

- *Bactrocera zonata* (Saunders) - Peach Fruit Fly
- *Bactrocera dorsalis* (Hendel) - Oriental Fruit Fly
- *Bactrocera cucurbitae* (Coquillet) - Melon Fly
- *Dacus ciliatus* (Loew) - Cucurbit Fly, Lesser Pumpkin Fly
- *Carpomya vesuviana* (Costa) - Ber Fruit Fly

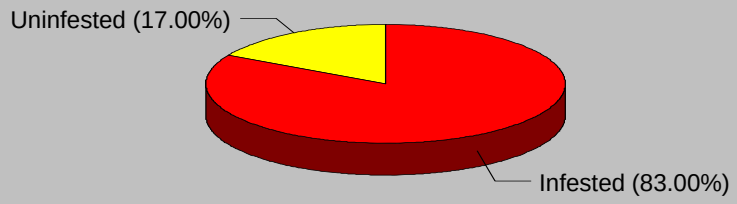
Programme of Field Research, 1998-1999

- **BAT**
  - Guava — DI Khan, Mardan
  - Jujube — DI Khan, Faisalabad
  - Melon — RY Khan, DI Khan, Faisalabad
- **MAT**
  - Mango — RY Khan

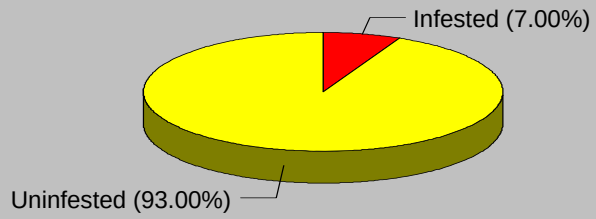
Guava infestation in BAT & check plots

Ripe fruit sampled before harvest

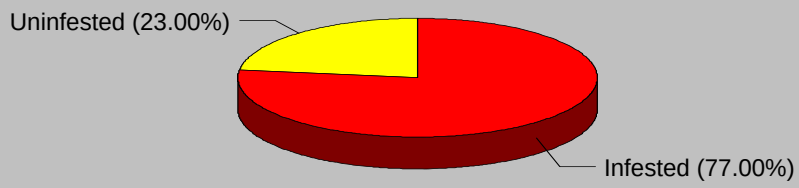
DIK A - Check



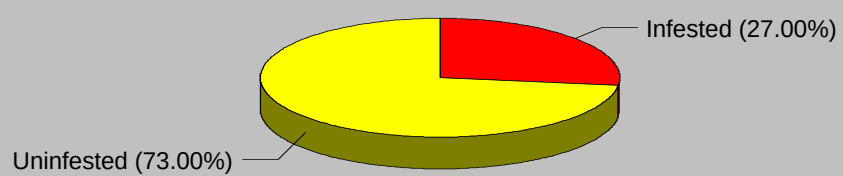
DIK A - BAT



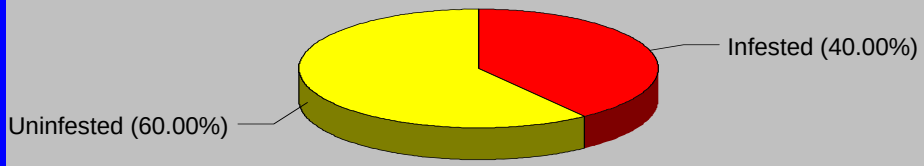
DIK B - Check



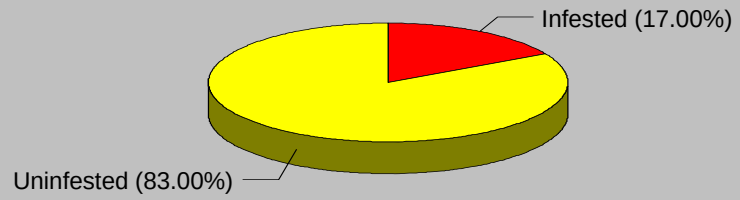
DIK B - BAT



Mardan - Spray



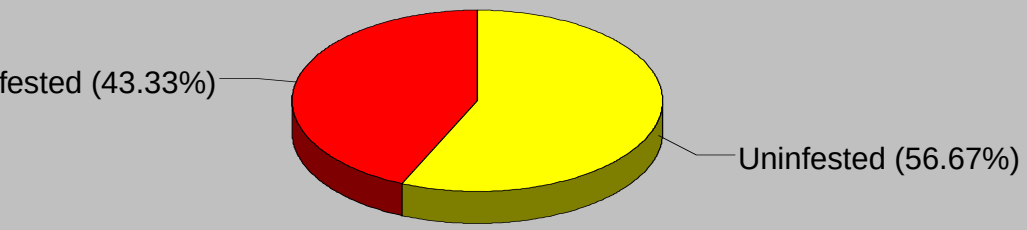
Mardan - BAT



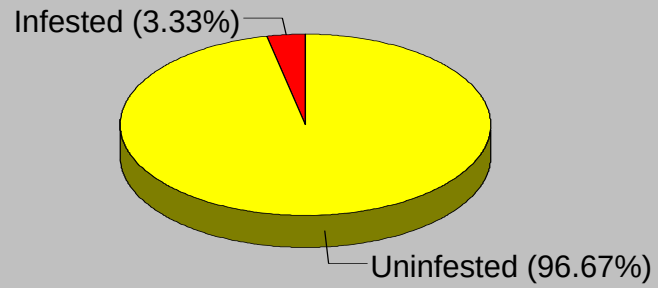
Jujube infestation in BAT/check plots

D.I. Khan - before and at harvest

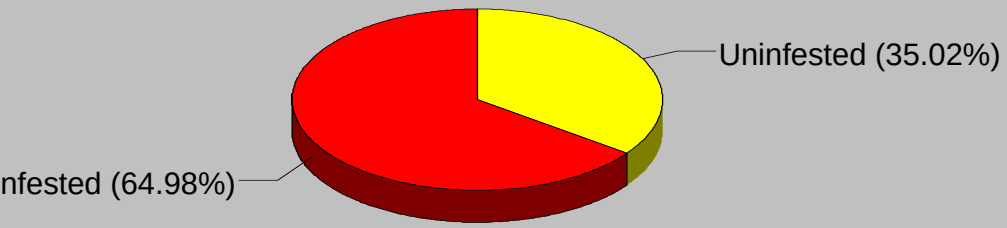
Ripe fruit - Check



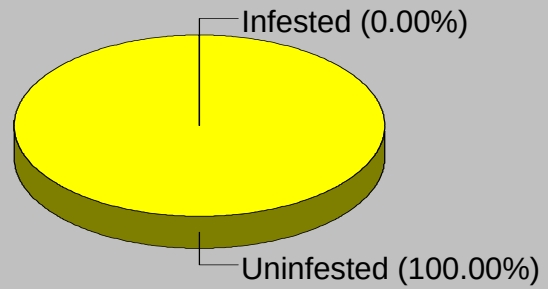
Ripe fruit - BAT



Harvest - Check



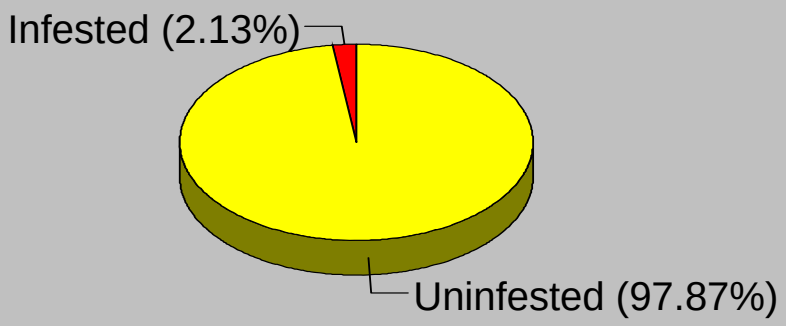
Harvest - BAT



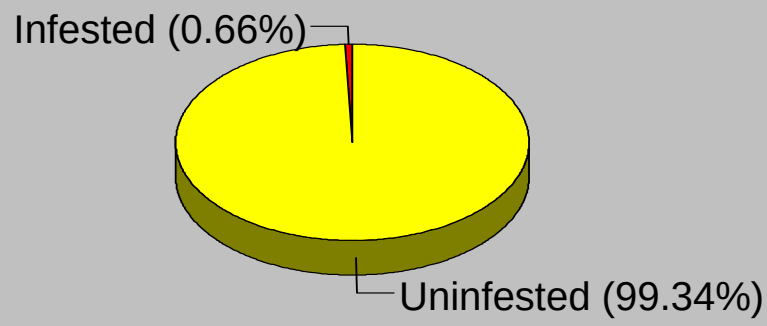
Jujube infestation at harvest

Check, BAT & Cover sprays, Faisalabad

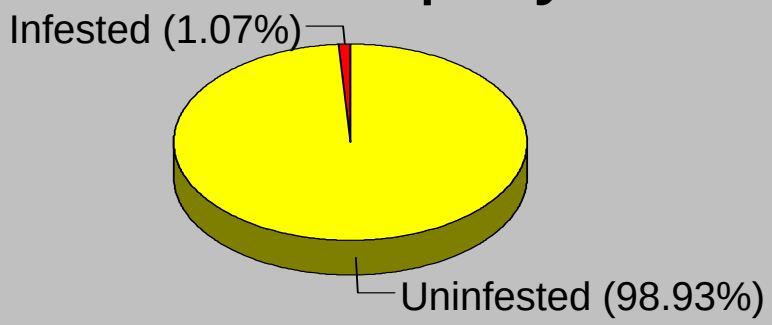
Check



BAT



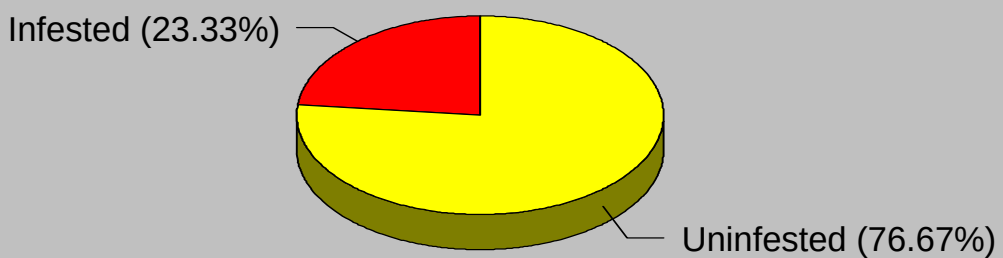
Cover spray



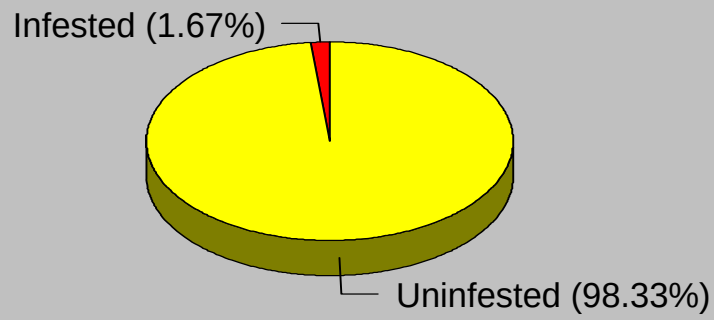
Melon infestation in BAT & check plots

RY Khan - before and at harvest

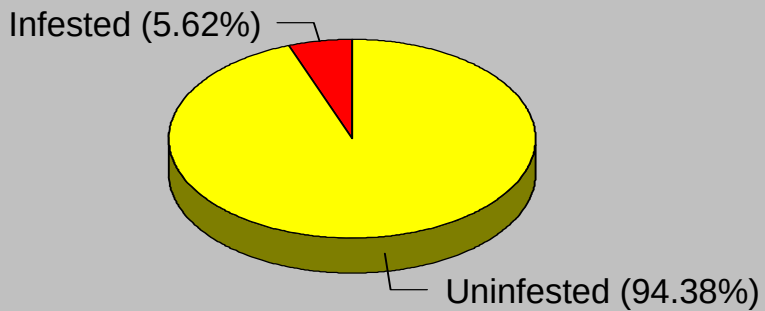
Before harvest - Check



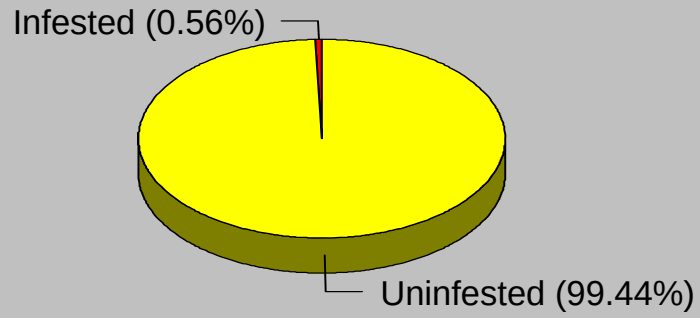
Before harvest - BAT



Harvest - Check



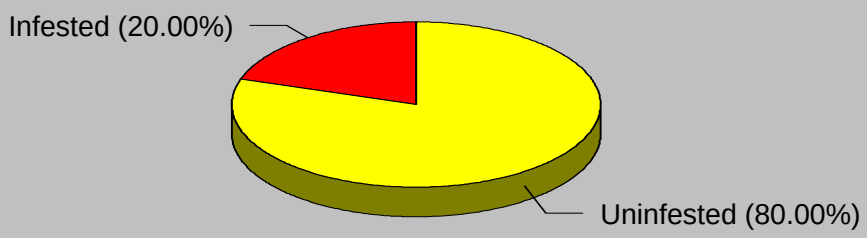
Harvest - BAT



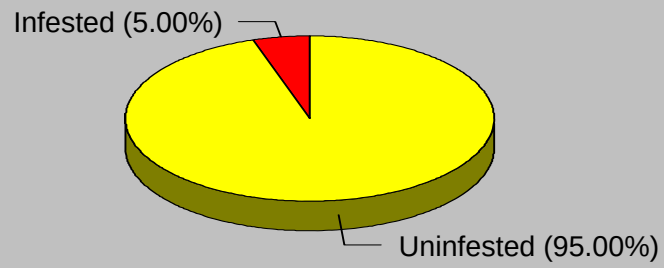
Melon infestation in BAT & check plots

DI Khan - before and at harvest

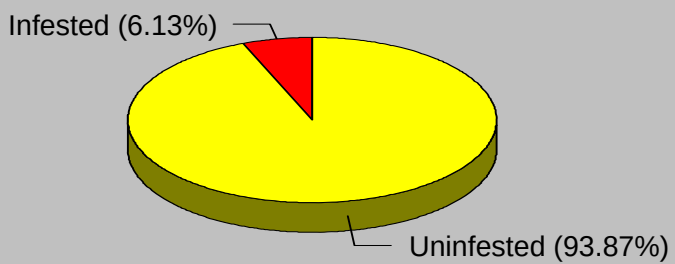
Before harvest - Check



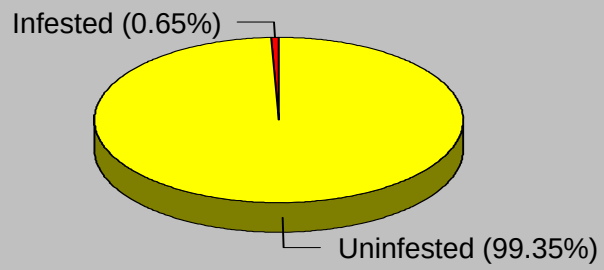
Before harvest - BAT



Harvest - Check



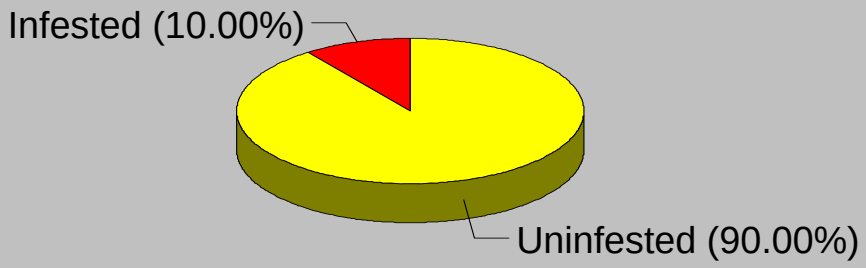
Harvest - BAT



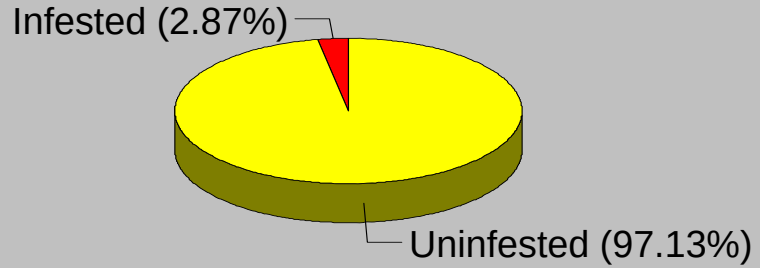
Infestation in check/BAT/sprayed melon

Faisalabad - before and at harvest

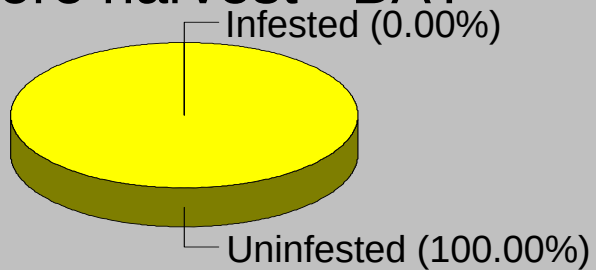
Before harvest - Check



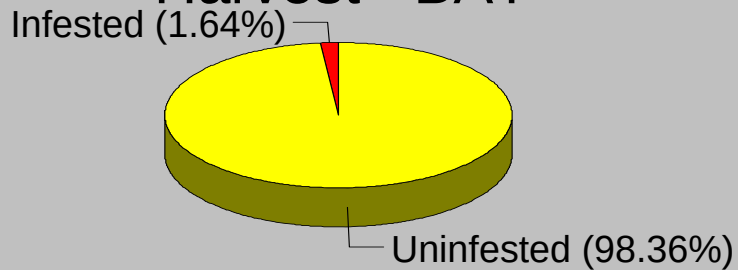
Harvest - Check



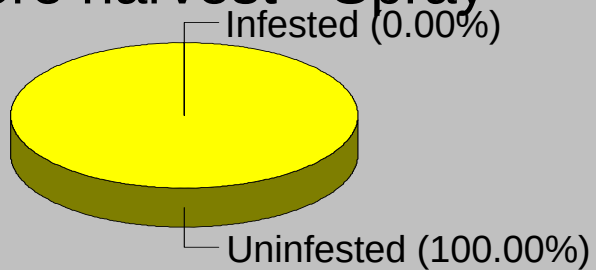
Before harvest - BAT



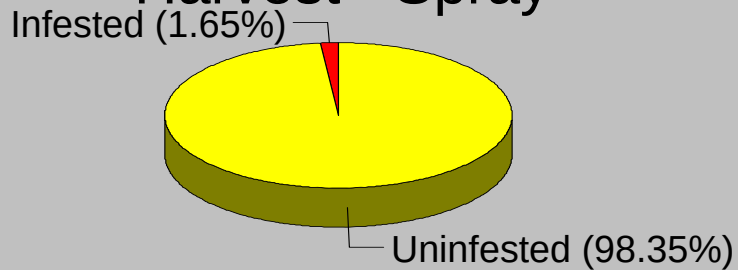
Harvest - BAT



Before harvest - Spray

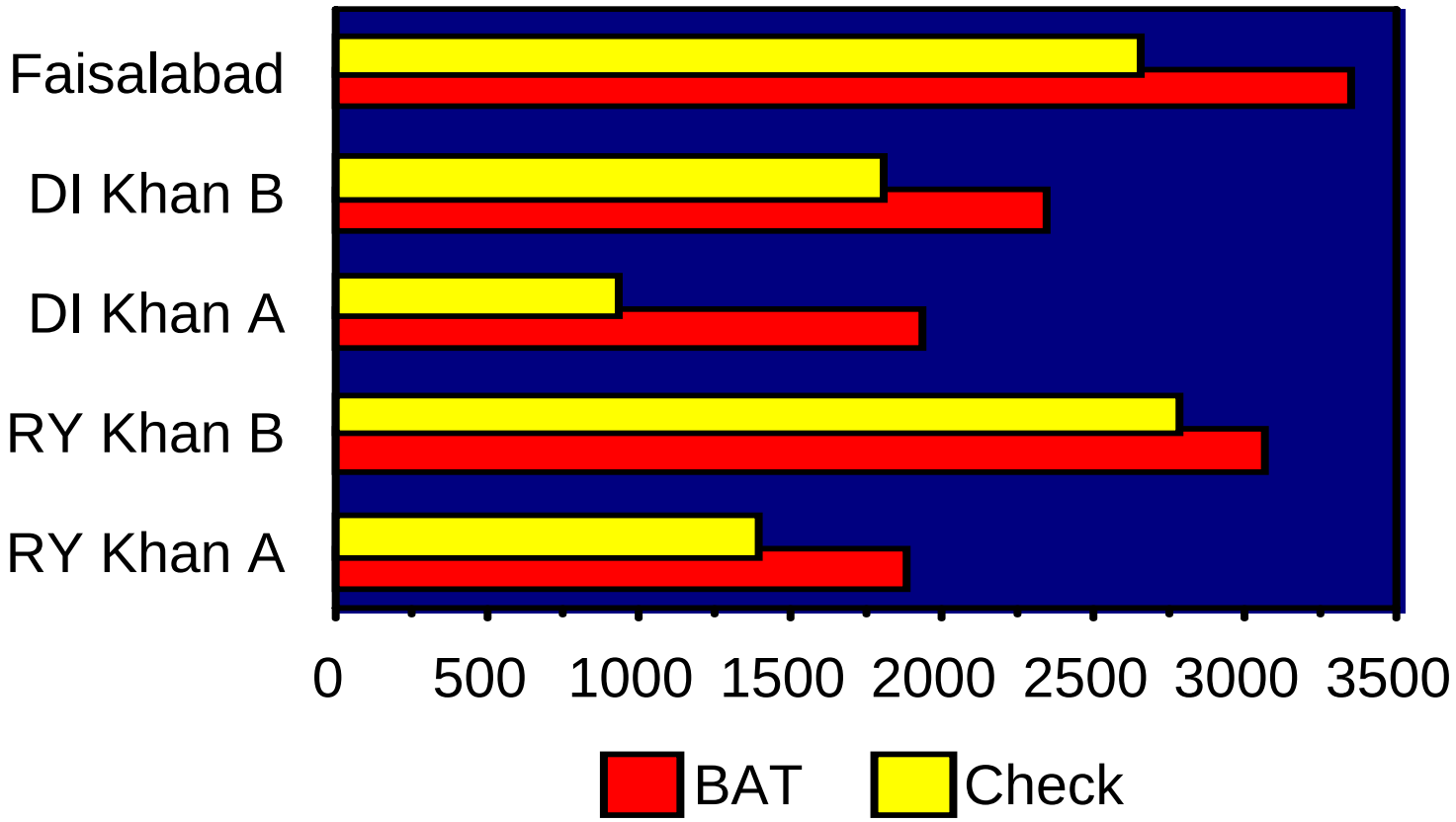


Harvest - Spray



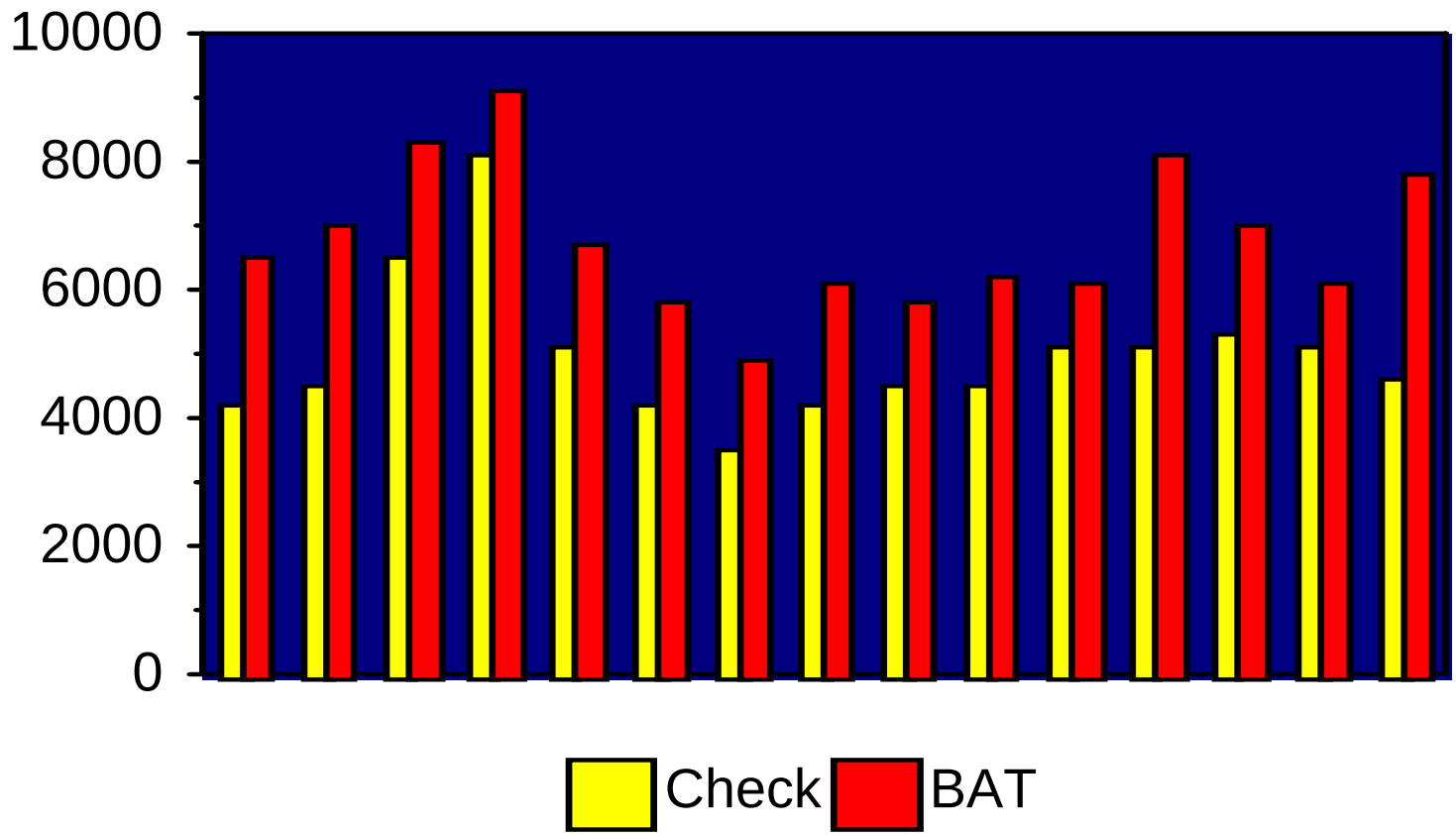
Pristine melon yield with/without BAT

Kg/hectare - five farms



Melon yields with and without BAT

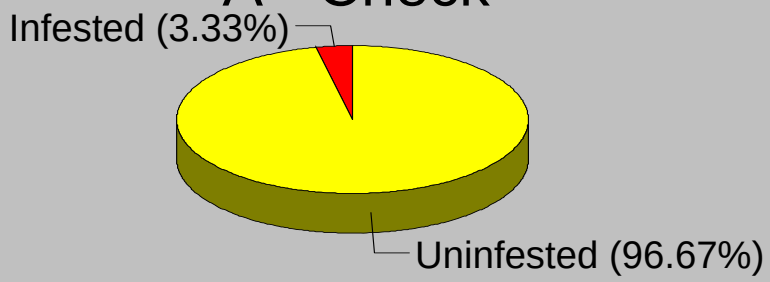
Kg/ha - 15 Kulachi melon farms



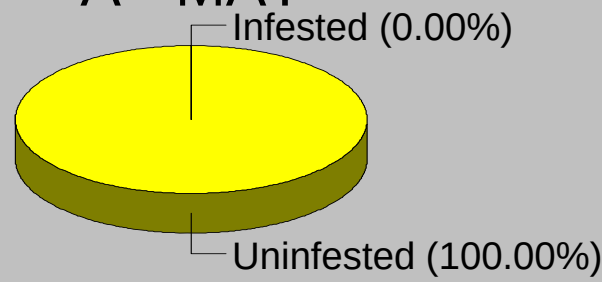
Mango infestation in check & MAT plots

Early-season varieties, before harvest

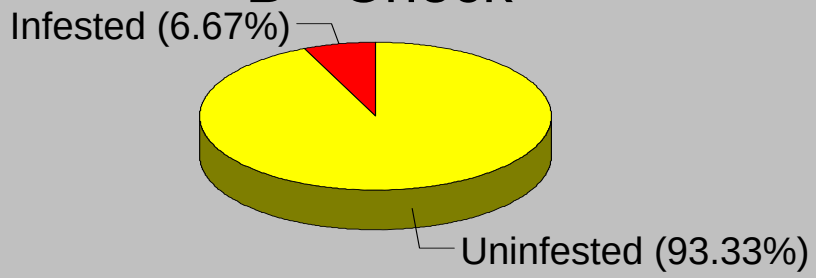
A - Check



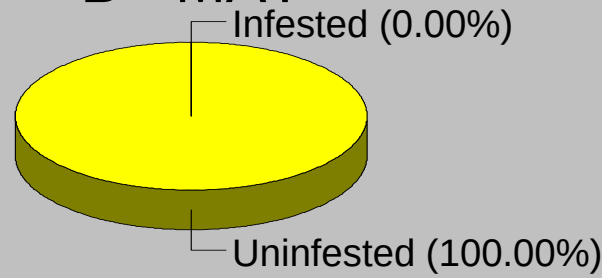
A - MAT



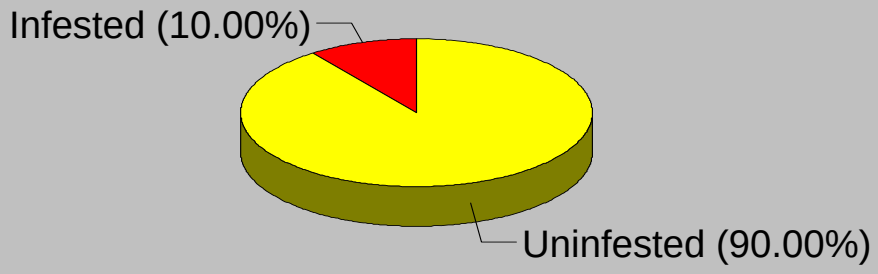
B - Check



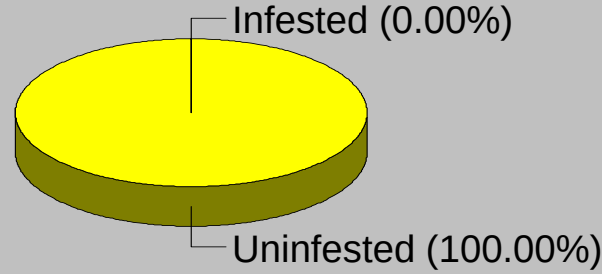
B - MAT



C - Check



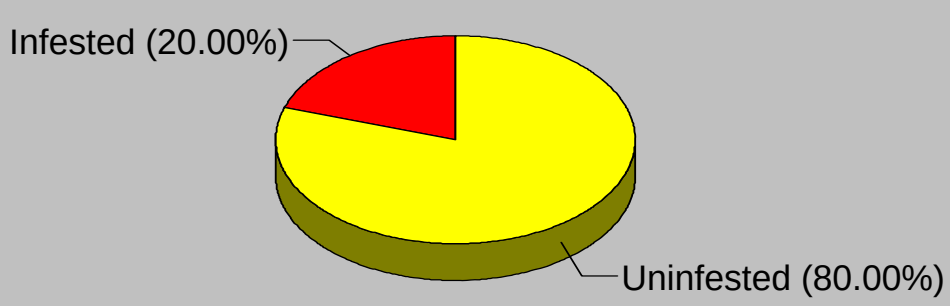
C - MAT



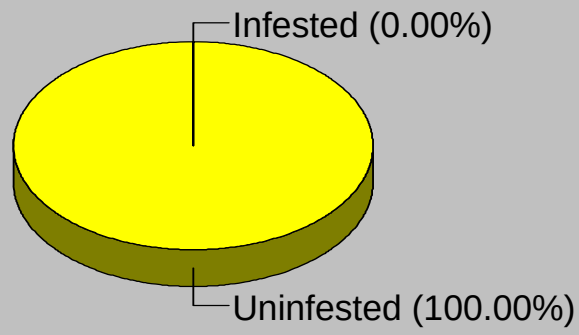
Mango infestation in check & MAT plots

Late season varieties, ripe & harvest

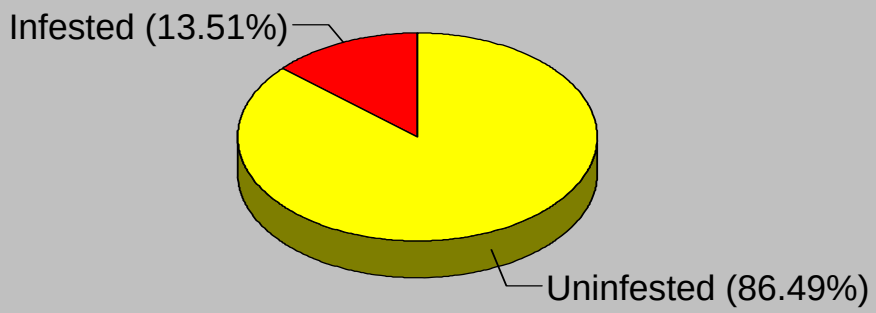
Ripe fruit - Check



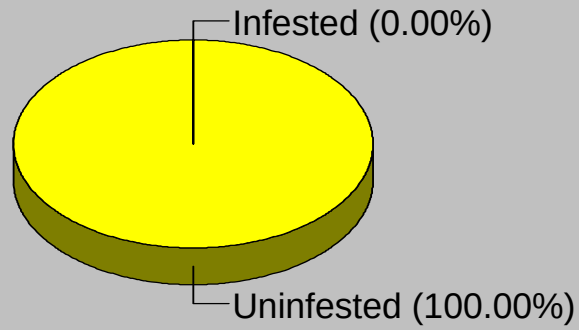
Ripe fruit - MAT



Harvest - Check

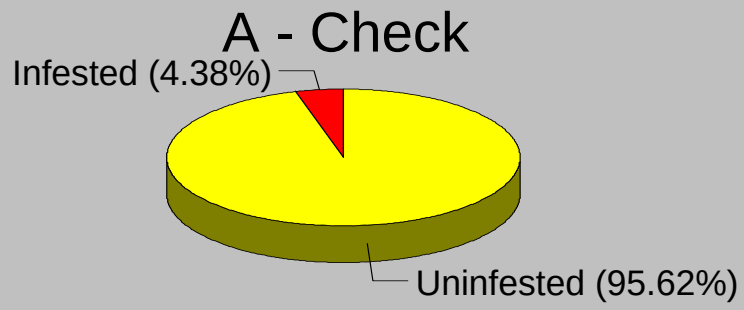


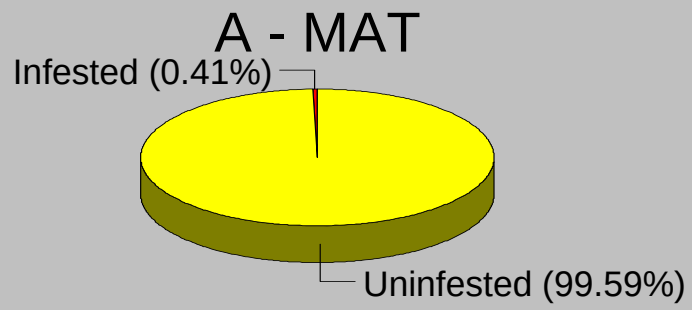
Harvest - MAT

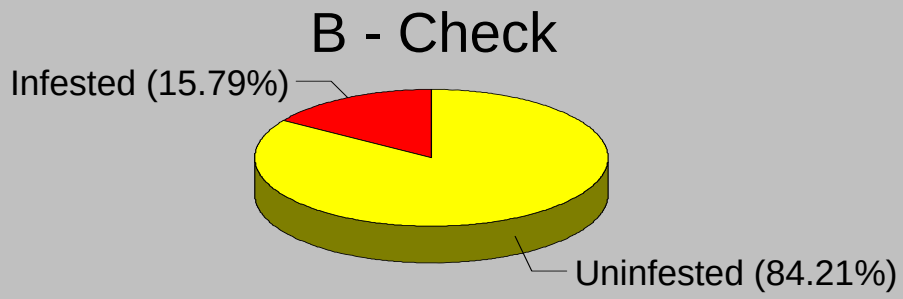


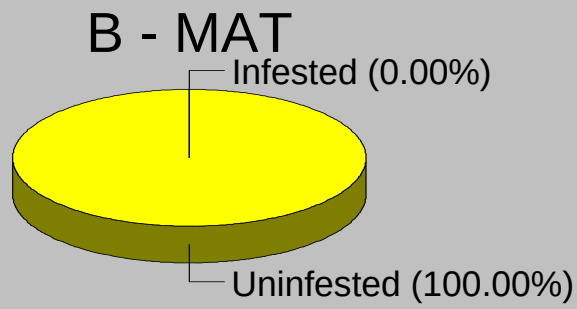
Mango infestation in check & MAT plots

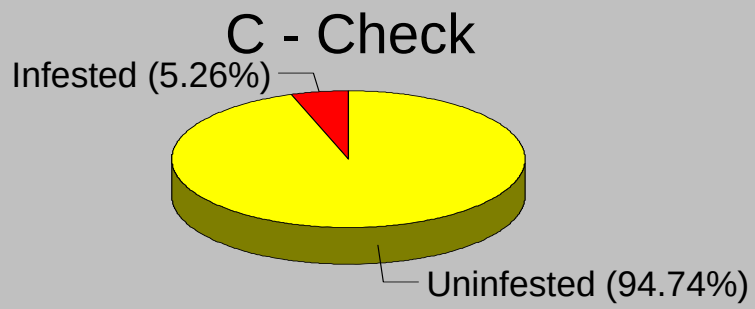
Early-season varieties, at harvest

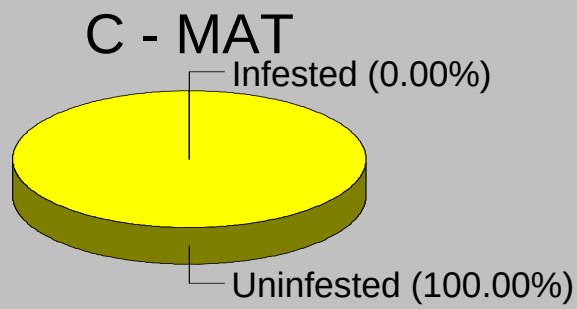












Summary

- **Guava, season end infestations**
  - BAT 17% Untreated 80%
  - Cover spray 40%
- **Jujube**
  - BAT 3% Untreated 43%
- **Melon**
  - BAT 3% Untreated 26%
- **Mango, late season**
  - MAT 0% Untreated 20%

The role of fruit flies in damage and loss of plums

Abdul Hai

Fruit fly losses may be from

- 1- infested fruit harvested but of no value
- 2- infested fruit which fall from the tree
- 1 is shown by data on percentage infestation of fruit on the tree and at harvest; but if 2 is prevalent then these data will underestimate true losses

Fruit fly losses

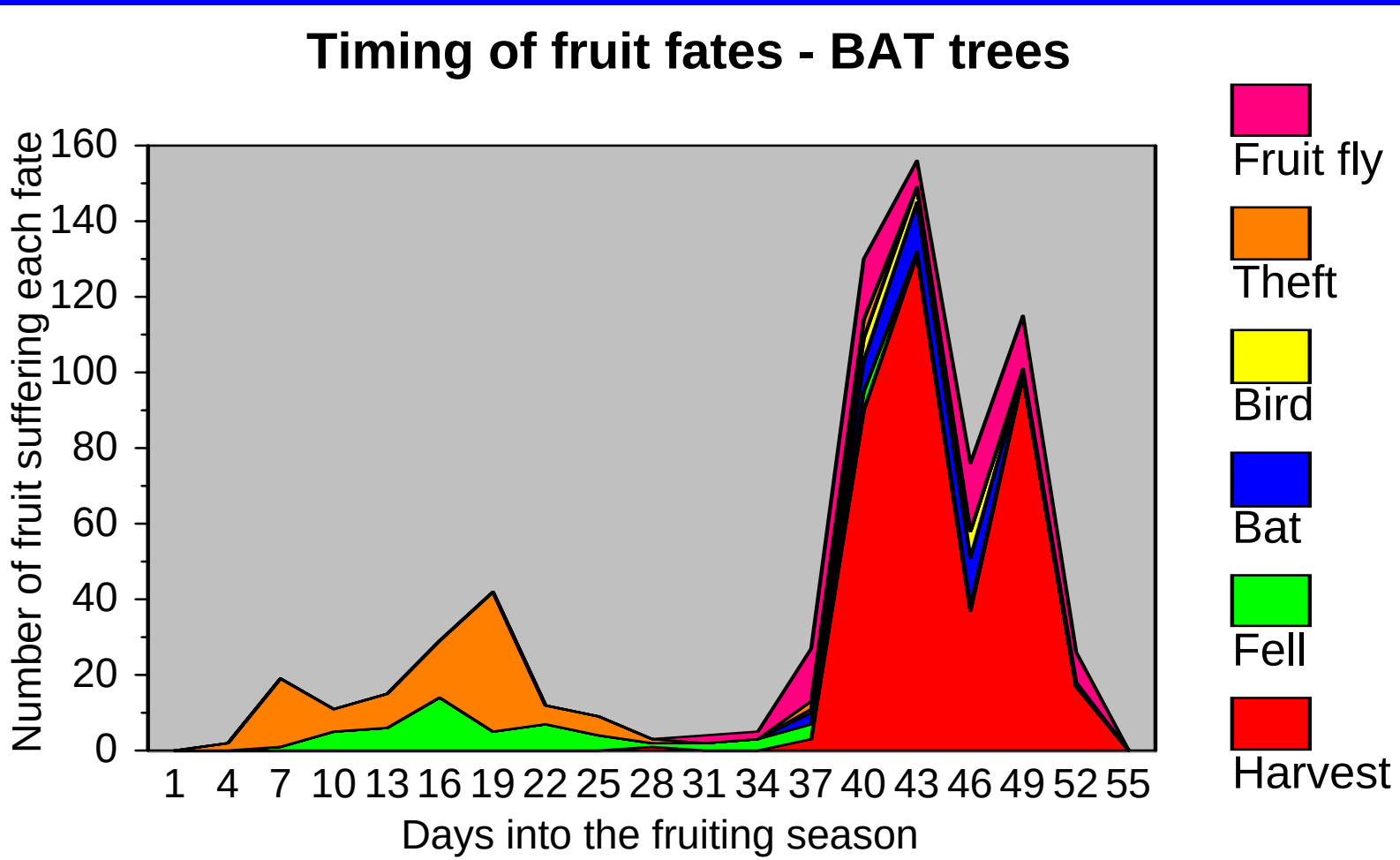
- Infestation is often higher in fruit on the ground than in fruit on the tree, because:
- infested fruit are more likely to fall ?
- fallen fruit are attacked on the ground ?
- more developed, riper fruit are more likely to be infested and to fall ?

Observations from quantification of fruit progress

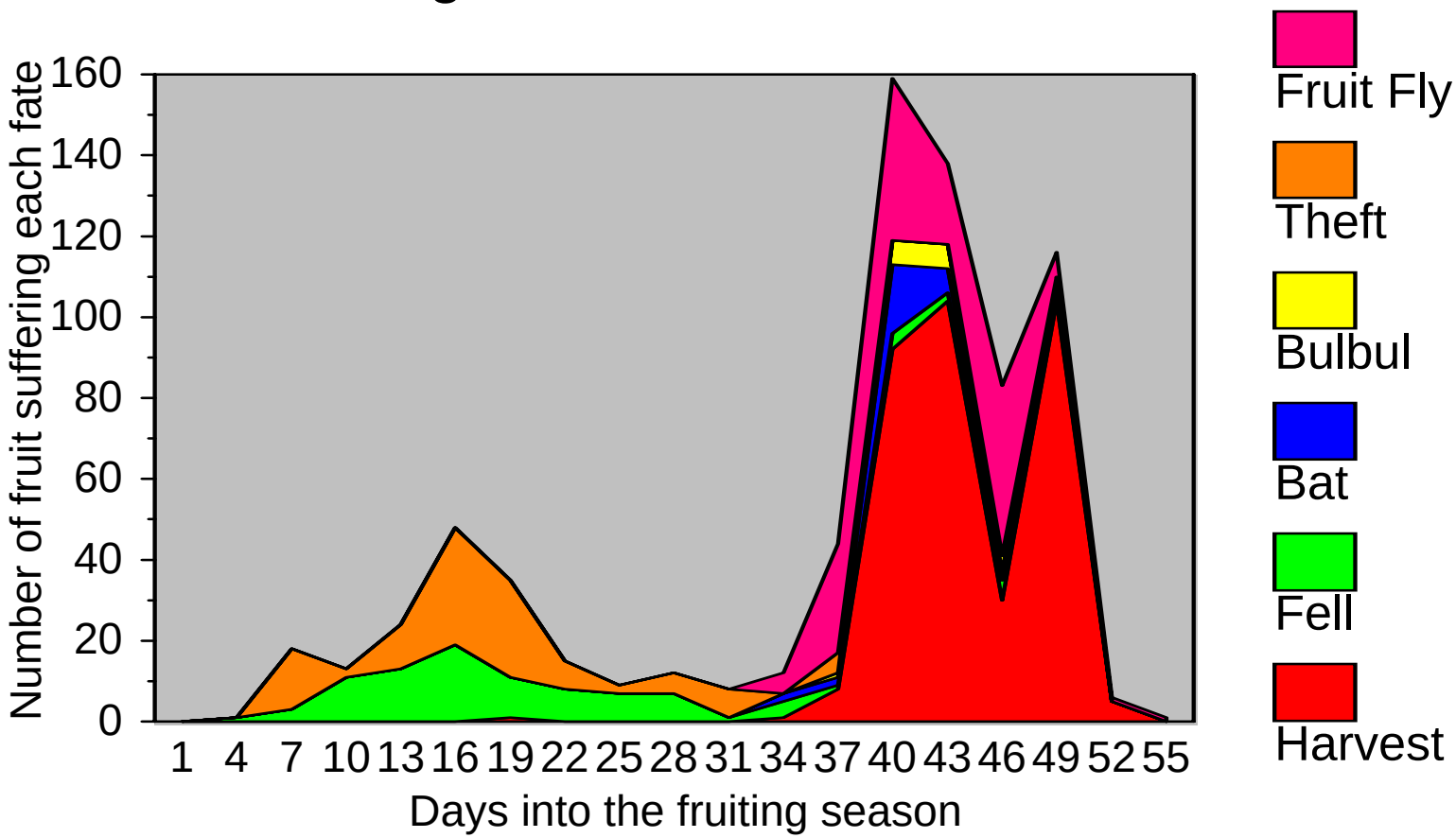
- Fruit fly larval survival was low, at 36%
- Fruit fly attacked 23% of fruit in unprotected orchards; 13% in protected orchards, larvae emerge in 6% of fruit in both

Observations from quantification of fruit progress

- Losses of fruit were 6% to fruit bats, 3% to birds, 17% to human theft
  - thefts were largely of green fruit early in the season, 14% of fruit fell from the tree and 60% survived until harvest
- Bat losses were greatest on the west side of trees
  - there were no significant differences in the compass orientations of losses to flies, birds or humans


Timing of fruit fates - BAT trees
Number of fruit suffering each fate
0
20
40
60
80
100
120
140
160
1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55
Days into the fruiting season
Fruit fly
Theft
Bird
Bat
Fell
Harvest

Timing of fruit fates - Check trees



The relationship between attack, ripening and drop

- Fruit are rarely attacked after they fall to the ground (1 fruit in 1200)
- Attacked fruits do not fall before unattacked fruits
- Attacked fruits ripen at the same rate as unattacked fruits

The relationship between attack, ripening and drop

- Faster-ripening, more developed fruits were no more likely to be attacked or to fall prematurely
- Most loss comes from unsaleable but harvested fruit, not from fruit flies causing fruit fall before harvest

Assessment of low-cost bait control of fruit flies in Pakistan

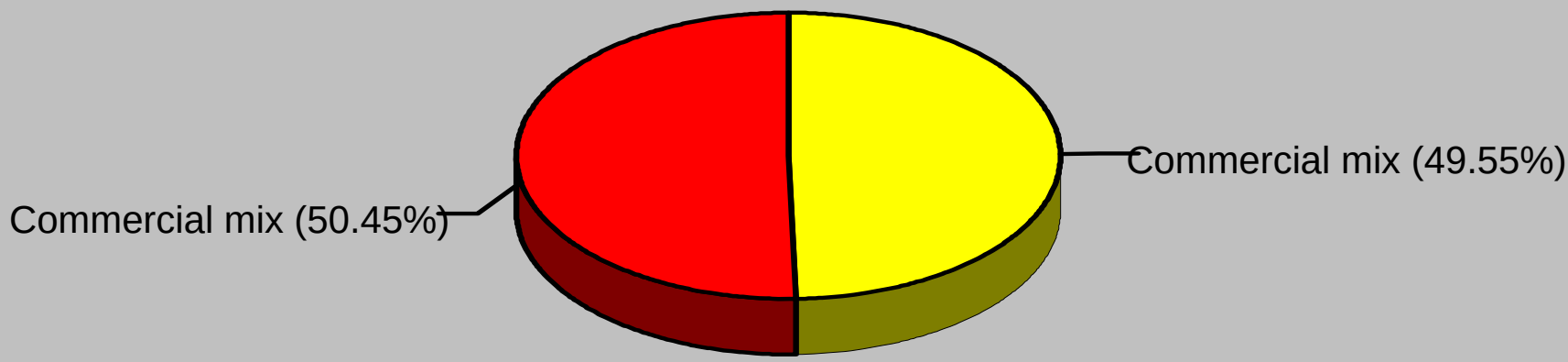
Qamar Zia

Fly mortality comparison

Commercial mix:Water only

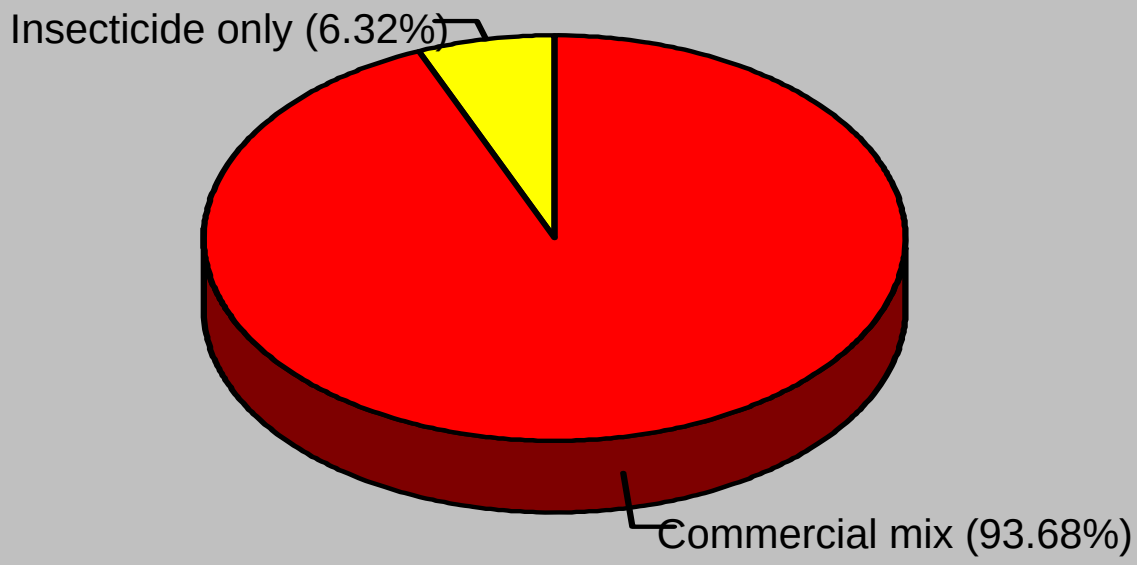
Fly mortality comparison

Commercial mix:Commercial mix



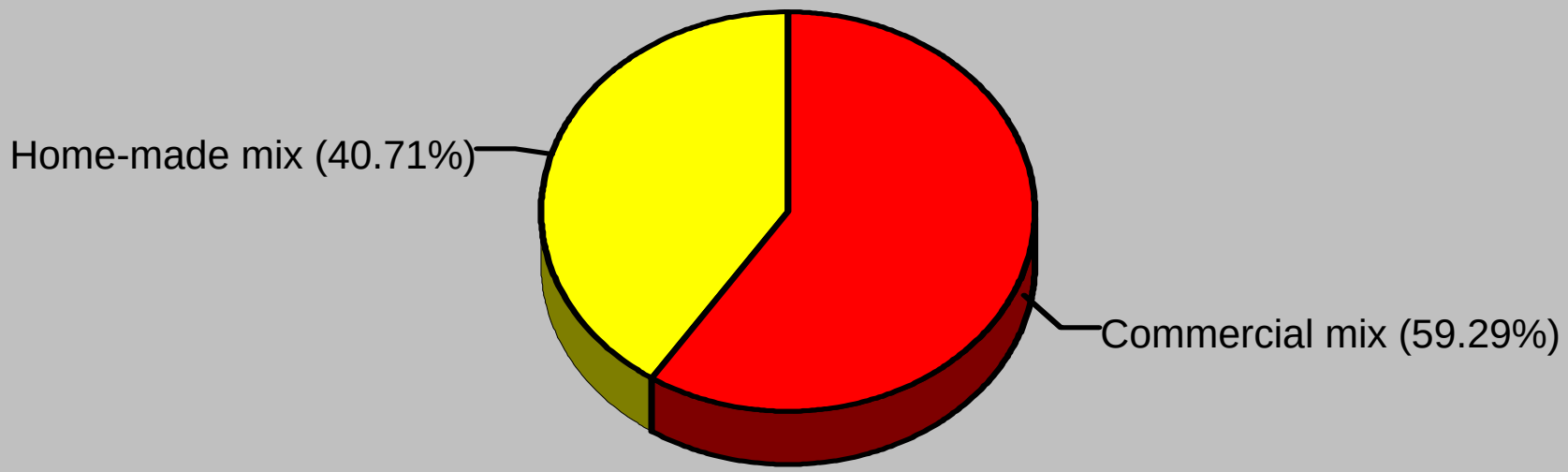
Fly mortality comparison

Commercial mix:Insecticide only



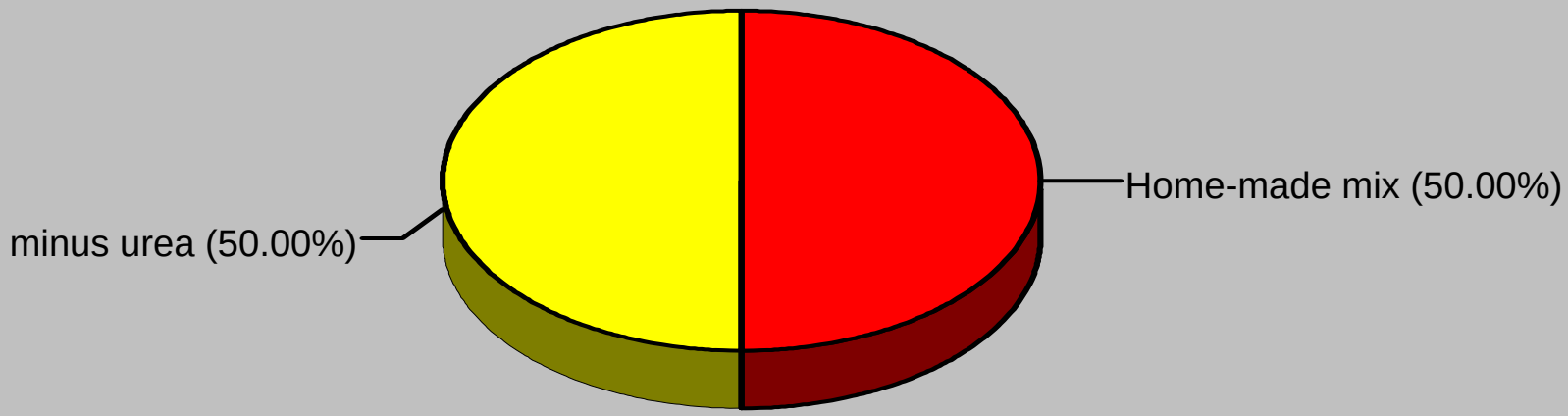
Fly mortality comparison

Commercial mix:Home-made mix



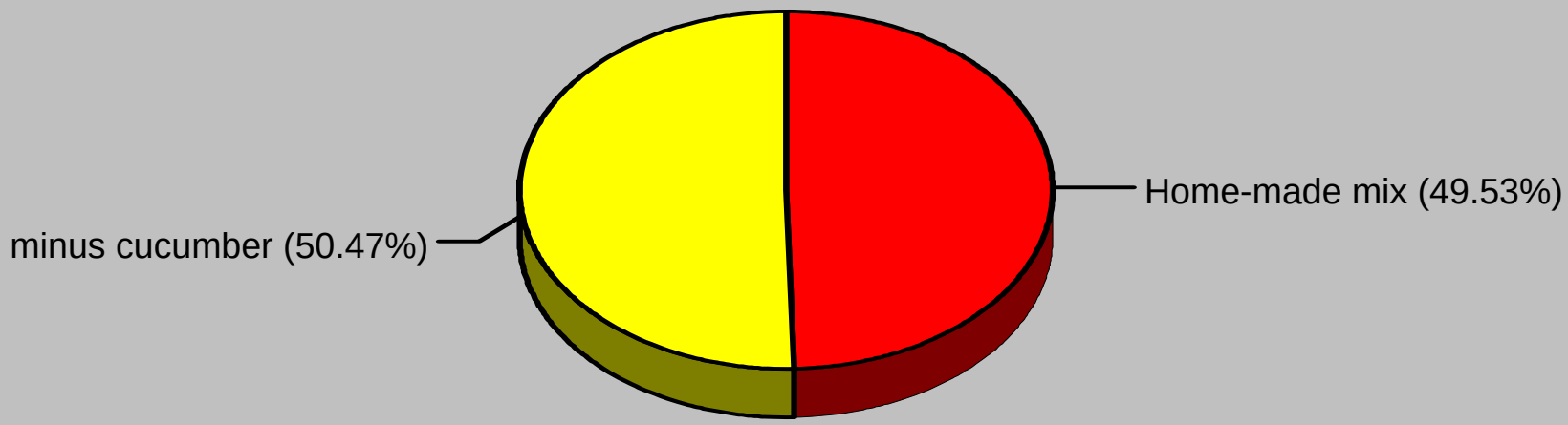
Fly mortality comparison

Home-made mix with/without urea



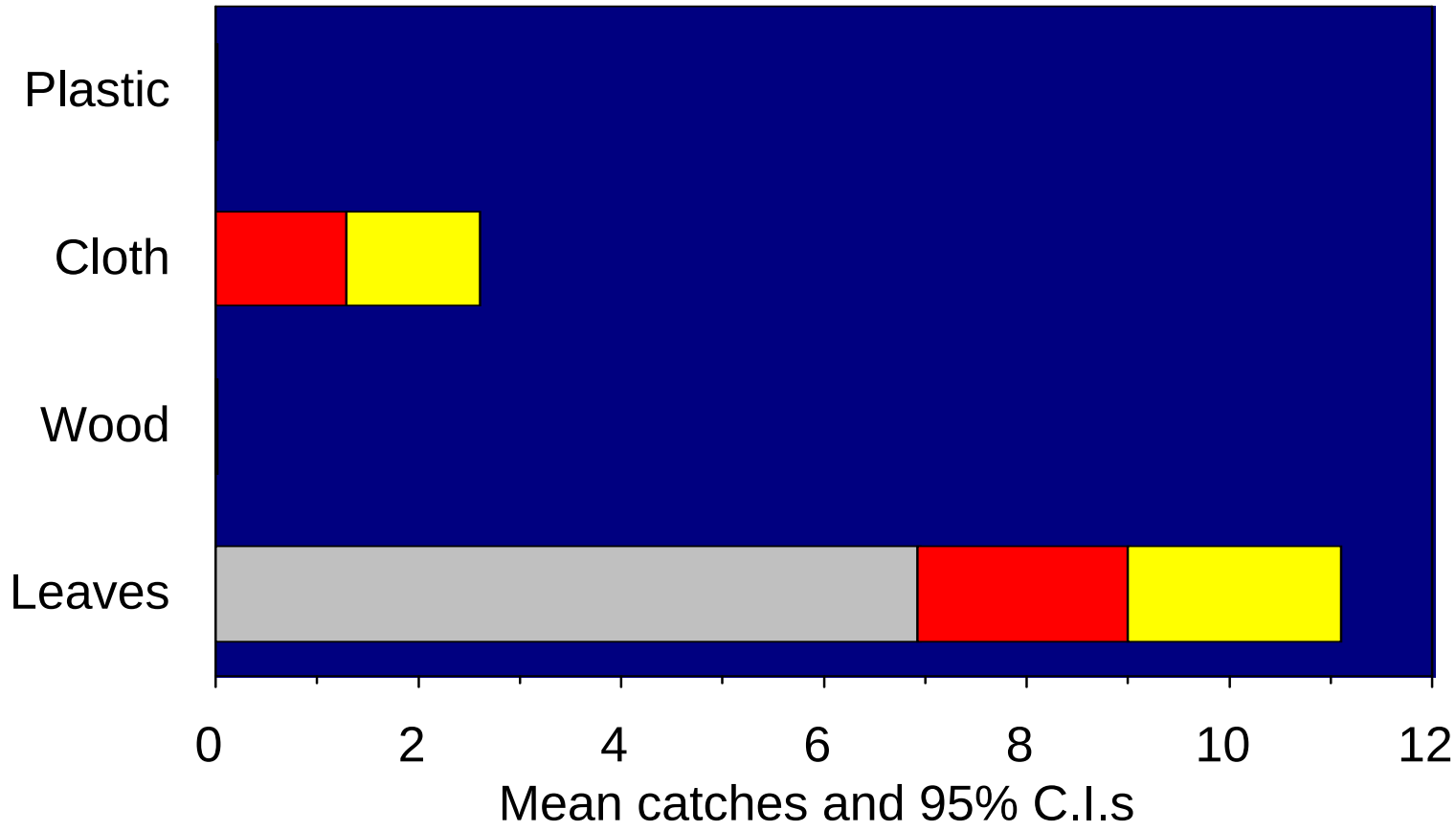
Fly mortality comparison

Home-made mix with/without cucumber



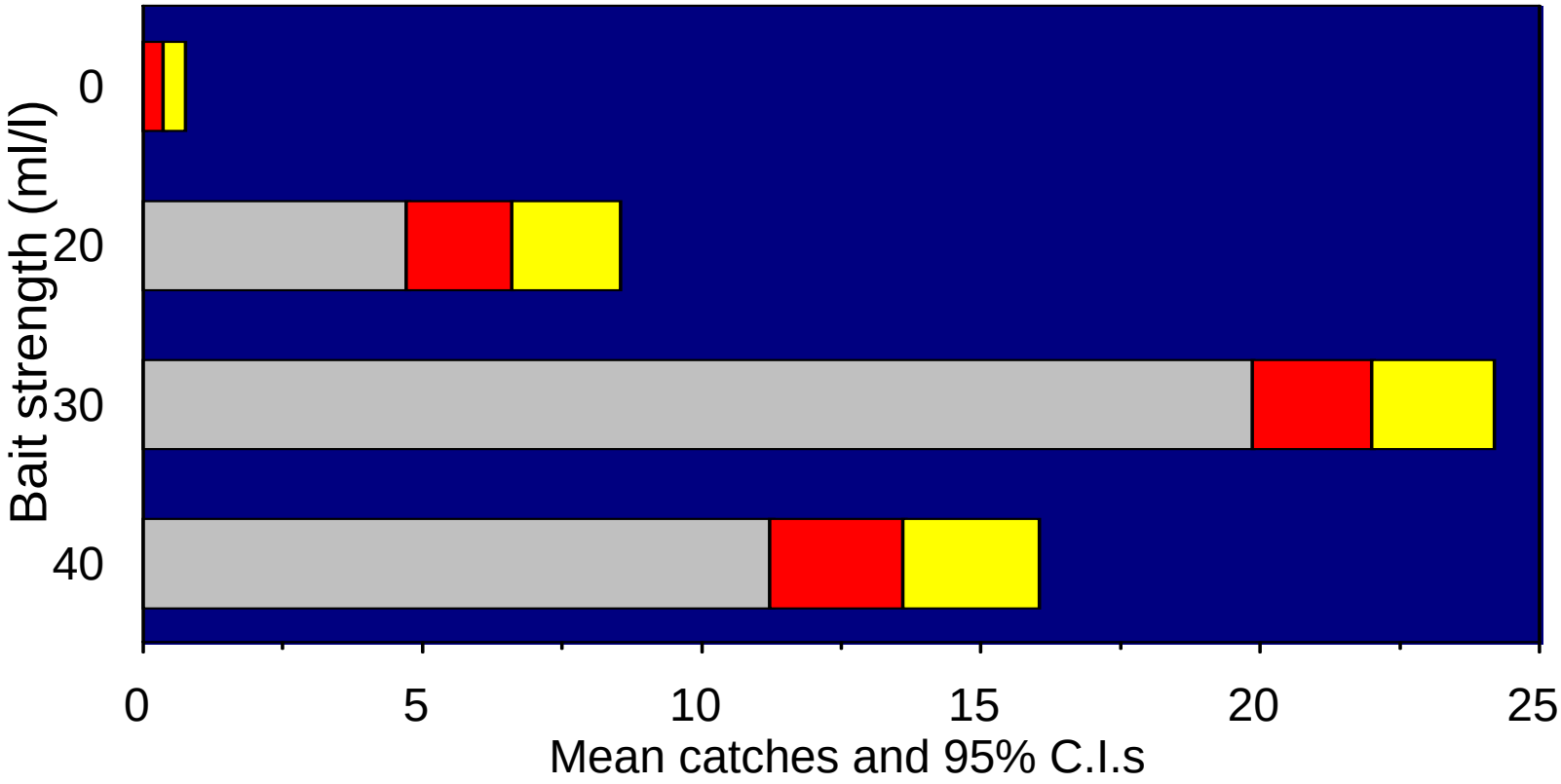
Comparison of bait substrates

Fly catches per baitspot after 5 days



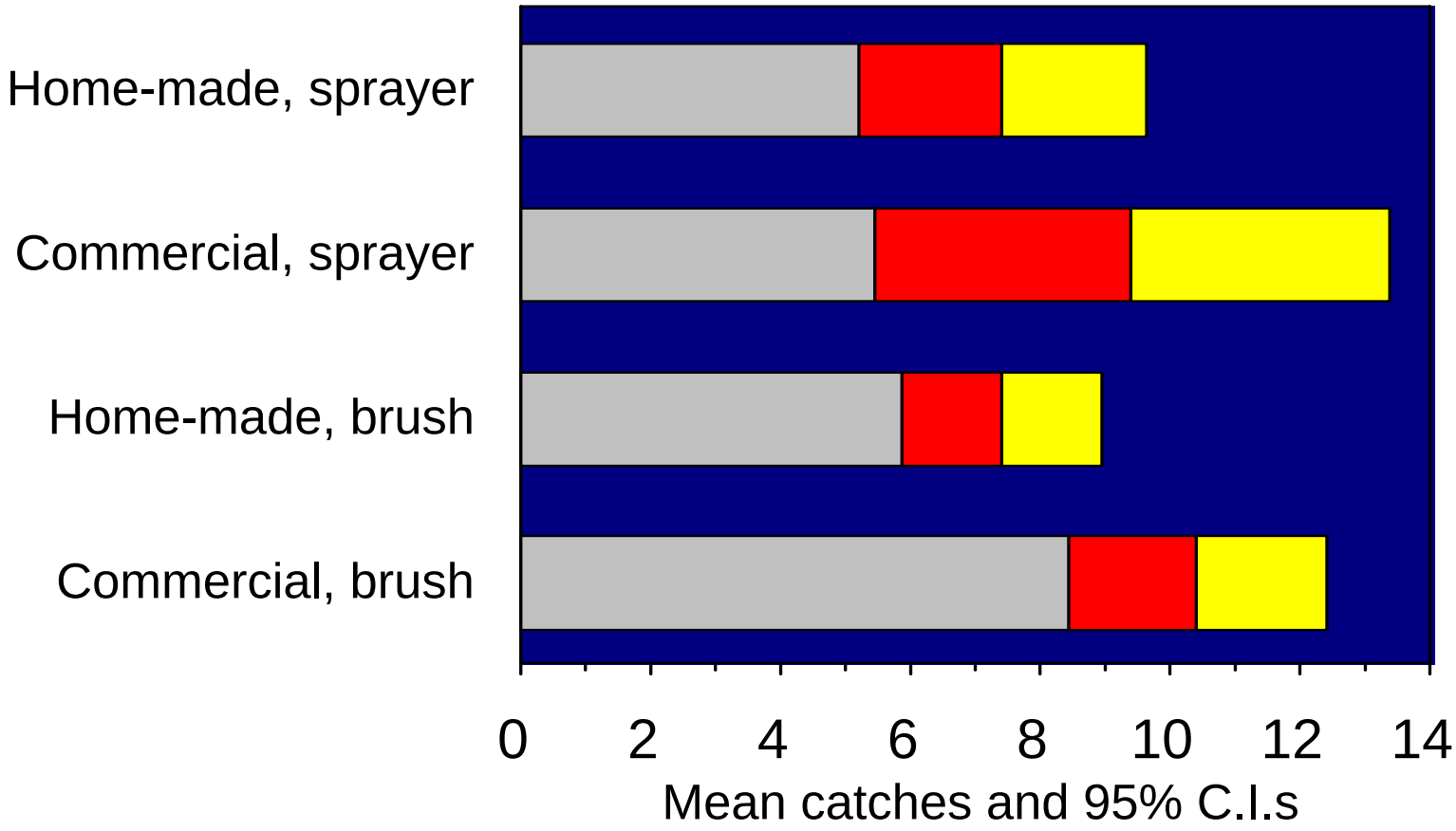
Comparison of bait strengths

Fly catches per baitspot after 10 days



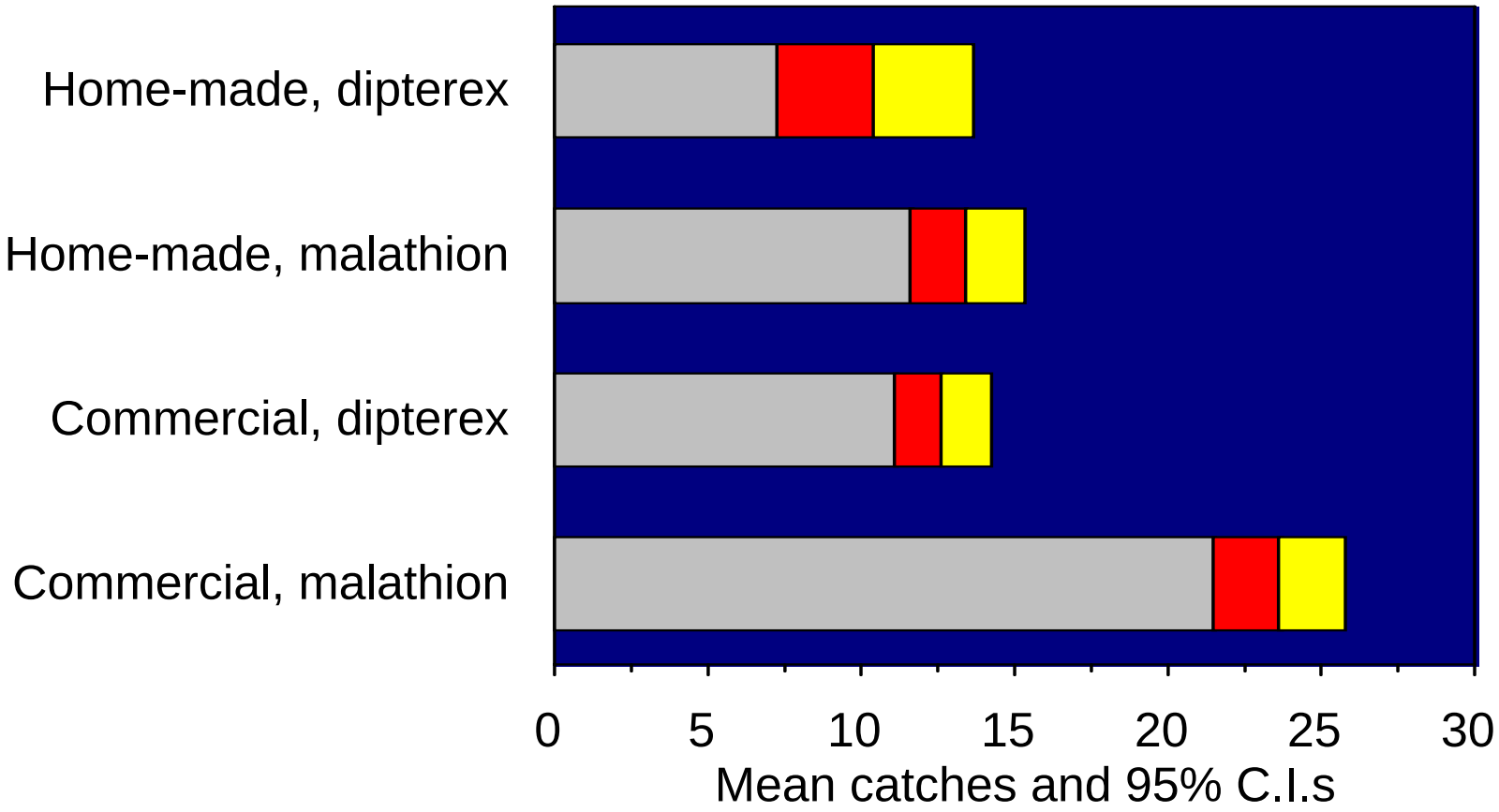
Comparison of baits and applicators

Fly catches per baitspot after 5 days



Comparison of baits and insecticides

Catches per baitspot after 5 days



Summary

- Beef broth 71% effect of commercial protein hydrolysate
- Brushes are as effective as spraying
- Dipterex is 62% as effective as Malathion
- Spray is most effective on foliage
- Urea and cucumber extract gave no benefit
- Possible health risks mixing insecticide and beef broth - care should be taken!

Optimisation of wood blocks for Male Annihilation Technique in Pakistan

Muhammad Afzal

Results

- A series of acetate overheads were displayed to show the results of MAT block experiments which are summarised in the next slide

Summary

- Blocks attract and kill flies in the field for about four weeks
- Plywood gave the best results
- Square and rectangular blocks were more effective than round or hexagonal blocks
- Lure:insecticide:alcohol ratio of 6:4:1 was most effective

Conclusions and implications of the Pakistan-UK Fruit Fly Project

John Stonehouse

What we have found so far

- Presence of flies
- Distribution, abundance and damage
- Control effectiveness
- Control cost-effectiveness

Questions remaining

- Scale effects
- Application
- Markets and flows of resources
- Extension and flows of information

Challenges remaining

- MAT-BAT as orphan technologies
- Safety and health risks
- Need for publicity and information provision to ensure that there is a successful launch of the technology

Objectives and options for fruit fly research and control

Workshop sessions

24 February 2000

Workshop planning session

- Objectives
  - commercial sector sales
  - village consumption
- Outputs
  - Bait and Male Annihilation capacity
    - materials in the markets, use organised
- Activities
  - commercialisation, extension, NGO mobilisation, research, quarantine

Workshop sessions

- **Research needs for on-farm control**
  - **Riaz Mahmood**
- **Extension and technology transfer**
  - **Ashraf Poswal**
- **Commerce, markets and supplies**
  - **John Stonehouse**
- **Quarantine challenges**
  - **John Mumford**

Workshop outputs

- **Objectives**
  - **objectives relevant to commercial orchard sector and to village consumption**
- **Outputs**
  - **what will be achieved or delivered?**
  - **what timescale?**
- **Activities**
  - **what should be done? where? by whom?**
  - **likely costs and resources**