United Nations Project 2008 - Guatemala

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Title: United Nations Project To Control *Monosporascus cannonballus* Vine Decline in Guatemala Using Alternatives to Methyl Bromide

Status of Melon Vine Decline in Zacapa: Many different microbes can cause vine decline in melons. These microbes are generally of fungal origin, but bacteria can sometimes be involved. Additionally, there are reports that Melon Necrotic Spot Virus (MNSV) has been detected in the Zacapa melon growing area of Guatemala. A fungus, *Olpidium bornovanus*, is the vector of the virus. Based on conversations with farmers and professionals in the area, we do not believe that MNSV is playing a significant role in the Zacapa production area at this time. In previous years, we collected melon plant samples from Zacapa and found that the fungus, *Monosporascus cannonballus*, was prevalent. Based on these results and conversations with farmers and crop consultants, it is our opinion that *Monosporascus cannonballus* is the predominant pathogen involved in vine decline of melons in Zacapa.

From limited soil analysis provided by Dr. Edin Francisco Orozco and one melon producer, the soil in the Zacapa area is a clay loam with about 25% clay and 50% sand. Disease management in this type of soil (moderate clay content) tends to be more challenging because of reduced water percolation, excessive soil moisture following irrigation, and reduced root penetration into the deeper soil profile. As a result, soil-borne diseases that affect and/or destroy the root system can be particularly damaging toward the end of the growing season. Approximately 30% of the root system is non-functional as the fruit approach maturity. This is the result of carbohydrates (photoasimulates) being diverted away from vegetation and root growth and redirected to producing the fruit. It is important not to over-water; especially in late-season. The crop should be watered thoroughly and only when the vines are beginning to show slight water stress. The pH of the Zacapa soil samples ranged between about 7.0 to greater than 8.0. The sodium (Na) content ranged between about 86 and 615 ppm. Melons are moderately tolerant to salts greater than 1000 ppm. In fact, 615 ppm would not be considered a high concentration of Na. However, the range of Na in the Zacapa fields is interesting and needs to be more fully explored. We are sure that some fields have a higher incidence of Monosporascus vine decline than others. It may be helpful to survey the incidence of vine decline and see if there is any association with Na levels and/or soil pH. There may be other nutrients of interest as well. We believe that there are some associations between soil characteristics and the incidence of Monosporascus vine decline. It will require a cooperative effort between the area farmers and our Research Station to obtain the necessary information and make the appropriate analyses. *Monosporascus cannonballus* is widespread in Mexico, Honduras, and Guatemala melon production areas. However, we have never found *Monosporascus cannonballus* from extensive studies in Costa Rica. If sufficient

farmers in Guatemala participate in the program, we will attempt to obtain additional soil analyses from melon growing areas in Mexico, Honduras, Costa Rica, Spain, Israel, and the United States. We may be able to determine if there are specific or sets of soil characteristics that correlate with the incidence of Monosporascus vine decline. The soil environment dictates the presence or absence of certain microbes like *Monosporascus cannonballus*. For example, *Monosporascus cannonballus* is a serious problem in melons in the Lower Rio Grande Valley of Texas. In central Texas (600 Kilometers north), the disease is never observed and it likely that the fungus is not present. This is likely due to the soil environment.

Purpose: Develop alternatives to methyl bromide for control of Monosporascus vine decline in melon using chemical and/or cultural methods.

Approach: We are presently evaluating a number of treatment regimes that may be particularly helpful in managing soil-borne pathogens; especially *Monosporascus cannonballus*. We will describe some of the concepts and rationale for the selection of the various products used in our research here at the Lane Research Station. We will also discuss how the products may be useful in achieving our disease management objectives.

I. Replacing a Diverse Microbial Population Following Fumigation

Using methyl bromide (MB) in soils with high clay content is extremely challenging because of the difficulty in penetrating the tight soil structure with the fumigant. The pathogen is never entirely eliminated and much of the beneficial microbial populations and microbial diversity may be greatly reduced. Methyl Bromide kills much of the microbial consortium, but does not eliminate *Monosporascus cannonballus*. *Monosporascus cannonballus* needs only the plant host (melon) to thrive and reproduce. The microbial community needs carbon and organic matter in order to thrive and reproduce. Under normal conditions, it can take approximately 25-30 weeks for the microbial population to recover following fumigation. Supplementation of beneficial microbes can improve the microbial diversity and rate of recovery. The fumigants, Chloropicrin and Vapam, are similar in their mode of action, but probably not quite as harsh to the microbial community as methyl bromide.

II. Biological control of *Monosporascus cannonballus*

Monosporascus cannonballus is a somewhat unique pathogen in that it appears to require both cucurbit root exudates in combination with certain microbes for germination of the ascospore. Once the ascospore germinates in the vicinity of the root, the fungus can penetrate and infect the melon root. Based on research done here in the United States, it appears that only cucurbits are infected by this fungus. We do not know which microbes may be involved in the ascospore germination process. This unique requirement may also provide an opportunity for biocontrol using beneficial microbes. The soil amendment products that we are evaluating in our studies are made up of many different microbes. Adding a food source such as molasses at 90 to 470 L per hectare provides a readily available carbon source for the microbes to quickly multiply. The microbes also required nitrogen for rapid growth and multiplication. It is recommended that 6 to 11 kg of nitrogen (N) per hectare be added to the molasses. It is not important to apply a high population of microbes. The more economical approach is to apply a low population of

microbes along with a carbon source and let them multiply naturally. It is very important that the molasses does not contain any anti-microbial products which would be harmful to the microbes being applied.

III. Increase Soil Organic Matter

Low soil organic matter is often associated with farming in warm climates. It is probably the most difficult soil component to change. The range of organic matter in selected Zacapa fields was about 1 to 3% where 1% is low and 3% is good. In the limited soil analyses that we had access to from the Zacapa region, organic matter was generally in the low range. Biologically, soil organic matter is the source of carbon and energy for a robust and diverse microbial consortium. The addition of refuse of plant origin can be particularly helpful in low organic soils and/or soils with high clay content. Organic matter can consist of various types of plant material such as sugarcane stalks and leaves, saw dust, or small wood chips. There are many sources of organic matter that can be used. Ideally, about 15 to 40 metric tons per hectare per year should be applied. Additional nitrogen (N) at 10 to 20 kg per hectare may be required in early season because the existing nitrogen will likely be tied-up by the microbial breakdown of the organic matter. Organic matter also improves soil aggregation, aeration, and allows water percolation. These are important soil characteristics that allow salt to move into the subsoil and improve root penetration and plant vigor.

IV. Humates and Humic Acid

In the absence of availability of sources of plant material (organic matter), the addition of humic acid and lignosulfonates can be used. Humic acid is the organic portion of plant mass that results from decomposition. During the decomposition process, cellulose, sugars, and plant proteins are broken down and the remaining plant structural fragments are primarily composed of lignin. Since lignin, because of its complex structure, decomposes more slowly due to the activity of bacteria and fungi; this portion of the plant residue makes up the largest fraction of decomposed organic matter. Clay particles normally lay flat and can become so dense and compact that they resist root penetration and water percolation. High salt content in the soil makes the situation even worse. Humic acid segregates the salts and removes them from the surface of the clay particle. As a result, humic acid causes clay particles to stand on end and allows for water penetration. Lignosulphonates are complexing agents for micronutrients to improve nutrient availability and plant growth. These products also stimulate microbial activity over an extended period of time. Although the data are preliminary, we have seen a reduction in the incidence of Fusarium wilt in watermelon using humic acid and lignosulphonates. Not all sources of humic acid and lignosulphonate are the same. Some sources maintain a higher level of quality control that assures a uniform product over time. Rates of about 5.0 kg per hectare per growing season or year should be supplied through the drip irrigation for optimal results.

V. Soil Fungicide

In the United States, 'Cannonball' Fungicide was cleared for use to control Monosporascus vine decline in 2005. There has been good success in using Cannonball Fungicide for control of Monosporascus vine decline. Cannonball is applied at .28-.56 kg

per hectare. It is applied prior to planting or transplanting in a 0.4 meter band shanked in with four fertilizer knives per bed or through drip irrigation. Additional applications are made starting at 21 days after planting or 7 days after transplanting via drip irrigation. Applications are continued via drip irrigation every 14-21 days if conditions favor disease development, and up to 3 applications at 0.56 kg/hectare may be made. Apply through drip irrigation to provide adequate treatment of the root-zone area. Due to limited movement of Cannonball in the soil, it is best to place the drip irrigation line directly below the plants and no more than 10 cm deep. Do not apply more than 1.68 kg Cannonball (0.84 kg active ingredient) per hectare per crop and do not apply within 14 days of harvest.

Proposed Treatments for Evaluation: Different treatment regimes will be outlined below and should be selected based on how easily the treatments can be implemented into existing farming operations. We do not expect a farm to try to implement all of the treatments described below. We do hope that Methyl Bromide is used for one treatment because it has been used as the standard treatment for years. What we want to know is how these other treatments compare with Methyl Bromide. You also need to have a non-treated control.

Treatment # 1

Non-treated Control

A non-treated control should be incorporated as a measure of how well other treatments perform.

Treatment # 2

Methyl bromide

Methyl bromide should be applied at the standard rate as normal. It will serve as the standard to which any other treatment will be compared.

Treatment # 3

Chloropicrin (preseason) + Vapam (after harvest)

In year # 1, experimental plots should be treated with the high rate of Chloropicrin (90 kg per hectare) and according to the manufacturer's label. Chloropicrin actually kills the ascospores of *Monosporascus cannonballus*. At the end of the season when fruit yields are no longer profitable, treat with Vapam. Vapam should be applied through the drip irrigation to kill the vegetative phase of *Monosporascus cannonballus* before it reproduces large quantities of ascospores. It is important to treat with the Vapam immediately after the last harvest. Vapam should be applied (140 L per hectare) according to the manufacturer's label. Vapam will only kill the vegetative phase of *Monosporascus cannonballus*. It does not kill the ascospores. In the second, third, and fourth years, use only Vapam at the end of the season. The number of years that Chloropicrin can be eliminated from the treatment regime will depend on the incidence of Monosporascus vine decline the previous season.

Treatment # 4

Chloropicrin (preseason) + Soil Amendment Complex + Vapam (after harvest)

In year # 1, experimental plots should be treated with the high rate of Chloropicrin (90 kg per hectare) and according to the manufacturer's label. One month prior to transplant, begin applying the Soil Amendment Complex (see Treatment # 5 below). At the end of the season when fruit yields are no longer profitable, treat with Vapam. Vapam should be applied through the drip to kill the vegetative phase of *Monosporascus cannonballus* before it reproduces large quantities of ascospores. It is important to treat with the Vapam immediately after the last harvest. Vapam should be applied (140 L per hectare) according to the manufacturer's label. In the second, third, and fourth years, use only Vapam at the end of the season. The number of years that Chloropicrin can be eliminated from the treatment regime will depend on the incidence of Monosporascus vine decline the previous season.

Treatment # 5

Soil Amendment Complex Only

A. We are testing a number of "Multi-Component" microbial compounds. Multi-component microbials simply means that the product has hundreds of different types of microbes. At this point in time, we do not have sufficient data to recommend specific microbial treatments. However, we strongly suspect that maintaining a high population of diverse microbes should be very helpful. We also recommend that more than one microbial product be used and the products alternated. A list of the microbial products that we are testing is listed below. The rate for each microbial product below can be a little different. Check with the distributor for specific rates.
B. A second component of our soil amendment complex is molasses at 90 to 470 L per hectare and 6 to 11 kg of nitrogen (N) per hectare. Make sure that no anti-bacterial or antibiotics have been added to the molasses. Obtaining the molasses directly from sugarcane processing plant will ensure purity.
C. The third part of the soil amendment complex is the humates and humic acid (BorreGro HA-1P Humate & Calcium Lignosulfonate Ca 800). One month before planting or transplanting, apply 1.5 kg per hectare each of BorreGro HA-1P Humate and Calcium Lignosulfonate Ca 800. At planting, apply 0.5 kg of each product per hectare. At fruit-set, apply 0.6 kg of each product per hectare. Once harvest begins, apply 0.5 kg of each product weekly throughout the rest of the season (until final harvest).

Components A, B, and C (Soil Amendment Complex) should be applied as a tank mixture through the drip irrigation.

Treatment # 6

Cannonball Fungicide

Cannonball fungicide should be used according to the manufacture's label. We also recommend that you contact Mr. Ricardo Hernandez for more detailed information. He has years of experience working on Monosporascus vine decline and using Cannonball Fungicide.

Mention of trade names or commercial products in this report is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture.

Soil Amendment Complex Treatments

Product: Bio-S.I. plus Humus
Company: Bio-S.I. Technology, LLC
Contact: Wayne Tucker
Address: P.O. Box 784
Argyle, Texas 76226
Phone: 940-594-7723 Fax: 940-323-0991
E-mail: wt48@juno.com

Product: Soil Activator and Beneficial Microbes
Company: Medina Agricultural Products Co., Inc.
Contact: Stuart Franke
Address: P.O. Box 309-4360 Hwy 90 West
Hondo, Texas 78861
Phone: 830-426-3011 Fax: 830-426-2288
E-mail: www.medinaag.com

Product: F-68 Soil Conditioner
Company: Fenic Co., Inc.
Contact: Frank Cavasos
Address: P.O. Box 1500
Mercedes, Texas 78570
Phone: 956-565-6120 Fax: 956-514-1712
E-mail: www.fenic.com

Product: Super Bio Soil Builder
Company: Advanced Microbial Solutions LLC
Contact: Bob Ames
Address: 801 Hwy 377 South - P.O. Box 519
Pilot Point, Texas 76258
Phone: 940-686-5545 Fax: 940-686-2527
E-mail: bames@superbio.com

Product: Bio-Inoculant Plus Humus
Company: Bio Inoculant Inc.
Contact: J. C. Hayes
Address: P.O. Box 760
Sanger, Texas 76266
Phone: 940-458-5400 Fax: 940-458-7350
E-mail: bioinoculant@yahoo.com

Product: SC 27 Soil Inoculant
Company: Big Boy Ag. Distributors, LP
Contact: Garrett Mann
Address: 511 N. 10th #287
McAllen, Texas 78504
Phone: 956-618-3933 Fax: 956-618-3903
E-mail: Garrett@bigboy.com

Product: PMSLA and EO-12
Company: Earthwise Organics
Contact: Thomas Harr
Address: P.O. Box 533816
Harlingen, Texas 78553-3816
Phone: 956-207-0500 Fax: 956-797-5043
E-mail: thomasharr@earthwiseagriculture.net

Product: Compost Tea
Company: Erath Earth Inc.
Contact: Sabino Cortez
Address: 16590 US Hwy 281 South
Hico, Texas 7647
Phone: 254-485-3560
E-mail: erathearth@gmail.com

Product: Actinovate AG
Company: Natural Industries, Inc.
Contact: Matt Kowalski
Address: 6223 Theall Rd.
Houston, Texas 77066
Phone: 888-261-4731
E-mail: mattk@naturalindustries.com

Product: Mpact
Company: Enviro Products Corporation
Contact: Jim Nymerer
Address: 2802 W. Washington Place
Broken Arrow, Oklahoma 74012-0921
Phone: 918-459-9035 Fax: 918-250-1418
E-mail: enviro@valornet.com

Lignosulphonate & Humic Acid Supplier

Product: BorreGro HA-1P Humate & Calcium Lignosulfonate Ca 800
Company: Tierra Resources International Inc.
Contact: Tony Filyk
Address: 8416 Rancho Colina NW
Albuquerque, New Mexico 87120-5811
Phone: 505-792-4261 Fax: 505-792-4261
E-mail: afilyk@ix.netcom.com

Cannonball Fungicide Supplier

Contact: Mr. Ricardo Hernandez
Field Sales Representative
Address: 3809 West Monte Cristo Rd.
Edinburg, Texas 78541
Phone: 956-383-8433
Cell: 956-330-1073
E-mail: rahernandez@wecon.com