QUESTION ONE – must be answered by all students!!

You received a call from a local tomato farmer who complained of a disease ravaging his tomato crop in the field. You discovered upon investigation that the crop is infected with bacterial speck disease of tomato. As a consulting Plant Pathologist, write a report including the following information:

Name and Taxonomy (Kingdom, Division, Class, Genus and species) of the organism (2)
Isolation techniques and identification characteristics (6)
Symptoms of the disease (9)
Disease cycle and infection process (9)
How the disease is spread (5)
Host range and Overwintering strategies (4)
Control options/disease management practices (9)

[45]

QUESTION TWO

(a) List and describe the five (5) ways in which Horizontal Resistance can be eroded, resulting in dangerous crop vulnerability. (20)

(b) Briefly narrate the tale of tropical rust disease of maize in Africa and describe three (3) lessons that may be drawn from it. (25)

[45]

QUESTION THREE

(a) Discuss how humans have influenced the wild pathosystem (consisting of host, pathogen and environment) in developing modern agricultural systems. (15)

(b) In progressing from the logistic equation (solving for r) to the equation defined by \( R_c \), two new concepts are introduced. Define and discuss these concepts using graphs and diagram(s) to support your answer. (15)
(c) Discuss the statement, “Most plants are resistant”, with respect to the question of whether resistant is specific or general. Reference should be made to the Lock and Key analogy. 

(10)

(d) List and draw a graph depicting the three (3) phases of an epidemic

(5)

[45]

QUESTION FOUR

(a) Discuss the three phases of a typical epidemic curve. Where does the majority of a disease multiplication occur?

(6)

(b) A plant pathologist monitored a potato late blight epidemic. He collected the following data, measuring percentage leaf area infected in the crop:

X₀ = 0.0005%
X₆ = 0.01%
X₁₂ = 0.05%
X₁₈ = 0.1%
X₂₄ = 2.5%
X₃₀ = 25%

He found that the latent period was 12 days, and the infectious period was 6 days. What were Apparent, Basic and Corrected Basic Infection Rate over the 30 days he rated the disease progress?

(15)

(c) The following data was collected by a third year plant pathology student at University of KwaZulu-Natal for potato late blight.

<table>
<thead>
<tr>
<th>Date</th>
<th>Disease level (x)</th>
</tr>
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<tbody>
<tr>
<td>10 June</td>
<td>0.0001</td>
</tr>
<tr>
<td>13 June</td>
<td>0.001</td>
</tr>
<tr>
<td>16 June</td>
<td>0.05</td>
</tr>
<tr>
<td>18 June</td>
<td>0.12</td>
</tr>
<tr>
<td>24 June</td>
<td>0.35</td>
</tr>
<tr>
<td>26 June</td>
<td>0.55</td>
</tr>
</tbody>
</table>

(i) Calculate the rate of disease progress for the period 10 June – 13 June

(4)

(ii) Calculate the rate of disease progress for the period 13 June – 18 June

(4)

(iii) Given that the latent period for this disease is 5 days, calculate “R” from 10 June to 18 June

(5)

(iv) Given that the latent period is 4 days and the infectious period is 4 days, calculate Rₖ for the overall epidemic

(7)
(d) Explain the following terms and where appropriate, illustrate your answer with a diagram.

i) Allo-infection (2)

ii) Auto-infection (2)

QUESTION FIVE

(b) Why is it essential to eliminate functional Vertical Resistance (VR) genes from a parent population used in breeding for Horizontal Resistance (HR)? (4)

(c) With the aid of diagrams, discuss the One and Two Pathotype techniques that are available to do so. Include comments on the advantages(s) and disadvantage(s) of both techniques (14)

(d) Graphically represent and describe the effect of Horizontal and Vertical Resistance on disease progress. (12)

(e) Outline the "pedigree" method of breeding for Vertical resistance. Discuss the advantages and disadvantages of this form of resistance. (15)