Managing Biosecurity Threats

Submitted by: Brunei
1. **Background**

Agriculture in Brunei is mainly devoted to food production and to the lesser extends floriculture to meet the niche market for flowering plants and ornamentals. Plantation agriculture of industrial crop is non-existence. Even large-scale agricultural farms are not common with the exception of poultry and egg production. These intensive commercial farms together with small and medium enterprises produce the bulk of the food requirement of the country.

Agriculture, including livestock accounted for B$137.91 million in 2004 representing 3 percent of the Gross Domestic Product (GDP). It is expected that agriculture will play a bigger role in the economy particularly when the government is putting greater emphasis in food production and economic diversification. In 2004, about B$400 million was expended on import of major food items and food products to meet the local demand. This suggests that tremendous opportunity exists for farmers to increase domestic production and profit from their activities.

2. **Fruit Industry**

Land area allocated for fruit industry in 2004 is approximately 1993.7 hectares, contributing 4515.7 metric ton of fruit production. However in the same year the country expended B$20 million importing fruits from Malaysia, Australia, Thailand, USA and China. Major fruits grown are durian, citrus, banana, cempedak (of Artocarpus species) and pineapples.

Citrus fruits represent the largest acreage and are one of the most important commodities of fruit industry in the country. Entry of pests and diseases became the major concern to the authority, particularly with the presence and spread of the Citrus Greening disease in the region. To safeguard the industry, the Department of Agriculture had imposed strict quarantine measures of not allowing the importation of any citrus seedling or any form of planting materials into the country. However, being a country sharing a common land border, where possible entry of pests and diseases is questionable, and the authority in 2004, decided to conduct an insect pest and disease surveillance to confirm for any presence of the Greening disease.

3. **Disease Surveillance**

Results from the surveillance shows that the citrus in the country were both infected by the Citrus Tristeza Virus from aphids vectors *Toxoptera citricidus* and *Aphis gossypii*, and the Citrus
Greening / Huanglongbing caused by phloem probacterium *Candidatus Liberobacter asiaticus*, spread by Asiatic citrus psyllid, *Diaphorina citri*.

With the catastrophic impact to the citrus industry in the region, to quote, the number of infected trees, in Indonesia 8 million, in the Philippines 1 million and in Thailand 95 percent of the Northern and Eastern region, Brunei decided to take appropriate action plan to content and prevent further spread of the disease to safeguard its major fruit industry.

4. **Short Term Action Plan**
The immediate action taken were firstly to strengthen the plant quarantine section of the Department by giving an intensive training to the quarantine staff on recognizing the symptoms of the disease, possible methods of courier and to take the appropriate action when there are cases of entry of plant seedlings or any form of planting materials into the country.

Secondly, to hasten the campaign of planting of indigenous fruit trees that are of commercial value as part of the contingencies plan incase the whole of the citrus trees are infected.

Third, was to control the insect vectors by engaging a systematic insecticide spraying on the infected orchards with the assistance of the farmers. Insect pest surveillance and monitoring systems were set up at strategic locations particularly surrounding the infected zone done by placing sticky traps and weekly counting of the aphids and psyllids.

Fourth, was to embark an awareness program to farmers and the public on the economic importance of the diseases by distributing fact sheets and conducting seminars at selected areas.

Lastly was to conduct case study on controlling the disease by using disease-free seedlings from certified nurseries. The study is still in progress and the result will be expected by the end of the year.

5. **Medium Term Action Plan**
With the immediate implementation of the Short Term Action Plan, the Department of Agriculture is also putting a Medium Term Action Plan, which include planting of tree crops near the infected citrus plant. The strategy is to create trap crops for the insect vectors and as an immediate substitute for the infected citrus.

The other action taken was to identify new areas for the citrus growing which is to be located at least more than 5 kilometers from the infected orchards. Relocating new areas to replace the existing farms is not an easy task for the Department to undertake because of the complication involved in providing the necessary infrastructures and facilities in addition to the reluctance of entrepreneurs for reasons of their initial investment in the existing areas.
6. **Long Term Action Plan**

With the importance of the citrus industry in the country, the Department is taking extra precaution in implementing the Citrus Rehabilitation Program by undertaking the following measures.

First, involve the production of disease-free mother plants and seedlings through shoot tip micro grafting. The success of this technique is yet to be seen however trial on this particular method is underway.

Second, to carry out mild strain cross protection. This technique involves the use mild strain citrus against the disease and to cross graft it with the healthy plants. Likewise, the result of this experiment is yet to be seen, however there is a fair chance that either one of the methods will provide a better alternative and salvage the citrus industry in the country.

Third, was to establish a disease-free nursery. With healthy seedlings, the citrus plants are in the better position to wade off the infection however there should be adequate healthy seedlings to set up the nursery.

Fourth, was to properly manage the disease-free orchard if there is any. Extra precaution needs to be taken which will include strict entry to the farm and most important, an ideal secluded location not in close proximity with any infected farms.

Last action that is been considered is eradication of infected trees. Due attention and careful consideration should be taken into account because it involves financial investment of the entrepreneurs.

7. **Conclusion**

In managing the biosecurity threats, each and every country has its own methods and measures, taking into consideration all aspects of socio-economic and political situations prevalent in each particular country. For Brunei Darussalam, the above action plans have been accounted for, all for the well being of the agricultural industry, the population and preserving the biodiversity of the country.
Citrus is one of the most important commodity of fruit industry in Negara Brunei Darussalam.
Trend of Local Citrus Production from 1999 to 2004

<table>
<thead>
<tr>
<th>Year</th>
<th>Limau Manis</th>
<th>Kesturi</th>
<th>Kapas</th>
<th>Pamelo</th>
<th>Jumlah</th>
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<tbody>
<tr>
<td>1999</td>
<td>1,030.02</td>
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<td>2000</td>
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<td>2001</td>
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<td>356.01</td>
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<tr>
<td>2002</td>
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<td>498.38</td>
<td>92.2</td>
<td>84.22</td>
<td>1,976.22</td>
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<tr>
<td>2003</td>
<td>978.95</td>
<td>534.94</td>
<td>140.89</td>
<td>55.63</td>
<td>1,734.71</td>
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<tr>
<td>2004</td>
<td>1,324.97</td>
<td>729.95</td>
<td>166.88</td>
<td>79.93</td>
<td>2,290.82</td>
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</table>

RESULTS OF DISEASE SURVEILLANCE
The result of the survey showed that citrus trees were infected by citrus tristeza virus and citrus greening / Huanglongbing.

Both diseases can be spread by vectors and vegetative propagation.

Disease impact to the citrus plant
Decrease yield drastically
   - poses major constraint in citrus production

Trees may die less than 5 years if:
   - Seedlings infected at the age of less than 5 years
   - Poor farm management
   - The trees infected by both diseases

Trees will survive more than 15 years and can produce high yield more than 10 years with good farm management
Caused by Citrus Tristeza Virus and the vectors for this disease are aphids, *Toxoptera citricidus* dan *Aphis gossypii*.

Infected plants will show symptoms such as yellowing of leaves, wilting, defoliation, stem pitting and die back.

But the plants that were surveyed were symptomless.
Stem pitting on pomelo

Aphid, *Toxoptera citricidus*
Aphid, *Aphis gossypii*

CITRUS GREENING/HUANGLONGBING
Citrus greening is caused by a phloem proteobacterium, *Candidatus Liberobacter asiaticus* and spread by Asiatic citrus psyllid, *Diaphorina citri*.

**Greening symptom on the leaves**
Greening symptom

Diseased

Healthy
Greening on pomelo leaves

Greening on pomelo leaves
Psyllid, *Diaphorina citri*
Eggs of *Diaphorina citri*

**Overview of Citrus Greening in ASEAN Countries**
Indonesia
- 1977, 5 million trees infected
- 1981, 10.5 million trees died
- 1985, more than 8 million trees infected, started rehabilitation programme

Philippines
- 1962, 7 million trees infected
- 1971, more than 1 million trees died in 1 province

Thailand
- 1980, about 95% of citrus trees were infected in Northern and Eastern parts of Thailand
- Then the disease spread to Southern parts of Thailand
Action Plan for Control Strategies

Short Term
Strengthening the plant quarantine

Planting indigenous fruits campaign

Control of insect vectors

Awareness program to farmers and public on Citrus Greening and Citrus Tristeza Virus through fact sheet and seminars

Conduct case study for disease control using disease-free seedlings from certified nursery

### Recommended insecticides for aphids control

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Mode of action</th>
<th>Rate for 1 litre of water</th>
<th>Spraying interval (days)</th>
<th>Duration before harvest (days)</th>
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<tbody>
<tr>
<td>Rogor (Dimethoate 38%)</td>
<td>Contact &amp; Stomach Poison</td>
<td>0.6 - 2.0 ml</td>
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<tr>
<td>Karate 2.5% EC</td>
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<td>Sumi-alpha 2.5 EC</td>
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<tr>
<td>Baythroid 5 EC</td>
<td>Contact &amp; Stomach Poison</td>
<td>1.0 ml</td>
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<td>7</td>
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</tbody>
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</thead>
<tbody>
<tr>
<td>Confidor 200 SL</td>
<td>Contact &amp; Stomach Poison</td>
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<tr>
<td>Merit 100 SL</td>
<td>Contact &amp; Stomach Poison</td>
<td>0.5 ml</td>
<td>7</td>
<td>7</td>
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Planting other tree crops near the infected citrus plant

Identify new area for citrus planting which is at least more than 5 km from infected farms

Long Term
Citrus Rehabilitation Program

- Mild strain cross protection
- Production of disease-free mother plants and seedlings through shoot tip micrografting
- Establishment of disease-free nursery
- Eradication of infected trees
- Management of disease-free orchard

THANK YOU