

# Problem-based Scenarios in Practice

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***E-learning for plant disease  
diagnosis***

# Problem-based Scenarios for Plant Disease Diagnosis

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- The why?
  - Diagnosis is more than just identification of a suspected causal agent
  - The diagnostician:
    - Need to follow a deductive process
    - Needs to integrate and apply knowledge from a variety of disciplines
  - How could we teach students “the art” of plant disease diagnosis?



# Problem-based Scenarios for Plant Disease Diagnosis

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- The wherefores
  - A “virtual” environment that contains plants with problems (a problem-based scenario)
  - Student must interact with this environment, examining objects, carrying out tests, eliciting information from “actors”
  - Forming hypotheses and proving/disproving them, the goal being to:
    - diagnosis the problem
    - justify the diagnosis
    - provide recommendations of how to fix the problem

# Problem-based Scenarios for Plant Disease Diagnosis

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- Needed software with this functionality...
  - Ability to specify locations, tasks and tests
  - Conditional revelations
  - Objects collectable and transportable
  - Tracking of students
  - Tailored feedback depending on actions
  - Associate costs with activities
  - Student reporting
  - Easy-to-author scenarios

# DIAGNOSIS V 1 (1991)

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- MS-DOS
- Text and Pictures
- Line-based, two word “verb-noun” interface.
- Big vocabulary needed to pick up synonyms

```
You are standing in an apple orchard in the Waikato. Most of the 4 - 5 year
old trees here appear small and unthrifty. It is close to harvest, but the
few small fruit these sick trees have produced litter the weedy ground.

From your conversations with the grower, it seems the plants have never done
well, but this year has been particularly bad.

As you walk through the affected block, you notice the most pathetic
specimens lie in the low areas. You stop in front of one particularly
unhealthy tree for a closer examination.

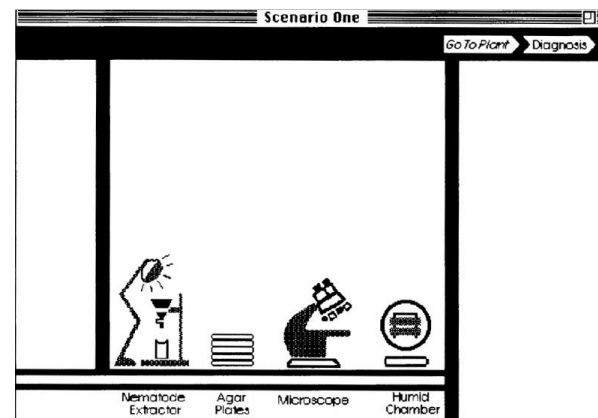
An almost bankrupt grower is here with you.

<----->
Many of the remaining leaves are small, highly coloured and in an advanced
state of chlorosis or necrosis. You examine a few with a hand lens but
there are no signs of pests or pathogens on the surface.

What will you do next?  examine roots_
```

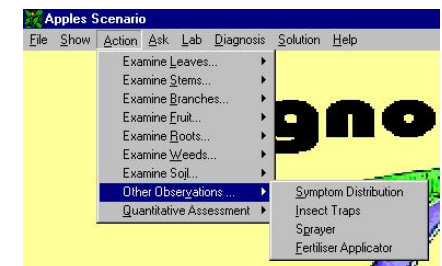
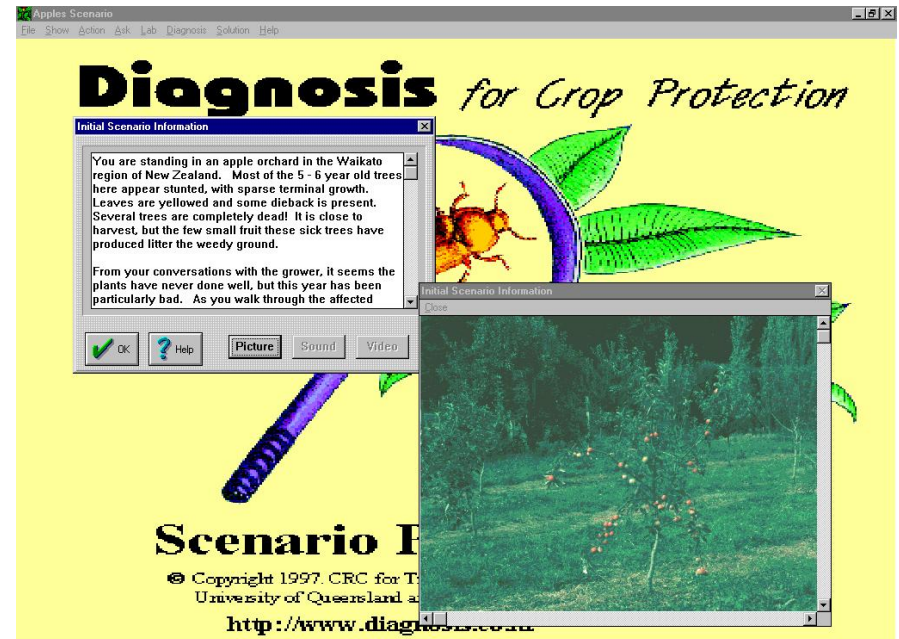
# DIAGNOSIS for Mac (1993)

- HyperCard
- Graphical “drop and drag” interface
- Generic plant and generic lab
- Fully multimedia



# DIAGNOSIS V 2 (1995) (with UQ, Aust.)

- Windows 3.1
- Menu driven
- Fully Multimedia
- New tasks and observations
- Accommodated insect problems



# DIAGNOSIS V 3 (2003)

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- 98/ME/XP/NT/2000/
- No “fixed” tasks. All defined in the scenario
- Accommodates hyperlinks
- Allows tutor-directed Help
- Player is “Frame” based
- Builder uses a Windows Explorer metaphor
- Accommodates multi-choice
- Can sequence activities



# Problem-based Scenarios for Plant Disease Diagnosis

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- Screenshots from the Diagnosis for Crop Problems **Player** i.e. the student's view....



## Doug's Apple Problem



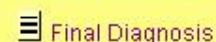
Back



Initial Info



Collected Items



Final Diagnosis



More Info



### Orchard

Expenditure: **\$0.00**

Please use the menus below to select places you wish to go, things you wish to examine, questions you wish to ask and tasks you wish to carry out.

- Orchard
- Leaves
- Trunk
- Branches
- Fruit
- Roots
- Weeds
- Soil
- Ask Grower
- Ask Neighbour
- Other Observations
- Quantitative Assessment
- Laboratory

You walk through the orchard. Most of the 5 - 6 year old trees here appear stunted, with sparse terminal growth. Leaves are yellowed and some dieback is present. Several trees are completely dead! It is close to harvest, but the few small fruit these sick trees have produced litter the weedy ground.

From your conversations with the grower, it seems the plants have never done well, but this year has been particularly bad. As you walk through the affected block, you notice the worst specimens are in the low-lying areas. You stop in front of one particularly unhealthy tree for a closer examination.



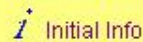
The grower remains beside you, his appearance stoic, despite his seemingly impending bankruptcy.



## Doug's Apple Problem



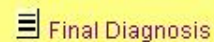
Back



Initial Info



Collected Items



Final Diagnosis



More Info



### Cut Into

Expenditure: **\$0.00**

Please use the menus below to select places you wish to go, things you wish to examine, questions you wish to ask and tasks you wish to carry out.

- Orchard
- Trunk
- Cut Into
- Collect
- Laboratory



Squatting down, you take out your pocketknife and cut into the bark at the base of an affected tree.

The bark and phloem is seen to be dark brown and it has a sour smell. Further cutting reveals this area of discolouration extends up and around the trunk, and down along the main roots. The lesion has a zonate margin.

Nasty...!

# Doug's Apple Problem

Expenditure: \$0.00

Please use the menus below to select places you wish to go, things you wish to examine, questions you wish to ask and tasks you wish to carry out.

- Orchard
- Ask Grower
- Past Weather
- Disease Management
- Weed Management
- Insect Management
- Fertiliser
- Irrigation
- Variety**
- Neighbors' Crops
- Grower Diagnosis
- Change in Management
- History of Problem
- Land Use History
- Drainage
- Laboratory

## Variety



The grower tells you the variety is Cox's Orange.

He goes on to say that he considers newer varieties a passing fad and will stick with one that is tried and true.

Nevertheless he has a few of the newer varieties like Pacific Rose and Braeburn in another block, just to cover himself in case the Cox market collapses. "In fact those trees aren't looking too bad..." the grower mutters with a puzzled look.



## Doug's Apple Problem



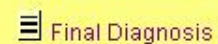
Back



Initial Info



Collected Items



Final Diagnosis



More Info



## Pesticide Residue

Expenditure: \$0.00

Please use the menus below to select places you wish to go, things you wish to examine, questions you wish to ask and tasks you wish to carry out.

- Orchard
- Laboratory
- Collected Items
- Leaves
- Cut Into
- Arthropods
- Microscope
- Humidity Chambers
- Nematode Extraction
- Virus Testing
- Plant Nutrient Analysis
- Pesticide Residue
- Plate to Agar

Select the pesticide residues you want tested for and click OK.

	Pesticide	Cost
<input type="checkbox"/>	Captan	\$20.00
<input checked="" type="checkbox"/>	Dithoicarbamate	\$20.00
<input type="checkbox"/>	Fenarimol	\$20.00
<input checked="" type="checkbox"/>	Azinphos-methyl	\$20.00
<input type="checkbox"/>	Dodine	\$20.00

Total

\$40.00

Select All

OK



## Doug's Apple Problem

[Back](#)[Initial Info](#)[Collected Items](#)[Final Diagnosis](#)[More Info](#)

### Results

Expenditure: **\$40.00**

Please use the menus below to select places you wish to go, things you wish to examine, questions you wish to ask and tasks you wish to carry out.

- Orchard
- Laboratory
- Collected Items
- Leaves
- Pesticide Residue
- Results

You send the leaves to an analytical lab for a pesticide residue analysis.

Dithiocarbamate: No detectable residue

Azinphos-methyl: 0.005ppm

# Doug's Apple Problem

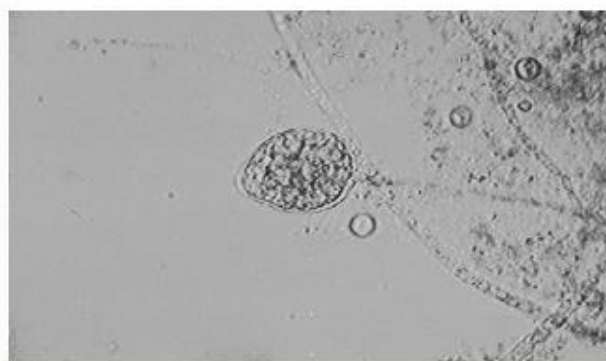
Expenditure: **\$100.00**

Please use the menus below to select places you wish to go, things you wish to examine, questions you wish to ask and tasks you wish to carry out.

- 🌳 Orchard
- 🧪 Laboratory
- 📁 Collected Items
- 🔪 Trunk
- 🌀 Plate to Agar
- ▶️ 🌀 Fungus
- 🧪 Pathogenicity
- 🧪 Identification

## 🌀 Fungus

Hyaline fungal structures are visible.





## Doug's Apple Problem

[Back](#)[Initial Info](#)[Collected Items](#)[Final Diagnosis](#)[More Info](#)

### Final Diagnosis

You should now have completed the investigatory phase of this exercise. This final part requires you to provide an assessment of the problem and a recommendation to the grower.

Please fill in the text boxes below.

**Diagnosis** - Your deduction of what is causing the problem.

**Justification** - Your reasons for making the diagnosis.

**Recommended Action** - Your plan for dealing with the problem.

[Click to see report](#)

Proceed



# Problem-based Scenarios for Plant Disease Diagnosis

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- Screenshot from the Diagnosis for Crop Problems **Builder** i.e. the tutor's/author's view....



- Doug's Apple Problem [Start]
  - Initial Info
  - Orchard
    - Leaves
      - Cut Into
      - Arthropods
      - Collect
      - Microscope
      - Humidity Chambers
      - Nematode Extraction
    - Virus Testing
    - Plant Nutrient Analysis
    - Pesticide Residue
    - Plate to Agar
  - Trunk
    - Cut Into**
    - Collect
    - Microscope
    - Humidity Chambers
    - Nematode Extraction
    - Plate to Agar
  - Branches
    - Cut Into
    - Collect
    - Microscope
    - Humidity Chambers
    - Nematode Extraction
    - Plate to Agar
  - Fruit
  - Roots
  - Weeds
  - Soil
  - Ask Grower
  - Ask Neighbour
  - Other Observations
  - Quantitative Assessment
- Laboratory
  - Collected Items

Basic Extended **Important Clue Observed** Important Clue Not Observed

Description

Icon    knife.gif

Cost

Times New Roman 12 Normal **B** *I* U 



Squatting down, you take out your pocketknife and cut into the bark at the base of an affected tree.

The bark and phloem is seen to be dark brown and it has a sour smell. Further cutting reveals this area of discolouration extends up and around the trunk, and down along the main roots. The lesion has a zonate margin.

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# Problem-based Scenarios for Plant Disease Diagnosis

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## ○ Scenarios:

- Allow students to explore a number of likely hypotheses
- Use an “Adventure-game” metaphor
- Use a 2<sup>nd</sup> person perspective
- Incorporate characterisation and humour where possible
- Contain misleading clues and “red-herrings”
- May suggest, lead, guide and interpret (or NOT!) as appropriate

# Student Survey 2002-2004

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<b>Question</b>	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>	<b>CHI</b>
<b>I enjoyed these exercises</b>	14	8	0	1	0	<0.01
<b>The interface was intuitive and easy to use</b>	9	12	1	1	0	<0.01
<b>These exercises helped me improve my knowledge of the diagnostic process</b>	11	11	0	1	0	<0.01
<b>I would have learnt more from just covering diagnostic examples given in formal lectures, rather than using the software</b>	1	0	4	10	8	<0.01

SA=Strongly agree, A=Agree, U=Undecided, D=Disagree, SD=Strongly Disagree  
23 students

# Student Survey 2002-2004 (cont...)

<b>Question</b>	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>	<b>CHI</b>
<b>I would have learnt more from just being given diagnostic examples in written form to read about at home, rather than using the software</b>	1	0	2	12	8	<0.01
<b>I found the typed "Creator's Solution" feedback comments on the returned script helpful</b>	7	13	3	0	0	<0.01
<b>I prefer to go through a scenario with one other, rather than by myself</b>	4	7	9	2	1	0.04

SA=Strongly agree, A=Agree, U=Undecided, D=Disagree, SD=Strongly Disagree

23 students

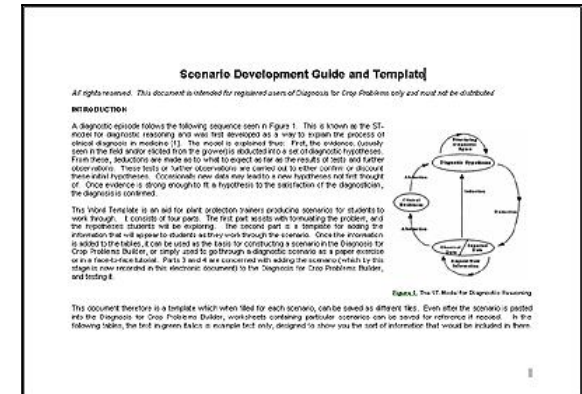
# Problem-based Scenarios for Plant Disease Diagnosis – Some wisdom

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- Storyboarding scenarios can be the most difficult part of the exercise
- “Embedding” into the course is important
- Careful thought needs to be given to..
  - Learning Objectives
  - Time-Frame
  - Student Resources
  - Team-play
- Some value in student’s creating their OWN scenarios

# DIAGNOSIS Extras

- Scenario Creation Guide
  - Assists teachers in developing, documenting and storyboarding diagnostic scenarios
- Support Website
  - [www.diagnosis.co.nz](http://www.diagnosis.co.nz)
  - Free scenarios
- Student Builder
  - Allows Students to construct scenarios



# Spin-off developments (2005- )

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## Challenge

- A generic version of DIAGNOSIS
- CHALLENGE FRAP (Form for Recording the Analysis of Problems)
  - Derivation of the CHALLENGE Builder
  - Acts as both a guide and a recording template for problem-based exercises
- PBL-Interactive
  - UQ software. An advance on CHALLENGE which includes a web-based player

# Spin-off developments (2005- )

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- E-CDF Project 512
  - Produce enhanced versions of
    - CHALLENGE FRAP
    - PBL-Interactive
  - Manuals and support material
  - Fifteen exemplar PBL-i scenarios
  - Make all of the above available to TEIs
  - <http://pbl.massey.ac.nz>

