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TEST-RUN ON THE USE OF MICROBIAL BIODIVERSITY AND POTASSIUM NITRATE TO IMPROVE PRODUCTION AND USES OF CASHEW IN MOZAMBIQUE

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INTRODUCTION

- The majority of cashew trees in Mozambique are more than 50 years old.
- The nutritional state of the cashew trees in sandy soiils are extremely precarious
- Oidium and helopeltis are the disease and the pest that affect the productivity of cashews
- Only about 50% of the trees are covered by the chemical program to control the pest and disease.

MOZACAJÚ
SHARED VALUE FROM TREE TO TRADE

- A joint-project of the Aga Khan Foundation and Technoserve for a 3-year period. This started in March of 2014. The donor is the USDA with the objective of increasing the industry efficiency and productivity in Mozambique.

- Technoserve is in-charge of market development and processing and the Aga Khan Foundation is in-charge of improving agricultural productivity of the cashews.

Test-Run of 2 Complementary Techniques To Improve Productivities of Old Cashew Trees

(Test Run: An exercise to put a machine or a system in a series of actions under actual conditions or simuulated environment and operations to determine its status or verify the reliability of its functions and capacities for a proposed set of work.....*Business Dictionary.)*

- **Microbial Biodiversity**: A cocktail mix of several known groups of beneficial microbes. (The first line of defense aside from genetic resistance against pests and diseases.)
- **Nutrition**: This was Potassium Nitrate. A foliar application, of Nitrogen and Potassium, elements easily leached and washed off in sandy soils. Cashews are mostly in the sandy coasts of Mozambique.

BN Regimen (Biodiversity and Nutrition)

Objectives of the Test-Run for BN (Biodiversity and Nutrition)

- Improve the productivity of cashews at acceptable levels and at low costs
- Have a system that producers can do on their own to control of pests and diseases
- Have an efficient system for producers and service providers for cashew spraying
- Reduce the costs of pest and disease control using locally available materials

Effective, practical, efficient, low cost, available

Functions of the BN Treatment

This is where in one application we have:

- A foliar fertilization (nutrition) function
- Flowering induction (and homogenization),
- A protection function (to reduce the effect of helopeltis, reduce the impact of Oidium, and diminish anthracnose infection)
- Utilization of cashew by-products which can be healthier for the business

Multi-Action

Where was this done?

In marginal conditions where there are equal possibilities for failure or success

- Far from the centers of the districts where the chemicals are not obtainable or which are in insufficient quantities
- Where the trees are not very productive and observed to have with nutritional defficiencies
- The producers have had both the experience of having chemicals and not having any at times

General Applicability or Wide Application

The Alpha Test Run in 2015

In three farms of small producers

(The Beta Test-Run (Still being run in 2016)

THE OIDIUM FUNGUS COLONIZING THE LEAVES

Results of the Alpha Test-Run

The weaver ants spread out (*Oecophylla longinoda)*

Flowers with low presence of *Oidium*

Results of the Alpha Test-Run

Table 1. Yields in 3 localities, Year 2014 (reference year) and Year 2015 (test run year), comparisons.

Producer	Site of the harvest	Harvest per tree Year 2014 (Ref. Year) (kg)	Harvest per tree Year 2015 (Test Run) (kg)	Increase in Yield %
Agostinho	Nacutuco	1.16	3.63* * *	315%
Abudo	Mucojo	1.80	3.60* *	100%
Calisto	Mucojo	2.88	3.66* +	27%

Results of the Alpha Test Run

Table 2. Quality of the Nuts from BN and TT in 2015

Characteristics of the Nuts as observed after drying	Nuts receiving the BN Regime	Nuts receiving the TT Regime
Average weight of the RCN	8,33 gm	7,55 gm
Number of Nuts. RCN / kg	120.5/kg.	132.7/kg.
Dry Weight of Kernel + Testa/Kg	480 g/kg	441,2 g/kg
Distribution of nut weight RCN (gm)	7.2 to 9.6 gms (=2.4)	6.50 to 9.3 gm (=2.8)
Ratio of Kernel/RCN por Kg	48%	44.12%
Oven dry weight of Kernel+Testa	388.8gms	371.9gms
% humidity of the Kernel + Testa	19%	15.72%

Results of the Alpha Test-Run

Table 3. Brix Readings with an Atago refractometer (at ~20° C) for the cashew juice for the BN and the TT Regimes.

Samples	BN Regime ° B	TT Regime ° B
1	10.0	7.5
2	10.0	9.0
3	8.0	9.5
4	7.5	10.0
5	9.0	7.5
6	9.0	7.5
7	8.0	8.0
8	8.0	8.0
Average	8,70	8.38

Results of the Alpha Test-Run

Nut comparison of the BN and TT Treatments

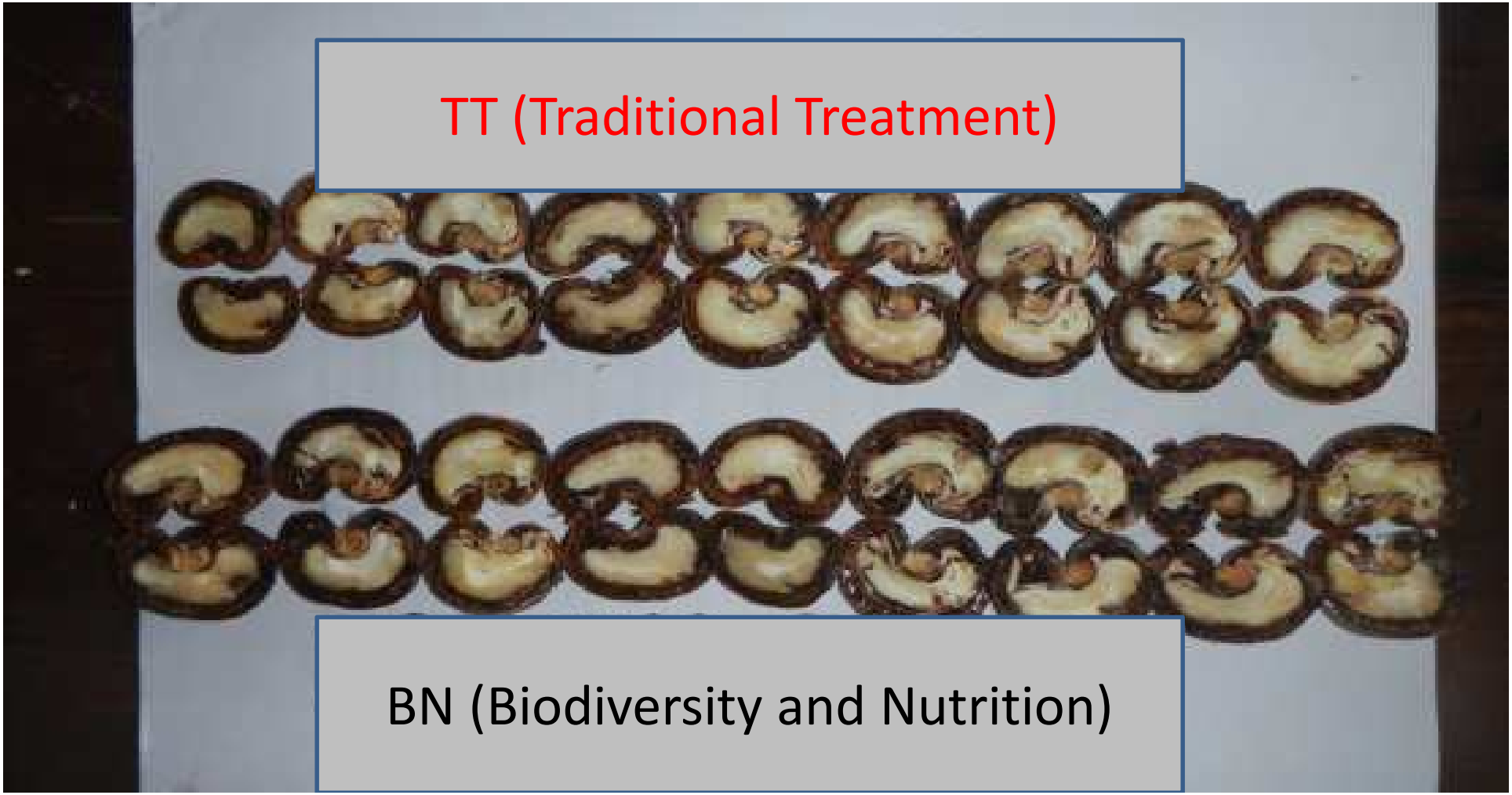

Table 4 Costs of Production Per Tree of Cashews, 2015

Cost of Production Items	TT Regime	BN Regime
Weeding	05	05
Pruning	10	10
Fungicides	(INCAJU, free = 25Mts)	05 x 4 = 20 bought *
Insecticides	(INCAJU, free= 05Mts)	05 – 10 bought *
Spraying	Contract of 30 Mts/tree	Family labor
Sprayer (amortization in 10 anos)	(25,000Mts/10anos/300 trees =8.3Mts	6,500/10/300 trees =2.16Mts
Small implements (10yr depreciation)	20/10 = 2Mts	20/10 = 2Mts
Harvesting work up to drying	Family labor	Family labor
Jute bags	Mts35/80x3.6/tree= 1.2/tree	1.2/árvore
TOTAL COSTS, Mts/tree	46,9 Mts with subsidy 76.9 without subsidy	45.76 – 50.76 Mts
Costs per Kg, Mts	24.93 per tree, 3,2kg National average	12.71—14.10/kg/tree with 3.6 kg. de BN
Price per kg, Farm Gate Price, Mts	30 a 45 Mts, in October 2015	30-45 Mts,in October 2015
+Can be reduced	Cexchange : 1 USD = 36 Mtz October 2015	

Results of the Alpha Test-Run

Less Oxidation (Biodiversity and Nutrition Treatment

How was it done in the farms?

- **Materials**

1. Potassium Nitrate, KNO3
a source of Nitrogen and Potassium

- Used in the foliar fertilization due to its high solubility in water. Now available in Mozambique

- Potasium Nitrate is a flowering inducer and an agent in the synchronization of flowering within a short period

Materials (cont.)

2. The "MM" (Microbes of the Mountains).

This was a cocktail mix of:

(a) baker's yeast(*Saccharomyces cerivisae*) available at most local markets,

(b) **lactobacilli of fresh milk** left in the open for 5 days to be colonized and fermemted to favor the multiplication of lactobacilli, and

(c) **actinomycetos (principally the mushroom types**) with whitish fungal hyphaes and spores colected from rotting wood materials.

Other Materials

3. The EM (Effective Microorganisms): with at least 11 pandemic microbes of

- 3 diferentes yeasts,
- 3 diferentes lactobacilli,
- 3 diffferent photosynthetic bacteria and
- With numerosos actinomycetes.

4. Trichoderma harzianum:

This is a very popular fungal microorganism which colonizes aggressively in the root zones and in the leaves.

The Process:
Anaerobic Fermentation (Multiplication)

Preparation of the MM.

- In a plastic bottle of 1.5 li some 150 ml of molasses was placed to the water (about 1.1 li) with the microbial cocktail (250 ml) and shaken to completely mix. It was sealed to ferment the mixture (microbial multiplication)..
- G**ás was liberated** every day by unscrewing the cap and rapidly re-sealing it as soon as the whistling sound diminished. This was done for a week.
- From this first plastic bottle **1 li** (sans solids) was put in the **20-li container that had in it 1 li of molasses and 18 li of water using the same fermentation** procedure as that of the plastic bottle (above) for some 8 days before application. The cocktail is useful for another 5 months.

Preparation of Molasses from Cashew

Multiplication (Aerobic) of Trichoderma

- **Rice (100 g) was soaked in water** for a 10-minute period. This was later put in boiling water to desactivate the microbes.
- The boiled rice was innoculated with ***Trichoderma*** commercially available to be colonized and multipled for a period of 3 weeks. This can be dried and still be useful for 3 months.

Note:

- We found in a dump site of Nampula a suspected *Trichoderma.* This was collected and also multipled.

The Application of BN

Application of the BN was done in the following manner:

- First Application:: 5 li of the MM fermented was added to the 100 li of water and ½ kg Potassium Nitrate was also added. After mixing this was sprayed with a hand-pump sprayer.
- Second Application: After 21 days Volltraid was available and was applied.
- Third Application. After another 21 daus Karate was also applied.

Note: A farmer continued with a second and third application using a mix of MM (5 li) + EM (5 li) + Trichoderma (25 ml) in 90 li of water as he did not have chemicals (Agostinho).

Other Equipment

Application of the BN

- A hand-pump, a long hose and a pole.

Implications

1. Reduction of farm costs with the perspectives of increased production.
2. Quality and yields of the nuts and the fruits are improved for better processing.
3. Longer harvest period of cashews will permit a longer processing, ideal for processing plants.
4. The natural systems allow safe cashew fruits processing for juice and other products
5. New approaches for the mixture of treatments to lower the costs of pest and disease control
6. A more extensive pilot test and more researches is in order for those interested.