2012 Oct SEMOC Visit – Report

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Seed Production Field Visits:

Zembe:

1. 18 hectares of seed potatoes planted in mid to end of July. Only whole seed planted; no seed cutting to reduce threat of transmitting diseases during cutting. – ***This planting date is very late and greatly responsible for low productivity in these fields. Yield is approximately 9-11 Tons/ha. With early planting (late March-early April) the yield of BP-1 in Susundenga field of a non-SEMOC grower was 25 Tons/ha.***

2. For irrigation with drip system, the field was divided into 3 Blocks (1, 2 & 3); each with sections of 2 ha. Drip irrigation of 6 ha at one time – Main line sub-divided into 3 sub-lines and then fed into each row of 2 ha section.

3. According to the field agronomist, the central 2-ha section got least pressure and thus was irrigated less than the other outside sub-sections.

		Drip Irrigation	
Block 3	2 ha 700 kg/ha 12-24-12 160 kg/ha Urea Liquid Carbon	2 ha	2 ha
Block 2	2 ha 500 kg/ha 12-24-12 100 kg/ha Urea		
Block 1	2 ha 1000 kg/ha 12-24-12 100 kg/ha Urea		

4. Blocks were fertilized slightly differently from one another.
    a. Block 1: NPK (12-24-12) 1000kg/ha at planting, and 100 kg/ha urea at the time of ridging/hilling. Pesticides spray was 10 times at 1 week interval, with fungicide + insecticide together most of the times.
        i. Fungicides used: Mancozeb, metalaxyl, chlorothalonil and Cupravit.
        ii. Insecticides used: Dimethoate, cypermetrin, Fortis-K, Chlorpyrifos, Agromectin
    b. Block 2: NPK (12-24-12) 500kg/ha at planting, and 100 kg/ha urea at the time of ridging/hilling. Pesticide (fungicide + insecticide) sprayed 11 times.
    c. Block 3: NPK (12-24-12) 700kg/ha at planting, Liquid Carbon and 100 kg/ha urea at the time of ridging/hilling. Pesticide (fungicide + insecticide) sprayed 9 times.

5. Visited the Zembe field on 17th and 18th of October, and made the following observations:
    a. Most plants were dead, and were infested with Red Spider Mites. These sap feeding mites are favoured by hot and dry conditions, as in October. Use of miticides, in permethrin, organophosphates, carbamates groups, is recommended. Abamectin (antibiotic insecticide) is reportedly effective; efficacy may depend on severity of infestation and number of sprays. Repeated use of pesticides leads to quick development of pesticide resistance in mites.

Red spider mites

    b. Some areas still had green plants but were affected with leafminer insect damage. The adults lay eggs in the leaves and larvae burrow tunnels in the leaf. The leafminer insect (*Liriomyza huidobrensis)* has been found to be resistant to many insecticides (organophosphates, pyrethroids etc) in South Africa. It is possible that in Mozambique also the insect is resistant to many insecticides.

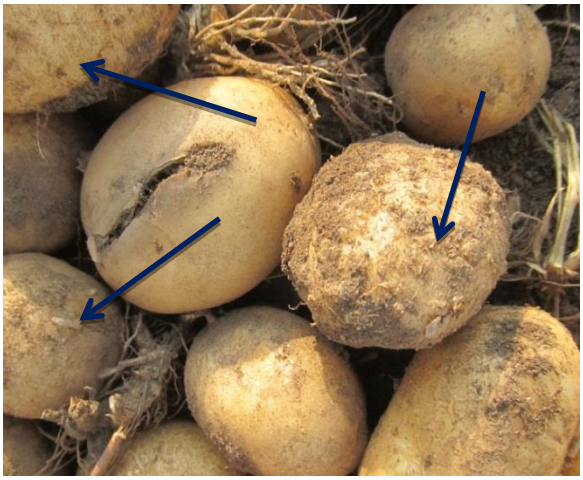
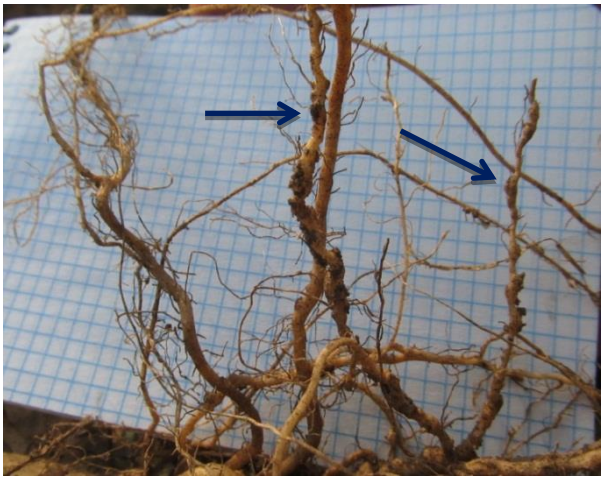
Leaf miner damage *Adult leafminer*

c. Tuber numbers per plant ranged from 3 to 8, often many of them were damaged with insect borers. Larva seen in a few cases. In Feb 2012 (previous visit) adults of potato tuber moths were seen flying in the seed storage. So it is possible that many of the tubers are infested with tuber moth eggs.

Oct 2012 Field Tubers with larvae

Potato Tuber moth on wall of storage; Moth infested tubers in storage. Feb 2012

d. Could not determine occurrence of any foliar disease, because the plants were either dead or in advanced stage of senescence.
e. Many tubers and some plants appeared to have swellings/bumps consistent with Root knot nematode damage. The sandy soils of Zembe fields could support high populations of root knot nematodes. A soil test could confirm the level of infestation.

Nematode infected tubers and roots

f. The harvesting of the Zembe fields started in mid-October and to-date about 14 ha has been harvested out of 18 ha.
g. A 2-row digger with one of two chains was broken. The replacement chain had been ordered (now about 2 weeks ago). About 1 ha is being harvested daily – with 9-11 one-tonne boxes being sent to the storage in Chimoio (30km away) by tractor.
h. The temperature of tubers during the day has ranged from 26°C early morning to 35°C in the afternoon.

i. On arrival at the storage facility, the seed is kept in a warehouse with ventilation, to cool down the potatoes.

j. It took 2-3 days to bring down tuber temperatures to 25-26C; they were then graded to remove rots; insect damaged or physically damaged tubers were separated for sale at discount.

k. The grading system sorts the tubers in undersize, oversize and with size grades (30 to 55 mm). ***– I have advised that the under and oversized good quality tubers be kept for SEMOC's own seed planting for next year. This will reduce cost of seed purchase and also allow timely planting of many fields.***

l. The 2nd chain of this digger broke a few days ago and now the harvesting is being done by hand implements (about 1/3rd ha per day is being harvested by hand. If the digger(s) are not fixed – the remaining harvest of Zembe field could take 10 more days. This is not a good situation – *due to high temperatures the risk is increasing for higher losses due to tuber rotting*.

6. Limitations at Zembe:
   a. Late planting. Optimal time would be late March to mid-April.
   b. Irrigation – middle sub-sections in all 3 blocks had lesser water.
   c. At planting 25°C but no rains
   d. Insects: Red spider mites, leafminers, potato tuber moth damage
   e. Harvesting in hot conditions, a lot of rotting due to insect borer damage
   f. Digger problems – only 1 chain of 2-row digger was working initially; then the 2nd chain also broke. Harvesting by hand is very slow and getting into hotter weather.

Revue Farm, Susungdenga, Gondola District:

1. About 2 ha planted on June 16 after receiving seed on the 14th. Another batch of seed was received later and 1.3 ha planted late on 20th of July.
2. Mainly BP-1 planted, some Avalanche for testing.
3. Fertilizer: 800 kg/ha NPK 12-24-12 broadcast before planting, and 200 kg/ha urea at the time of ridging/hilling.
4. Irrigation by ground – channel flooding. Not enough capacity. Problems in irrigating regularly.
5. Pesticides: 8 times with fungicide & insecticide mix. Fungicides and insecticides similar to Zembe fields.
6. Limitations at Revue:
   a. Late planting, optimal time would be late March to mid-April.
   b. Irrigation – could not keep up.
   c. At planting 25°C but no rains
   d. Insects: Red spider mites, leafminers, aphids
   e. Harvesting in hot conditions, a lot of rotting due to insect borer damage

Heavy aphid infestation of leaves.

Vanduzi:

1. 10 ha planted; but according to Aaron (the farm incharge) the area could be around 15 ha. 34 tons of seed planted. It means the seed was planted further apart. 37,000 plants /ha.
2. 3 varieties – Avalanche and Lilomile were being trialed on a small scale; BP-1 was the main variety.
3. Planting 16 June to 12 July – BP1. Avalanche and Lilomile planted on 28 June.
4. Fertilizer: 500 kg/ha 12-24-12 NPK, 250 kg/ha urea at time of ridging/hilling (1 &1/2 month after planting).
5. Pesticide sprays – similar to other 2 farms, only 5 times.
6. Early planted plants appeared to have 1kg tubers/plant but late planted plants had about 200 g tubers/plant.
7. Fewer tuber borer problems, a few patches appeared bare due to nematode damage – bumps on tubers and roots seen.
8. Red spider mites, appeared to be a major cause of early senescence of many plants. Hot dry conditions favor the mites.
9. Soil was very dry and there were many clumps/ clods. These rock hard soil clods can damage tubers during harvest. Irrigation systems was removed by the landlord, just a few days ago. If irrigation was provided, it will help mellow/soften the soil for easier harvest and may also cool the tubers.
10. Harvesting will begin when a digger is available. Too many hectares to harvest by hand.
11. Limitations:
    a. Late planting of crop.
    b. Irrigation not available till near harvest.
    c. Mites and nematodes could be an issue.
    d. Tubers will be hot during harvest.
12. Aaron (farm in-charge) appears to be quite knowledgeable about potato crop.

Manica:

1. Visited a grower's potato field – 3 ha, first attempt at potato production

2. Able to irrigate using flood irrigation from a mountain stream
3. Fertilizer 1200 kg/ha 12-24-12 NPK and 500 kg/ha urea.
4. Pesticide applications done
5. Planted in mid-July – harvested 20 October. Approx. yield = 2.5 Tons/ha ☹
6. 2nd batch planted in early August !! Waiting for plants to grow.
7. Limitations:
    a. Seed received from Agriculture Dept in mid-July!
    b. Potato borer damage low, but present.

Proper Storage of Potatoes
(Observations and Recommendations)

1. **Potato crop should be harvested before the air temperatures get above 30°C. This will probably before end of September.** The fields to be harvested should have plants dead and dry for 10-14 days before digging – this allows for good skin set.
    a. The fields are being harvested towards the end of October; not even 50% harvested yet.
    b. Air temperatures are around 32-35°C; tuber temperatures recorded at 32 to 35°C coming from the field.
2. After digging the tubers should be collected and put into the 1 Ton wooden pallet boxes (currently being used). The wooden pallet boxes appear to be of good quality.
3. Since the potatoes are being picked by hand, there is enough time for the potatoes to dry (field soil moisture). If the field is wet, the air may help drying. Best to have dry tubers and not wet when putting into boxes.
4. During transport the boxes MUST be shaded from direct sun. Heating of the potatoes can create storage problems.
    a. Very warm potatoes need to be cooled down before going to cold storage bins. It has taken 2-3 days to bring down tuber temperatures to 25-26°C.
    b. Seed delivered from Zembe was not covered
5. Once in Chimoio facility, the seed boxes should be put in a shaded building with good air movement to cool down and dry the tubers – this may take 1 to 3 days, depending upon the outside air temperature and humidity.
6. **The tubers should be graded as soon as possible, and then put in 15°C bin (room) with 95%+ relative humidity.** This will help heal wounds from grading and get the tubers ready for colder temperature storage.
7. After 7 days in 15°C room with 95%+ RH for the last box(es) or bags put in, the temperature of the room should be brought down slowly (over 7-10 days) to 3°C. High humidity (95% +) must be maintained all the time. Below 90% shrinkage losses are high.
8. Fogger fans, misting nozzles or humidi-cell are some good options for humidification of a storage room. ***It is extremely important to invest in humidifiers to prevent shrinkage losses.***

9. It is very important to have air circulation in the potato storage; otherwise there could be condensation on tuber surfaces. Free moisture on tubers often leads to various diseases to develop on tubers – silver scurf, Fusarium dry rot and soft rot are the important diseases which increase due to moist tuber surfaces.
10. **It is critical to have stable temperature regime in the storage room.** Temperatures going up and down reduce the dormancy of the tubers, and lead to early sprouting in storage.

Observations for the Storage:

1. Potatoes are coming hot from the field, and this leads to more tubers rotting within 1-3 days (to cool potatoes) and to wait for sufficient seed volume to run the grading system for a day and to use labour efficiently

2. A simple good knife is not available to cut and check tubers. The staff had to use sides of equipment to smash open tubers or use pieces of tin to cut! Some staff just had to buy their own after I repeatedly asked for a knife!

3. There were no disinfection trays for shoes; staff working on rotten-potatoes tractor was coming into the clean storage area without cleaning shoes. This is potentially

a serious source of contamination of good seed. *Trays with disinfectant was put near the storage entrance on 25th of Oct.*

4. Currently there is ability to provide humidity only in one room, with one misting nozzle in the air circulation system and by putting water in the air channels in the floor. This is NOT sufficient to raise relative humidity (RH) to 95% (at this level the shrinkage loss is significantly reduced). This bin has 88% RH.
5. In other rooms the only way humidity can be raised is by filling the air channels with water, regularly. This is insufficient to raise RH to desired levels. There can be a potential shrinkage due to water loss from tubers to the level of 10 to 15%. This is direct 10-15% loss of money.
6. The fresh air intake and discharge of air with higher CO_2 is manual – this should be made electrically controlled; preferably with a CO_2 sensor (when finances permit).
7. The grading line is very new and good. But insufficient supply of seed potatoes for processing prevents efficient use of the good facility. This is primarily due to 2 diggers out of operation – and no facility close by to fix. It is important to keep spare parts of some critical items. This prevents down-time (i.e. no work being done when the machines are in-operative.
8. In a similar manner, I noticed that the potato grading lines have many motors and gear systems – it is important to have at least 1 or 2 motors as spare.
9. There should a maintenance program in place for all critical equipment. All maintenance should be recorded in a ledger / journal, so equipment can be kept in working order for longer periods.
10. The fork-lift with rotator (for unloading potato boxes) has been out of service and has not been used for this season. This has led to using one forklift for doing all operations. Unloading of the seed boxes is done by breaking open the side boards towards the bottom of the box.

Cleanup of the potato grading line:

1. Potato grading line MUST be cleaned after every lot and when a variety is changed. This cleaning prevents disease problems from one lot from passing to the other lot.
2. Cleaning protocol in brief (if possible, this should be posted on the wall of the grading area for all staff to see:
    a. The equipment must first be wetted with water and mud scrapped off from very dirty areas.
    b. In dirty parts (before dirt remover) - this should be followed with a water wash to remove soil and big tuber pieces stuck in various parts of the grading line.
    c. After water wash, the whole line should be cleaned with water + soap. This should be followed with a spray of disinfectant.
    d. Sufficient time (at least 30 minutes) should be given for the disinfectant to work before next batch of grading starts.

SWOT: General Observations about the SEMOC potato program

STRENGTHS:

1. There is no competition for cold storage facility with any other company. SEMOC should exploit this capacity.
2. Seed planting Angonia, Tsangano, and Lichinga can be a big market for November planting. SEMOC must exploit this potential market.
3. This also requires early planting and harvesting in August.

WEAKNESSES:

1. Lack of technical knowledge about potato production and seed storage.
2. Information provided for seed potato production was not followed through, especially timely planting
3. Not enough work done to provide humidity in the storage rooms for better seed storage.
4. Little information or knowledge of market competition – was not discussed much.
5. Ordering for seed from South Africa, the tissue culture lab in Maputu not used to initiate early generation seed for SEMOC.
6. Seed potato crop not planted in time.
7. Director / Manager Agronomy not on site for constant work with the field agronomy staff and making timely decisions
8. Equipment maintenance and repair is not scheduled. Unfortunately, some critical equipment have been unavailable during harvest.
9. Lack of apparent interaction with CIP potato production staff; they seem to have work agenda independent of SEMOC.
10. There appear to be financial constraints in the system; else there would be easier access to funding or timely funding minor purchases, not just capital items.

OPPORTUNITIES:

1. Not enough seed produced or available within the country
2. Import substitution will save significant amounts of foreign exchange
3. There are new potential seed producing areas in the hills nears Chimoio, for summer planting (November – December) when there is sufficient rain water available.
4. New market possibilities for SEMOC within Mozambique - Angonia, Tsangano (Tete province) Lichinga (Niassa province).
5. Need to set up demo plots to promote SEMOC produced seed.
6. CIP (International Potato Center) Mozambique office is located within the SEMOC facility. Dr. Dieudonne Harahagazwe, Seed Systems Specialist works from this office. In a brief discussion with him – he sees potential for seed supply for Nov-Dec (summer) planting in the hills, the northern provinces of Mozambique. But he will not discuss details – said needs official request for information.
7. There is 400 kg old seed in storage which should be used for November planting in the hills. There are 2 benefits from this
    a. Testing the hill area production in summer and

b. If there is production, it will save SEMOC from buying that much seed (hopefully enough for 1 hectare).

THREATS:

1. New companies from Portugal and South Africa trying out seed production.
2. Lack of in-depth knowledge of field seed production, disease and insect pest problems. Soil analysis for nutrient needs not done.
3. Inability to perform timely field operations – mainly planting, which delays harvesting. Delayed harvest leads to hot conditions during harvesting, and eventually storage losses due to rots.
4. Lack of in-house ability to fix large field equipment in a timely manner.

KEY RECOMMENDATIONS:

1. Technical staff may greatly benefit by exposure to advanced system of production and storage management. Arrangements could be made to visit some farms and storage facilities in the US or a European country. It may be possible that South African potato industry may not want to train or provide technical information to SEMOC staff (a potential competitor in the making).

2. It is critical to have timely orders for seed from South Africa (or other exporter) so that seed crop is planted in Manica area by late March to mid-April. Just this change could double production from 2012 levels. Timely decisions can be initiated only by the senior management and with finance department's cooperation. Timely planting will allow timely harvest and significantly reduce storage rot and shrinkage losses.

3. It is critical to add humidification system in storage rooms – this can be simple misting nozzles to improved and automated fogging systems. It is important to heal tubers at 95%+ relative humidity, else storage shrinkage losses can be high and the tuber dormancy is shortened (sprouting before seeding time).

4. Fresh air inlet and exhaust of old air could be automated to be on timer or based on CO_2 level sensor. Currently, fresh air inlet is opened manually.

5. Soil analysis for nutrients to adjust fertilizer inputs.

6. Use of soil insecticides to control potato tuber moth and nematode infestations – major problems in production areas.

7. Increase utilization of storage capacity to reduce fixed cost per tonne of potatoes. This could be achieved by increasing SEMOC's productivity per hectare, increased seed acreage and also by use of contract growers. Contract growers share the risk of production losses. Previously, some of the seed contracted to growers was diverted to open market, and may partly be due to better prices in the open market for fresh potatoes than the price SEMOC could be offering to buy their seed. Increased utilization may also be achieved by buying and storing fresh/table/ware potatoes for a few months – say till December-January when prices are high. Four bins could be kept at 12-15°C store table potatoes. Sprout inhibitor chemical like CIPC should not be used in the same facility due to seed also being stored in near-by bins. However, use of certain dormancy enhancing chemistries could be explored.