KNOW-HOW 3000

Good Practice *IN DETAIL*

Growing Tomatoes on Contaminated Soils

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Young Africa Agri-Tech
2020

HORIZONT 3000
AUSTRIAN ORGANISATION FOR DEVELOPMENT COOPERATION

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Experience in Detail
"Growing tomatoes on soils contaminated with bacterial wilt (Ralstonia solanacearum)"

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1. General Information

Name, address and geographical region of the organisation or institution

Country: Mozambique;
Organisation: Young Africa Agri-Tech, Dondo, Macharote, Sofala

Purpose of the institution and area of work

Young Africa Agri-Tech is an agricultural training centre for disadvantaged youth. We operate a 200-hectare training farm and offer a range of vocational/agricultural courses. We raise pigs, cattle and chicken and have fields and greenhouses where we grow crops for training purposes as well as to generate income for the centre.

Name of the experience

The experience presented here is titled “Good Practice: Growing tomatoes on soils contaminated with bacterial wilt (Ralstonia solanacearum)”

When was this experience made?

The project started in 2019 and is still ongoing in 2020.

Geographical range where the experience has been made/ the practice is applied

The experience has taken place in Dondo, Mozambique, where the Young Africa Agri-Tech centre is located. There’s hope that the technique applied will spread in the area.

Figure 1 (Source: Google Maps)

Why is this experience relevant?

The experience is relevant, since it might be useful for other organisations as well. Dealing with bacterial infections of soils is quite common, above all in humid tropical areas.

This experience is a good practice example for growing tomatoes on soils contaminated with bacterial wilt.

2. Context of the Experience

Bacterial wilt (also known as Southern Wilt) is a common disease of tomatoes and other solanaceous plants almost all over the world, especially in the tropics. It is caused by a bacterium called Ralstonia solanacearum, which clogs the vascular system of tomato plants and prevents the transport of water and nutrients within the plant. It is transmitted through infected soil. Symptoms are severe wilting and death without yellowing of leaves but with brown discoloration and decay visible in the stem. (see: Bacterial wilt. entoweb.okstate.edu). The first signs of wilt show up in the young leaves. The disease also affects bell (green) peppers (Capsicum annuum) (www.pestnet.org)

We have had considerable problems with this disease here at Young Africa Agri-Tech farm. Several times in the past, the tomato crop failed completely, both in the field as well as (more recently) in newly installed plastic-tunnel greenhouses. We also lost some bell peppers due to this disease but to a lesser extent. The local population grows tomatoes and other vegetables as a cash crops and farmers rarely know why plants are dying.

Another serious disease problem here, especially in field tomatoes is the Septoria spot fungus, which can however be prevented by fungicidal sprays which most growers know how to use, while control of bacterial wilt is much harder and unknown to small farmers.

First experience with the wilt problem: Tomatoes (varieties Romana, Thomas and Cereja) were transplanted into fields and inside of an 18 m long polytunnel greenhouse (installed by IDE, Brazil) in October 2019. Temperatures were very high during the time of first planting, well above 30°C outside during the day and of course even hotter inside the tunnel. The plants grew quickly at first, but they soon showed signs of wilting. Water stress was suspected at first but after examining the plants closely this seemed not to be the case as all had enough water and some plants still grew normally. A lack of drainage was not

encountered either. Checking the symptoms, it looked rather like bacterial wilt.

The diagnosis was confirmed by cutting the stem to see the characteristic brown discoloration of the xylem and applying the ooze-test method. (Ralstonia solanacearum Projects.ncsu.edu). Practically all plants started to die after a few days and had to be removed, no fruit could be harvested.

Brown discoloration in stem of tomato plant infected with bacterial wilt

3. Development of the Good Practice

To solve the problem a trial was made with tomatoes a few weeks later as the new farm manager and H3 counterpart, Benito Quembo started at Agri-Tech. He had previously grown tomatoes in plastic sacks. Thus, it was decided to see, if this would work on a larger scale as well to control bacterial wilt on the farm. Tomato transplants were transferred into porous bags (repurposed bags of animal feed) and filled with compost and soil from further away fields (where tomato had not recently been grown). The bags were placed upright onto the ground (soil) within the same polytunnel, which was very likely still to be heavily contaminated with Ralstonia.

The result was much better this time, the plants grew well, but a few soon showed signs of wilt again. Temperatures were not quite as high during that time of the year – hardly reaching 30°C so heat stress could be ruled out.

Many of the plants grew well and fruits reached harvest size so it was concluded that bacterial wilt from the soil was blocked considerably by the bags alone, but this was not perfect as too many plants still developed the disease.

Bags placed directly on the soil inside a foil tunnel

4. Main Characteristics of the Good Practice

A further tomato crop was planted in April 2020. This time half of the bags were place upright onto a black, thick plastic sheet which covered the ground below. The other seeds were also planted in bags but placed again directly onto the soil below.

This time bacterial wilt hit all plants within the bags which had not been placed onto a plastic sheet (probably the because bacteria multiplied during previous trial), while those which were on the plastic sheets grew normally and stayed healthy.

The conclusion drawn was that the plastic sheet provided a barrier which prevented the wilt bacteria to get through into the bags. On the other hand, the ones placed directly on the soil now managed to get into the bags probably due to the build-up of the pathogen in

the soil and due to the pores of the bags which are needed for drainage.

Plastic sheets between soil and bags served as a barrier to stop bacteria

Further tomatoes were planted in bags outside along the greenhouses. They grew much slower but suffered less from bacterial wilt. They, however, were heavily infected with Septoria chocolate spot fungi (Septoria lycopersici) after a rainy weekend instead, which destroyed most foliage after just a few days. It was too late to spray. Some tomatoes still reached maturity, albeit with much reduced total yields as many smaller fruits and flowers could no longer develop. Inside the greenhouse next to them we had hardly any Septoria disease.

On the left, infected plants in bags placed on the soil. On the right healthy plants placed on plastic sheet.

Close-up of an infected plant

Close-up of a healthy plant placed on top of plastic cover

Harvest

Latest planting method

Tomatoes are now planted in bags on slightly raised beds of soil covered with a plastic sheet. Bags are filled with a soil/compost mixture and closed with a needle and thread.

Now bags are placed flat onto the sheets and 3 holes cut into each sack to insert one tomato plant each.

Closed bags are placed flat onto the plastic sheets under shade cover

A drip irrigation pipe is watering the tomatoes through the 3 adjacent holes. The plants are later pruned and supported by a trellis wire and a string to allow them to grow higher.

It is indeed possible to grow tomatoes even if the soil is heavily contaminated with bacterial wilt, but it requires quite a lot of labour inputs. It is ok for small scale operations, since it doesn't require a lot of capital and is easy to do.

We had much better results as all plants stayed healthy and we hope to achieve the same in the future by using such precautions.

It remains to be determined how often we need to replace the soil in the bags or if pasteurization or sterilization of soil could be a viable solution.

One problem occurred with the procurement of bags, as we soon ran out of supply. We only get new bags every time we buy feed for animals, but we need many more. So, we asked students to collect bags in the community by incentivizing them: the student who brings along the most bags will receive a simple mobile phone. This is how we were able to collect well over 120 bags in one week.

5. Stakeholders & Partners

Stakeholders: Young Africa Mozambique, students, employees, franchisees, local community, farmers, local government, provincial government, local entrepreneurs a.o.
Partners: ADA, Horizont3000, IDE, GIZ

6. Resources

Infrastructure; hostel for boys and hostel for girls, training/production workshops, classroom facilities, 200 ha farmland, buildings, sheds, animals (24 cattle and around 85 pigs), a Nissan Pick-up truck, bus, lorry, tractor, machinery and equipment etc.

7. Validation Process

The practice will continue, and a longer-term evaluation will be done.

8. Impact

The tomato production generates income for the centre. Great reductionof inputs such as seeds, fertilizer and pesticides as compared to the previous planting system, which incurred in complete loss of the capital invested. This can also help other farmers in the area by adopting the practise.

9. Lessons learned

It is indeed possible to grow tomatoes even if the soil is heavily contaminated with bacterial wilt, but it requires quite a lot of labour inputs. It is ok for small scale operations, since it doesn't require a lot of capital and is easy to do.

10. Sustainability

The new practice requires only few additional resources in comparison to normal tomato growing, i.e. readily available plastic sheets and porous bags. The plastic sheets and the bags can be reused, but will of course constitute a certain hazard to the environment once discarded. They therefore should be collected and disposed properly. Other, biodegradeable, materials could be considered instead depending on availability. The main problem with the new practice is a relatively high labour input. Since daily wages for farm workers rarely exceed 2$ per day and unemployment is high, jobs can thus be created. Planting in plastic tunnel greenhouses is optional as the practice can also be used outside in shaded areas.

11. Experience Sharing/ Up-scaling

We are sharing the experience with our agricultural students who are mostly from a rural background of families with small farms. They can learn from this practice and easily apply it on their own land.

12. Links & References

Local organization:
www.youngafrica.org
Bacterial wilt.
www.entoweb.okstate.edu
(retrieved 18. 6.2020)
Fact sheet-tomato bacterial wilt (146)
www.pestnet.org (retrieved 15. 6.2020)
Ralstonia solanacearum Projects.ncsu.edu
(retrieved 20. 7.2020)
Bacterial wilt www.entoweb.okstate.edu

13. Action Plan for Learning

Practical training makes up 70% of the YA agricultural curriculum, thus the students will be trained using this practise as soon as the Covid-19 epidemic allows us to reopen the school. Theoretical background will also be taught during plant production classes. Visitors to the farm are also able to see this project. This should ensure wider dissemination of the practice.