**Cultivar group:** _____Cavendish AAA_________________

1. **Estimate yield potential in monoculture without limiting factors:**

   Biggest recorded bunch weight: **130 kg**  
   Days to harvest: **495**

   Plant density for high density annual planting 2500 plants/ha

   Plant density for perennial monoculture 2400 plants/ha

   Formula for estimating **yield potential** (Ortiz and Vuylsteke, 1998):

   \[
   \text{Yield Potential in tons/ha} = \text{biggest recorded bunch weight in kg} \times 365 \times \frac{\text{plant density ha}^{-1}}{\text{(days from planting to harvest x 1000)}}
   \]

   Calculated yield for high density annual monoculture: **240** tons/ha/year

   Calculated yield for perennial monoculture **230** tons/ha7year

2. **Estimate yield variability for two important contrasting production systems or production zones for the cultivar group following the diagram:**

   ![Yield Variability Diagram]

   Global yield potential

   Above average farmer yield in production zone

   Average farmer yield in production zone

   Below average farmer yield in production zone

   Worst case scenario yield
2.1 Identify major production zones/production systems you are most familiar with:

1. Near intensive production export system
2. Mixed small holder systems

2.2 From the list, select two contrasting production systems in different production zones or common production system in two contrasting zones and estimate yields:

**Production system 1:**

Location: India, Brazil, Australia, China (country, zone)

Cultivar name: Cavendish (small number of cultivars)

Production system: Near intensive production export system

Brief description of total rainfall, length of dry season(s), altitude, longitude/latitude:

1400-2200 mm, 3-4 months, altitude 0-300m, 0-30° north and south, no limit on longitude

For this zone, estimate the average yield/ha/yr, above average farmer yield and below average farmer yield (using bunches ha/yr and mats/ha). Finally indicate yields/ha/yr if important pest/disease and production problems are severe (worst case scenario).

**Above average farmers – production system 1:**

Yield __45___ t/ha/yr  Bunches/ha/year ___2340_____  Mats/ha 1800____

**Average farmers – production system 1:**

Yield _35___ t/ha/yr  Bunches/ha/year ___2340_____  Mats/ha 1800 __

**Below average farmers – production system 1:**

Yield __25____ t/ha/yr  Bunches/ha/year ___2340_____  Mats/ha 1800___

**Worst case scenario – production system 1:**  Yield _12 t/ha/yr
Production system 2: Mixed small holder systems

Location: Indonesia (country, zone)

Cultivar name: Cavendish subgroup

Production system: Mixed small holder systems

Brief description of total rainfall, length of dry season(s), altitude, longitude/latitude:
Rainfall 1200-2000 mm.; two-three months: altitude 0-600 m; longitude the same 0-30° north and south, no limit on longitud

For this zone, estimate the average yield/ha/yr, above average farmer yield and below average farmer yield (using bunches ha/yr and mats/ha). Finally indicate yields/ha/yr if important pest/disease and production problems are severe (worst case scenario).

Above average farmers – production system 2:
Yield 9.8 t/ha/yr Bunches/ha/year 390 Mats/ha 300 (25kg/bunches)

Average farmers – production system 2:
Yield 5.2 t/ha/yr Bunches/ha/year 260 mats/ha 200 (20 kg/bunches)

Below average farmers – production system 2:
Yield 2.0 t/ha/yr Bunches/ha/year 120 Mats/ha 100 (15kg/bunches)

Worst case scenario – production system 2: Yield 0.5 t/ha/yr
2.3 Identify major factors explaining yield differences as shown in the diagram

<table>
<thead>
<tr>
<th>Major factors in yield variability</th>
<th>Production zone 1</th>
<th>Production zone 2</th>
</tr>
</thead>
</table>
| **Type 1:** difference between global potential and above average farmer yields | 1. No or few elite planting material  
2. Below optimum sunshine  
3. Temperature variation from optimum (28 degrees)  
4. Below optimized irrigation  
5. There are not Black Sigatoka and other pest and diseases.  | 1. Lower planting densities  
2. No elite planting material  
3. Less light available  
4. Temperature variation from optimum (28 degrees)  
5. Rainfed  
6. Some incidence of black Sigatoka and other pest and diseases  
7. Below optimum nutrition for banana |
| **Type 2:** difference between average and above average farmer yields | 1. Loss of plants  
2. Below optimum nutrition  
3. Black Sigatoka management  
4. Fair to below optimum irrigation and drainages  
5. Other pest and diseases control (nematodes, bacterial wilt,  
6. Less favourable agroecological conditions                                                                 | 1. Lower planting densities including loss of plants  
2. No elite planting material  
3. Less light available  
4. Temperature variation from optimum (28 degrees)  
5. Rainfed  
6. Stronger pressure of black Sigatoka and other pest and diseases  
7. Clearly below of optimum nutrition |
<table>
<thead>
<tr>
<th><strong>Type 3:</strong> difference between average and below average farmer yields</th>
<th><strong>Type 4:</strong> difference between below average farmer yields and worst case scenario</th>
</tr>
</thead>
</table>
| 1. Loss of plants  
2. Poor or lack of fertilization  
3. Poor or lack of black Sigatoka management  
4. No irrigation or poor drainages  
5. Poor or lack of other pest and diseases control (nematodes, bacterial wilt,  
6. Relative unfavourable agroecological conditions  
7. Financial problems related to Institutional policies and organization | 1. Loss of plants  
2. No fertilization for banana  
3. Poor black Sigatoka management  
4. No irrigation or poor drainages  
5. Poor or lack of other pest and diseases control (nematodes, bacterial wilt,  
6. Relative unfavourable agroecological conditions  
7. Financial problems related to Institutional policies and organization |
| 1. No population management  
2. Lack of fertilization  
3. Lack of black Sigatoka management  
4. No irrigation or poor drainages  
5. Lack of other pest and diseases control (nematodes, bacterial wilt,  
6. Relative unfavourable agroecological conditions  
7. Lack of inputs because different financial problems  
8. Lack of labour and partial time farming. | 1. No population management  
2. Lack of fertilization  
3. Lack of black Sigatoka management  
4. No irrigation or poor drainages  
5. Lack of other pest and diseases control (nematodes, bacterial wilt,  
6. Relative unfavourable agroecological conditions  
7. Lack of inputs because different financial problems  
8. Lack of labour and frequently partial time farming. |
2.4 For each of the production zones, identify 2-3 additional possible intervention options for smallholder systems which would contribute to yield or income:

### i) post-harvest, processing and marketing:

<table>
<thead>
<tr>
<th>Production zone 1</th>
<th>Production zone 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Improve handling, storage and transport</td>
<td>1. Improve handling, storage and transport</td>
</tr>
<tr>
<td>2. Add value activities to processing and product differentiation</td>
<td>2. Add value activities to processing and product differentiation</td>
</tr>
<tr>
<td>3. Business organization of small holders and farmers association to improve bulking and to achieve high bargaining power</td>
<td>3. Certifications of cropping system</td>
</tr>
<tr>
<td></td>
<td>4. Business organization of small holders and farmers association to improve bulking and to achieve high bargaining power</td>
</tr>
</tbody>
</table>

### ii) intra-household roles, decision making, and resource allocation

<table>
<thead>
<tr>
<th>Production zone 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Labour allocation improvement</td>
</tr>
<tr>
<td>2.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Production zone 2</th>
</tr>
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<td></td>
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</table>
iii) household resource endowment (labor, capital, land, information)

<table>
<thead>
<tr>
<th>Production zone 1</th>
<th>Production zone 2</th>
</tr>
</thead>
</table>

2.5 Identify trends or (likely) future changes (e.g. climate change, spread of diseases) which may alter the importance of limiting factors or the opportunities for smallholders producing this cultivar group?

1. Intensification of black Sigatoka
2. Increase in spread of other diseases such as Fusarium wilt RT4 and BBTV
3. Distabilizing effect of climate change on production
4. Changes in market demand (consumer preferences)
5. Changes in environmental regulatory systems.

2.6 Based on the factors explaining yield variability, other intervention options and trends and changes, select up to 8 priority intervention options for the cultivar group which have applicability across major production zones. Please rank them by order of importance (1. = highest importance).

We do **NOT** prioritize the following intervention options as they are location specific.

1. Improved black Sigatoka management including alternatives to fungicides.
2. Mitigation and prevention of spread of Fusarium wilt, BBTV and BXW.
3. Improved cropping system including pest control.
4. Improved seed systems.
5. Farmers organization, including capacity building.
6. Improved postharvest and processing practices.
7. Improved marketing systems.
8. Improved political and institutional frameworks.