

Progress Report - HG in Tapioca / Cassava

28.6.2010



- **Introduction:**

- Test sites are located in Kanchanaburi, Korat, Khon Khen.
- Test Plantation are small scale farms.
- Thailand is the world largest Tapioca exporter with closed to 31 million ton yearly output.
- Present output per Rai is around 3 ton, but need to reach 5 tones to meet the increasing demand.
- The plant critical stage is in dry seasons keeping insect infestation at bay, otherwise tapioca is a extremely robust plant.
- Planting to harvest cycle takes 8 - 10 month
- Thailand is under pressure to increase its output by at least 25% until 2020, based on the additional demand for Biofuel.

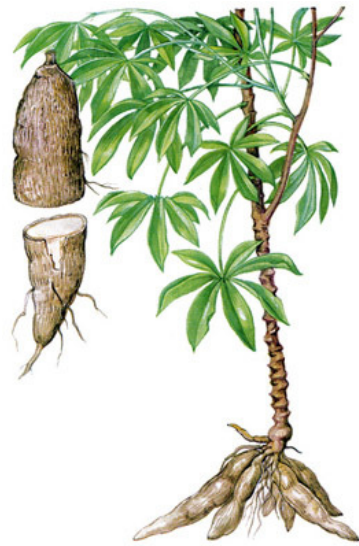
- **Observation:**

- Tapioca farming start with keeping old stems ready for cutting into about 20 cm long pieces.
- As planting is done by the beginning of rainy season, the stems are very often already penetrated with the white Mealy Bug .
- Pesticides are not tolerated by Cassava.
- Around the planting time, the stems are getting ready to sprout and the insects nourish around the young sprouts.
- Once cuts are planted, insects and disease are a danger to stay on with the young plants.
- Especially In dry weather conditions all size of Tapioca plants can be infested and damaged by the White Mealy Bug.
- Tapioca does not except any chemical treatment such as pesticides.

- **Test results with Herbagreen:**

- Mealy Bug infested plants, sprayed with **Herbagreen Protect** (non toxic, non chemical) showed an extreme fast disappearance of the Pest. (14 days)
- To the other extreme, the damaged plants recovered very well and sprouted their leafs in even bigger size than before.
- Plants damaged by the Mealy Bugs, sprayed and recovered by **HG**, developed substantial bigger Roots than usual.
- 2-5 Month old plants sprayed 2-3 times with **HG** also showed an average of over 50 % heavier roots developed than regular fertilized.
- Damaged Tapioca plants, suffering with Yellow Leaf effect (insects damage leafs , expanding within plots in Tapioca field), then treated with **HG** recover in short time and continue a highly dynamic root development.

HG in Tapioca – Stem preparation



Structure
of
Tapioca



Tapioca / Cassava Stems before cutting



Cutting of Stems



Planted Stems with first spray

Pest in Tapioca



Insect free sprouting



Sprout damage from Mealy Bug



Mealy Bug



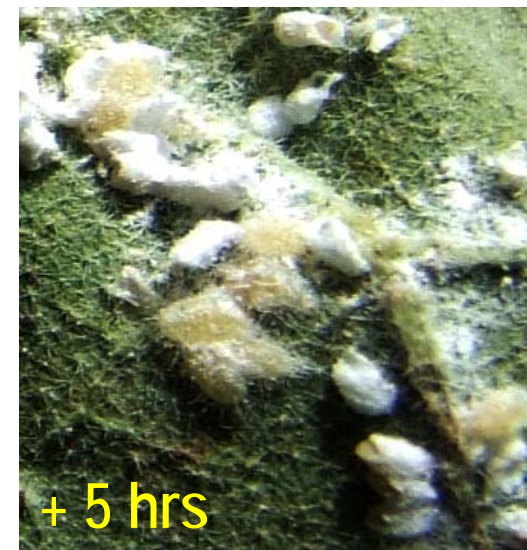
Mealy Bug on Tapioca Stems before planting

Phenacoccus madeirensis – Mealy Bugs

Treatment HERBAGREEN **Protect**



Effect of Herbagreen Protect (experimental)



- Mealy Bug infested leaf sprayed with Herbagreen Protect
- Slow deterioration of mealy bug environment after 30 min.
- bugs falling from leafs, on to their back and dye within 60 min.
- Additional mealy bugs fall to the ground and walk away from bush/plant. They stay in save distance to sprayed bush but dye within the next days from starvation or intestine damage.
- After 5 hours already clear damage happened to the colony.

Herbagreen recovery on Insect damaged plants



Infested Plant, nesting of Mealy Bug .
- damaging leafs and stem –
Stopping growth and destroying plant



After spraying HG Protect, insects just
disappeared or starved to death
Unusually stimulated growth of plant followed

University of Khon Khen



- Visit of infested University Test Plot
- 16.May 2010 observation and test spraying of infested plants with HG Protect.
- 31. May 2010 re-visit and review of improvement. (2 weeks only)
- Sprayed plants recovered very well, White Mealy Bug was gone and plant continued growing very dynamically.



Ampere Dan Kun Tod / Korat Area -Yellow Leaf Problem -



Yellow Leaf damage inside Tapioca field (leaf damage by worms)



Introduction of HG to effected farmers



Improved Plot after 2 month and 2 time HG sprayed



Comparing unearthened plants, - left control, - right yellow leaf damaged but recovered HG plant

Plant comparison of 5 month old plants



Visual and weight comparison of un-earthed plants.

1 plant of Control group, treated by competitor fertilizer (right)

1 Plant of HG group, recovered from yellow leafs, outperformed result of control plant. (left)

Appearance: Control plant and HG selected with same body shape and height. HG has clearly bigger and more roots than C.

Weight: Control plant: 1,8 kg

HG plant : 2,7kg , + 50% to control group



Ampere Ban Pai / Khon Khen

25. Aug. 2010

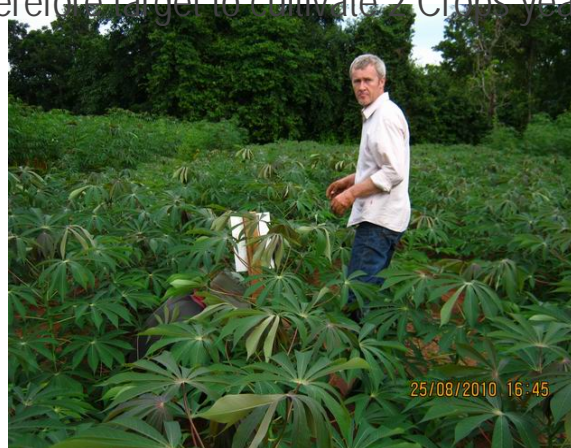


Test Site **LEFT** to middle, - 2 times sprayed - Middle to **RIGHT** followed with 1 spray 1 week ago

Farmer observed a faster growth of Cassava and better developed roots. He expect to reduce the growth time from 8 month down to 6 and therefore target to cultivate 2 Crops yearly by using Herbagreen



5 ½ month old plants, 2 times sprayed, ready top harvest in size



Height of 2 month old HG plants



Roots of 2 month old plant - sprayed 2 times by HG are much better developed than usual

5 ½ month old plants



Plant age 5 ½ month; 2 time sprayed only; first spray at age of 3 month, 2nd spray at 4,5 month; weight difference of same age and size of plant : HG+ 58% to Control plant !
At next crop cycle farmer will use HG from the beginning.



Ban Pai 2nd Plot, test field recovered from Mealy Bug



- test field has been damaged by Mealy Bug
- damaged plants sprayed with Herbagreen Protect
- 2nd spraying with Herbagreen Basic
- test field recovered, Pest stopped and Roots developed further, even so plants didn't grow to full size
- harvested unusual many well developed roots / plant
- harvested unusual long roots / plant
- farmer received from this remaining 2,5 rai field the same yield than from last years harvest on 4 rai !



Intermediate Starch test: Control plant against Herbagreen



- Control: 7 Month of age
- No Herbagreen used
- 23% Starch content only
- too much fiber content



- Herbagreen: 7 month of age
- 1 time HG applied
- 25% Starch content
- 8,7% more Starch
- good thin skin
- even tapioca, low fiber content



Starch test: Herbagreen 7 month and 3 time application; Control plant 12 month



- Herbagreen: 7 month of age
- 3 times applied
- 28% Starch content
- 22 % more starch than same age in control plant
- very good overall quality



- control: 12 month of age
- 29% Starch content
- left picture: lower part Control, upper part Herbagreen Tapioca

	Control, Age:7 month	HG, 1 spray, Age:7 month	HG, 3 spray, Age: 7 month	Control, Age: 12 month
STARCH	23%	25%	28%	29%
INCREASE		+8,7%	+22%	
STANDARD		7 – 10 month 23-25%	10 – 12 month 25-30%	Over 12 month Starch is rerducing

HG usage in Cassava



1. Dip / soak Cassava cut-stem 1 to 2 hours in 0,3% **HG** solution; or 300 gr. **HG** mixed with 100 liter of water.
2. Dried cut stem, protect with termite / insect prevention.
3. First spray when Cassava developed 4 leafs with size of 8-10 cm diameter.
(good uptake when **Hg** sprayed on)
4. Mixture should be 300 grams **HG** per 100 liter of water.
5. Best practice and maximum growth is by spraying **HG** every 3 weeks.
6. Use machine able to produce fine fog when sprayed on.
7. Spray fog upward into plant (spray under-face of leaf), where 70% of uptake happens.
8. In case of Grass need to be killed, spray 3-4 days after Grass died off **Herbagreen**. (will immediately recover stress for Cassava and continue growth)
9. Fertilizer usage should be reduced by 70%. (Fertilizer uptake is maximized by **HG**); example: instead of 3 time, use only 2 times but also less.

Best practice in Cassava cultivation (Thai Agriculture Department mixed with HG practice)



- Prepare soil in overturning into Ripper layers, 50-60 cm deep. (1st time length side and 2nd width side plowing)
- Improve the soil condition by humus (Feces mix with chaff).
- Select the Cassava strain suitable for the area example Huaybong 60(หัวบง 60) , Huaybong 80(หัวบง 80) , Rayong 9 (ระยอง 9) , Keawplodne(CMR35-22-196) the age of cassava strain should be 8-12 months.
- Prepare the cassava stem by using the middle part and cut it to lengths of 30-50 cm.
- Dip / soak Cassava cut-stem 1 to 2 hours in a 0,3% **Herbagreen** solution; or 300 gr. **Herbagreen** mixed with 100 liter of water.
- Dried cut stem protect with termite / insect prevention.
- The distance for planting is 1 x 1 m or 1.2 x 0.8 m , deepness is around 20 cm.
- First spray **Herbagreen** when Cassava developed 4 leafs sized 8-10 cm diameter.(able to uptake **Herbagreen** when sprayed on)
- Best practice and maximum growth is by spraying every 3 weeks **Herbagreen**.
- Use humus every 2 months.
- Give water to cassava for the first 1-2 month (once a week)
- For Nitrogen supply , plant Beans together with Cassava. Cut them down for Nitrogen release when blossoming. Distribute the cuts on the soil for keeping moisture and limit grass growth.
- In case of Grass need to be killed, spray plants 3-4 days after Grass died off with **Herbagreen**. (will immediately recover stress for Cassava and continue growth)
- In case Fertilizer are used, reduced them by 70%. (Fertilizer uptake is maximized by HG); example: instead of 3 time, use only 2 times and - less.
- Prevent chemicals to control grass, do it by people.
- In case of Mealy Bug outbreak, use **Herbagreen** protect only.
- TARGET: 30 ton per Rai.

Best practice in Cassava cultivation (Thai Agriculture Department)



- They have 9 conditions to get more harvest.
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- Turn over the soil in Ripper layer, deep 50-60 CM. 2 times (1st time length side and 2nd width side)
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- Improve the soil condition by humus (Feces mix with chaff) or use organic fertilizer 2-3 tons/rai.
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- Select the Cassava strain suitable for the area ex sample Huaybong 60(หัวบง 60) , Huaybong 80(หัวบง 80) , Rayong 9 (ระยอง 9) , Keawplodne(CMR35-22-196) the age of cassava strain should be 8-12 months.
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- Prepare the cassava strain, use in the middle part, should be use the saw off length 30-50 cm have spot around 5-7 spots and put it in hormone for the root grow too fast.
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- The distance for plant 1 x 1 m or 1.2 x 0.8 m , plant vertical and deep around 20 cm.
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- Use the humus every 2 months and spray with organic fertilizer every 15 days.
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- Give the water to cassava first 1-2 month (once a week)
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- Put the Nitrogen to the soil , plant the bean together when plant the cassava and cut it down when blossom to lay on the soil to keep the moisture and control grass.
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- Don't use the chemical and control grass by people. If brake out for (Pea-Pang) have to use Beauria bassiana to spray.