An overview of banana production in Pakistan key constraints and management options

By
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Japanese Attitude For Work:

If one can do it, I can do it. If no one can do it, I must do it.

Our Attitude For Work:

If one can do it, let him do it, if no one can do it, how can I do it?
Introduction:

- Sindh-Pakistan produce 87% of total banana production remaining in Balochistan and South Punjab.
- Area: nearly 31,000 ha
- Production: 1,39,000 tons
- Production per ha (Progressive Growers are getting above 50 tons per ha)
- Per capita per year consumption nearly 0.9 kg (FAO)
- Major commercial cultivars: Cavendish Dwarf (covers more than 90% of area), Grand Naine, Williams, Dhaka etc
- Major planting material source: bunch harvested pseudostems and suckers (Non-TC plants)
- Planting Season: 15th Feb to March
- Major planting distance 6 feet by 6 feet
- Mostly intercropped with chilies, but in some cases other crops also
- Irrigation method: 100% flood (canal & in some cases both canal & underground)
- Peak harvest time: August to October
- Marketing: mainly domestic
- Banana employ so much labor force
Following were and are Key production constraints:

- Banana Plantation too dense like jungle (still is and was)
- Banana Bunchy Top Virus Disease (still is and was)
- Panama Wilt (Recent Threat)
- Poor planting material (still is)
- Irrigation water shortages/drought (is & getting serious)
- Flood Irrigation over and unnecessary (was and is)
- Climate Change (is getting even more unpredictable)
- Land degradation (is at alarming rate)
- Poor technical know how (was and is)
- Poor harvesting and handling (still is)
- Competition from Indian Banana in domestic markets (still is)
- Family Farms (small & medium) ranging from 2 ha to 10 ha
- Business model: Growers give away their banana plantation on lease to traders for 1 to 3 years at certain price per acre
- Research & Development Non-Existent
- Production model: conventional
Back in 2000 this is how banana plantation looks like...above 4000 plants per ha and BBTVD
After thinning and proper followers selection in 2001, 2200 plants per ha were maintained.
Banana Bunchy Top Virus was a major threat from 1989 to 2001 almost 80 percent banana was wiped out
After 2003 BBTVD was no more a serious threat, following protocols were developed.
Prevention and control:

1. Use of disease-free planting material

2. Black aphid can be controlled on banana plants with the use of systematic/contact insecticide or with biological control like (*Trichogramma* spp.). Spray the plants thoroughly, importantly on petioles, furled leaves, whorls, plant base, or on young suckers. Banana black aphid usually appears on banana plants in October to February and in Rainy Season (July/August)

3. Control aphids on weeds. In Sindh, black aphid usually appears on monocot grasses like barn yard and bermuda after 15th August & it prevails up to March.

   a) Weeding manually by using spade or hoe in and around banana field such as; irrigation water feeding channels, bunds and surrounding areas.
   b) or to spray weedicide & insecticide to control both weeds & black aphid.
   c) Mulching with banana trash (pruned leaves, chopped pseudostems etc.)
4. Removal of infested entire mats (rouging) as early as possible, spray the entire banana mat with suitable/approved insecticide in order to kill black aphid and also spray surrounding banana plants, after few days the diseased plant or entire mat must be carefully removed (rouged) and sprayed with pure kerosene oil or weedicide.

5. The gaps must be filled with disease free tissue cultured plants or sucker.

6. In Sindh, the disease symptoms become clearly visible on banana plants in February up to May.

7. Wind breaker trees must be planted at the borders. It can have following benefits, it will help minimize leaf tearing & reduce evatranspiration, second, it can create barrier against direct landing of black aphid.

8. Above all, capacity building of farm workers
New and very serious threat to Banana in coastal belt of Sindh called Thatta......Panama Wilt Disease. It is a same place from which BBTVD was first reported back in 1988
We are @ this level with regard to Panama Wilt

Meetings
Poor Planting Material

Suckers

Bunch harvested Pseudostem
Tissue Culture Banana Plants are now getting popularity
In many parts of Sindh for 3 to 4 months no single drop of water during peak demand
Rare to see over Sindh cloud cover especially when water is needed.
They gave hardware but no software how to schedule water :site specific:
Frost Bite in Winter (Every 3 to 5 years it happens) below 4 degree C
Everything was documented almost on monthly basis from January, 2014 to July, 2014.....slide 1....Growth stages and healthy plants r key to minimize losses even after frost bite

November, 2013

January, 2014

March, 2014

April, 2014
Vegetative growth stage plants suffer less

Fresh fallen bunches suffer more

Weak Plants suffer more
Monsoon Torrential Rains back in late August and early September 2011 made history, this area received 1200 mm rainfall in just 7 days and followed by -2 degree C in Feb 2012......
Banana Plantation first time ever with basic soil drainage ditches. Necessity is mother of all inventions in future we may see tile drainage and drip irrigation.
High wind Velocity coupled with leaf tearing and transpiration it incur sizeable losses (July to August)
Wind-breaks

Conocorpus and plantain
Why soil analysis before plantation is so important?...Idea came when growers were making complaints why this and that banana of that grower suffer less or more during summer

Clay loam and clay soils with hard pan below with Poor soil drainage and higher soil EC above 2 r not recommended For banana plantation....sandy loam, silty clay loam and loamy soils with excellent drainage And EC below 0.25 dS/m r best soils for banana.....

All happens in May & June
During May & June and After May & June
Soil EC, texture and banana during super hot summer and during mild winter

With different young & educated growers
Mission started just to see what actually Happens in field by using simple thing

EC, Texture and soil drainage

<table>
<thead>
<tr>
<th>Texture</th>
<th>pH</th>
<th>Electrical Conductivity (dS/m)</th>
<th>Available Phosphorus (ppm)</th>
<th>Available Potassium (K) (ppm)</th>
<th>Soluble &amp; Exch. Na (mens/L)</th>
<th>Soluble Ca + Mg (mens/L)</th>
<th>Sodium Adsorption Ratio (SAR)</th>
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<tbody>
<tr>
<td>Clayloam</td>
<td>8.4</td>
<td>1.8</td>
<td>43.4</td>
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<td>7.8</td>
<td>17</td>
<td>2.7</td>
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<td>7.7</td>
<td>2.1</td>
<td>44.8</td>
<td>280</td>
<td>5.2</td>
<td>20</td>
<td>1.6</td>
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<tr>
<td>Clayloam</td>
<td>7.9</td>
<td>2</td>
<td>33.6</td>
<td>280</td>
<td>5.2</td>
<td>21</td>
<td>1.6</td>
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<td>2.5</td>
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<td>12.2</td>
<td>20</td>
<td>3.9</td>
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<td>60</td>
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<td>2.1</td>
<td>25.9</td>
<td>220</td>
<td>9.1</td>
<td>37</td>
<td>2.1</td>
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<td>1.8</td>
<td>17.5</td>
<td>220</td>
<td>9.6</td>
<td>35</td>
<td>2.3</td>
</tr>
</tbody>
</table>
Difference of EC in between these two soil patches in June

Both r in May
Local weather

Tando Soomro
Thu, 26 April 3:02 pm
Hazy sunshine
High

41°C

Tando Soomro
Tue, 1 May 4:45 pm
Hazy sunshine
Moderate

47°C

Tando Ghulam Ali
Thu, 26 April 3:01 pm
Hazy sunshine
High

45°C

Tando Ghulam Ali
Thu, 26 April 3:01 pm
Hazy sunshine
Moderate

40°C
Local weather

Tando Ghulam Ali
- 28 March 3:37 pm
- Hazy sunshine
- High

Hourly:
- 43°C

Daily:
- 46°C
- 44°C
- 43°C
- 42°C
- 43°C
- 42°C

Probability of precipitation: 0%
UV index: High

Tando Soomro
- 28 March 3:37 pm
- Hazy sunshine
- Very High

Hourly:
- 34°C

Daily:
- 46°C
- 35°C
- 37°C
- 41°C

Probability of precipitation: 0%
UV index: Very High
Production Managers

If more irrigation water
Especially flood is applied
During May & June banana
Will suffer more because
In arid and semi arid regions with
Flat lands and no rainfall situations
Irrigation Has to be applied but
risk is Salts accumulation on
Surface @ root zone due to
Excessive evatranspiration during
Hot summer

Principle is soil surface must
Be wet and under surface
Must be dry..not possible with
Flood irrigation but yes
With mulching & wide irrigation intervals
Losses can be minimized especially
during May & June

Followers are alright....it’s an opportunity
Banana performance in saline soil during May & June and in August

In harsh subtropical conditions Time is key for banana “stress avoidance & management”
Conventional Harvesting & Handling for domestic market

Open End Top Truck Load

Whole Sale Market
Indian & Pakistani Bananas in Islamabad

Huge Price Per Dozen Difference
Indian for example @ retail......200 PKR
Pakistani @ 80 to 100 PKR

Cardboard Packing being taken as value addition
Post harvest handling intervention

In field Indian Model being applied by few traders unofficially banana export to Iran and Afghanistan
Bunches r being hanged, dehanded washed, graded, dried, packed in cardboard and loaded to open end top vehicles
Post harvest
Lahore Whole Sale Market
In plastic Crates
Banana Production Per ha yearly basis from conventional single row 6 feet by 6 feet method of plantation

Courtesy: Asim Agriculture Farm Tando Allahyar Sindh
# Banana Production Per ha

## Productivity Per Hectare / Month

<table>
<thead>
<tr>
<th>MONTH</th>
<th>TOTAL PRODUCTION (TONS)</th>
<th>PRODUCTIVITY (TONS) PER HECTARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAY-11</td>
<td>405.92</td>
<td>3.206</td>
</tr>
<tr>
<td>JUN-11</td>
<td>374.88</td>
<td>2.961</td>
</tr>
<tr>
<td>JUL-11</td>
<td>491.32</td>
<td>3.880</td>
</tr>
<tr>
<td>AUG-11</td>
<td>785.64</td>
<td>6.213</td>
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<tr>
<td>SEP-11</td>
<td>1,380.36</td>
<td>10.902</td>
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<tr>
<td>OCT-11</td>
<td>1,326.68</td>
<td>10.470</td>
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<tr>
<td>NOV-11</td>
<td>693.88</td>
<td>5.480</td>
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<td>DEC-11</td>
<td>326.96</td>
<td>2.582</td>
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<tr>
<td>JAN-12</td>
<td>159.68</td>
<td>1.281</td>
</tr>
<tr>
<td>FEB-12</td>
<td>87.94</td>
<td>0.694</td>
</tr>
<tr>
<td>MAR-12</td>
<td>120.68</td>
<td>0.953</td>
</tr>
<tr>
<td>APR-12</td>
<td>168.96</td>
<td>1.334</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>6,322.800</strong></td>
<td><strong>48,935</strong></td>
</tr>
</tbody>
</table>

Total Area: 126.62 Hectare

Productivity Per Hectare: 48.935 Tons
PRODUCTIVITY PER HECTARE / MONTH

MONTH | TOTAL PRODUCTION (TONS) | PRODUCTIVITY (TONS) PER HECTARE
--- | --- | ---
MAY-08 | 63.36 | 0.451
JUN-08 | 63.04 | 0.633
JUL-08 | 144.52 | 1.222
AUG-08 | 318.12 | 2.690
SEP-08 | 1,151.92 | 9.740
OCT-08 | 1,551.12 | 13.115
NOV-08 | 773.84 | 6.543
DEC-08 | 526.68 | 4.453
JAN-09 | 216.48 | 1.830
FEB-09 | 216.92 | 1.834
MAR-09 | 405.84 | 3.431
APR-09 | 681.04 | 4.813

TOTAL | 6,002,880 Tons

Total Area 118.27 Hectare

Productivity Per Hectare | 50.756 Tons
PRODUCTIVITY PER HECTARE / MONTH

<table>
<thead>
<tr>
<th>MONTH</th>
<th>TOTAL PRODUCTION (TONS)</th>
<th>PRODUCTIVITY (TONS) PER HECTARE</th>
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<td>MAY-10</td>
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<td>JUN-10</td>
<td>249.28</td>
<td>1.958</td>
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<td>JUL-10</td>
<td>645.12</td>
<td>6.067</td>
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<td>AUG-10</td>
<td>799.00</td>
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<td>1,610.36</td>
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<td>OCT-10</td>
<td>1,354.44</td>
<td>10.637</td>
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<td>NOV-10</td>
<td>691.72</td>
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<td>1.944</td>
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<td>JAN-11</td>
<td>222.60</td>
<td>1.748</td>
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<tr>
<td>FEB-11</td>
<td>143.36</td>
<td>1.126</td>
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<tr>
<td>MAR-11</td>
<td>258.68</td>
<td>2.032</td>
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<tr>
<td>APR-11</td>
<td>493.20</td>
<td>3.873</td>
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**TOTAL 7,196.440 Tons**

Total Area 127.33 Hectare

Productivity Per Hectare 56.519 Tons
From 01-05-2009 To 30-04-2010

**PRODUCTIVITY PER HECTARE / MONTH**

<table>
<thead>
<tr>
<th>MONTH</th>
<th>TOTAL PRODUCTION (TONS)</th>
<th>PRODUCTIVITY (TONS) PER HECTARE</th>
</tr>
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<tbody>
<tr>
<td>MAY-09</td>
<td>425.24</td>
<td>3.442</td>
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<td>JUN-09</td>
<td>439.68</td>
<td>3.626</td>
</tr>
<tr>
<td>JUL-09</td>
<td>653.84</td>
<td>4.442</td>
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<tr>
<td>AUG-09</td>
<td>644.16</td>
<td>5.166</td>
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<tr>
<td>SEP-09</td>
<td>1,231.66</td>
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<td>OCT-09</td>
<td>1,217.36</td>
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<td>3.693</td>
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<td>JAN-10</td>
<td>403.32</td>
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<td>FEB-10</td>
<td>210.08</td>
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<td>MAR-10</td>
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<td>APR-10</td>
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<td>TOTAL</td>
<td>7,309.000</td>
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Total Area 124.70 Hectare

Productivity Per Hectare 58.614 Tons
### PRODUCTIVITY PER HECTARE / MONTH

<table>
<thead>
<tr>
<th>MONTH</th>
<th>TOTAL PRODUCTION (TONS)</th>
<th>PRODUCTIVITY (TONS) PER HECTARE</th>
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<tbody>
<tr>
<td>MAY-12</td>
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<tr>
<td>JUN-12</td>
<td>34.72</td>
<td>0.271</td>
</tr>
<tr>
<td>JUL-12</td>
<td>104.32</td>
<td>0.813</td>
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<tr>
<td>AUG-12</td>
<td>152.05</td>
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<tr>
<td>SEP-12</td>
<td>899.31</td>
<td>7.007</td>
</tr>
<tr>
<td>OCT-12</td>
<td>701.01</td>
<td>5.462</td>
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<td><strong>TOTAL</strong></td>
<td><strong>1,947.214 Tons</strong></td>
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Total Area: 128.34 Hectare

Productivity Per Hectare: **15.172 Tons**
Darwin, Australia back in 2011 perhaps last remaining plantation after Panama wilt outbreak...in 2012 this banana had also gone

This double Row Hedge Grow Banana Plantation Changed the Perception
Signs of Hope ...new management options
## Soil Factor

<table>
<thead>
<tr>
<th>District</th>
<th>Taolka</th>
<th>kg No/det.</th>
<th>Given Ni Variety</th>
<th>Further details</th>
<th>EC</th>
<th>pH</th>
<th>OM</th>
<th>ppm ABTPA-P</th>
<th>ppm ABTPA-K</th>
<th>Particle size</th>
<th>%</th>
<th>T Class</th>
<th>Cu</th>
<th>Fe</th>
<th>Ni</th>
<th>Zn</th>
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</thead>
<tbody>
<tr>
<td>Badin</td>
<td>Matli</td>
<td>T₁</td>
<td>15</td>
<td>G-9</td>
<td>Mulched 0.2</td>
<td>7.31</td>
<td>0.78</td>
<td>3.20</td>
<td>124</td>
<td>44.5</td>
<td>25.00</td>
<td>30.50</td>
<td>Clay loam</td>
<td>0.45</td>
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<tr>
<td>Badin</td>
<td>Matli</td>
<td>T₂</td>
<td>16</td>
<td>William</td>
<td>Mulched 0.21</td>
<td>7.54</td>
<td>0.84</td>
<td>3.42</td>
<td>220</td>
<td>17</td>
<td>47.50</td>
<td>35.60</td>
<td>silly clay loam</td>
<td>0.99</td>
<td>9.50</td>
<td>2.92</td>
</tr>
<tr>
<td>Badin</td>
<td>Matli</td>
<td>T₃</td>
<td>17</td>
<td>Basra</td>
<td>Mulched Fertile soil 0.19</td>
<td>7.5</td>
<td>0.65</td>
<td>6.75</td>
<td>150</td>
<td>44.5</td>
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<td>28</td>
<td>Clay loam</td>
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<td>2.51</td>
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<table>
<thead>
<tr>
<th>ABTPA-extractable (ppm)</th>
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<th></th>
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<td>low</td>
<td>Marginal</td>
<td>adequate</td>
<td></td>
</tr>
<tr>
<td>Cu</td>
<td>&lt;0.2</td>
<td>&gt;0.2</td>
<td></td>
</tr>
<tr>
<td>Fe</td>
<td>&lt;2.0</td>
<td>2.1-4.0</td>
<td>&gt;4.0</td>
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<tr>
<td>Mn</td>
<td>&lt;1.0</td>
<td>&gt;1.5</td>
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</tr>
<tr>
<td>Zn</td>
<td>&lt;1.5</td>
<td>1.5-2.5</td>
<td>&gt;2.5</td>
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Top Quality Cavendish dwarf banana during May & June (soil EC & texture)
Grand Naine Banana in same type of soil and same area

This banana brought 145 tons per ha productivity Last season with Bimat Hedging
Same soil type but in acute irrigation water shortages: Method of Plantation is Bimat Hedge Grow: Cultivar Cavendish dwarf.

In 4 feet wide and 1 foot deep ditches banana performance is extremely good and less water was used than entire field flooding plus it is an ideal setting for Higher Efficiency Irrigation.
Williams banana from March, 2018 to August, 2018 in acute irrigation water shortage with Growth Control Bunch will fall during pleasant weather....Bimat Hedging

April, 2018

May, 2018

17 feet Interrow distance........ Cultivar: Williams

August, 2018

13 feet Interrow distance
Another good soil

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Bore/Location</th>
<th>Depth (Inch)</th>
<th>EC (1:2) dSm⁻¹</th>
<th>pH</th>
<th>OM (%)</th>
<th>N (%)</th>
<th>P (ppm)</th>
<th>K (ppm)</th>
<th>TEXTURE Class</th>
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<td>0.018</td>
<td>0.95</td>
<td>128</td>
<td>Silty Clay Loam</td>
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<tr>
<td>2</td>
<td></td>
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<td>0.43</td>
<td>8.4</td>
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<td></td>
<td></td>
<td></td>
<td>Silty Loam</td>
</tr>
<tr>
<td>3</td>
<td></td>
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<td>8.3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td></td>
<td>0-18&quot;</td>
<td>0.49</td>
<td>8.2</td>
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<td></td>
<td></td>
<td></td>
<td>Silty Clay Loam</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>0-18&quot;</td>
<td>0.53</td>
<td>8.2</td>
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<td></td>
<td></td>
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<tr>
<td>6</td>
<td>Wangran Wara 4 Acres</td>
<td>0-18&quot;</td>
<td>3.48</td>
<td>8.1</td>
<td>0.041</td>
<td>0.002</td>
<td>1.67</td>
<td>69.3</td>
<td>Silty Clay Loam</td>
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<td>0-18&quot;</td>
<td>0.58</td>
<td>8.4</td>
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Feb, 2017 date of plantation with Hybrid hot peppers (Bimat Hedge Grow)

Irrigation Flood
Hybrid Hot Peppers picking then removal in September and bunch falls (No irrigation Water Shortage)

April

June

Sept

November
2\textsuperscript{nd} generation bunches in August 2018
Cavendish dwarf banana and One unknown cultivar locally known as Dhaka

Architect of banana unit
Mutual Canopy, growth control and Natural movement of plants are being tested
From November, 2017 to August, 2018...Grand Naine Hedge Grow
Hedge Grow banana @ growers field and again soil EC
Banana Nutrition

We follow simple formula
For 22 tons per acre productivity (in split application round the year) except December to January (no fertilizer application winter time plus in flood irrigation during winter it takes longer for soil to reach @ wilting point….though nutrition depends upon soil & leaf factors but here is a basic formula

- 8 (50 kgs each) bag of Potassium Sulfate
- 8 (50 kgs each) bags of Urea
- 4.5 (50 kgs each) bags of DAP
- Zinc & Boron twice or once
- Sulfur once or twice

For more productivity per acre more fertilizer will require...

More research is required in that area like DRIS norms etc...

Note: above mentioned name of fertilizers r just for to make calculations easy otherwise DAP & Urea r not being used mostly NP, CAN and SOP
Irrigation

100 percent Flood Irrigation

3 to 4 acre inches per irrigation

Intervals from one irrigation to another varies with year round local weather, soil types and availability of canal irrigation water.

Previously even more unnecessary irrigation water was used for example 5 to 6 acre inches per irrigation with short intervals (8 to 10 days) especially during April to July now it is 3 to 4 acre inches and 12 to 15 days intervals during same period and in some case above 20 days intervals and in some places growers have started using mulching.
August to October above 20 days Interval......November to February above 30 days intervals.

Huge quantity of irrigation was conserved not at all places but atleast in few places....After Turkey one project on banana with drip irrigation is in place @ one grower field
New cultivars
Chinese Banana Cultivar: Pishang
Chinese Banana Cultivar: B-10
Chinese Banana Cultivar: W-11
Banana bunch care & bagging

a. Deflowering
b. Removal of dried bracts
c. Removal of false hands from the base
d. Leaving one or two heroes fingers
e. Removal of male bud with hand
f. Optional: 1.5% SOP +20 ml of APAS80
g. Plastic Diapers
h. Bagging
EMBRAPA in Brazil
Albanian have shown interest to source banana from us
Collaboration with Sindh Agriculture University Tando Jam Sindh Pakistan on banana
Research & Development in collaboration with Sindh Agriculture University Tando Jam, Thanks to worthy Vice Chancellor....

All it happened @ private farm “Asim Agriculture Farm Tando Allahyar Sindh”
Compost “Biofertilizer” with Banana waste, press mud, farm yard manure and rock phosphate
Compost Making From Banana Waste at AAF
Integrated Banana Nutrient Management, SAU Tando Jam Students, One female and One male
P.hD on banana Nutrition have been completed
Different Intercrops with banana, Date palms, bittergourds
Cluster bean, cotton, sesbania
Maize and sunflower
Summary (in our part of world May & June r main culprits for banana)
Suggestions

• We found out that hedge plantation which offers more solution in subtropics than conventional single row 6 feet by 6 feet plantation...with growth control according to soil types, local weather and irrigation water availability...it offers mutual canopy benefits during summer which may help minimize productivity and quality losses plus it offers more no of plants per acre above 1300.

• Spacing.. For bimat Hedge grow two TC plants or suckers r required to make one unit @ 90 degree angle with spacing of 2.5 to 3 feets, one bimat unit to another distance is 8 feets or little more and interrow distance starts from 11 feets upto 15 feets..depending upon given resources no of plants in ratoon can be increased with followers...Individual Units Architect will be key...There can never be a universal formula which suits everywhere but it is worth trying it

• During summer we still prefer Cavendish dwarf and for rest of period Grand Nain and other cultivars
Conclusion

Indepth technical collaborations with regard to Panama wilt, Cultivars, Irrigation, Nutrition, & post harvest r required which means time have changed the fate of centuries old traditions are @ stake better to be fine tuned with scientific knowledge...sooner the better
Thanks