The Effectiveness of Organic Amendments in the Production of Vegetables in Two Regions of Puerto Rico

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Significance

Commercial vegetables are grown year-round in Puerto Rico's open fields at different geographical locations and have constantly use synthetic agrochemicals to yield competitively. This constant use has caused soil erosion, reduced soil health and fertility, impacted biodiversity and agricultural sustainability and possibly hinder future production. Furthermore, ground waters can be polluted, and our climate can negatively be impacted. For this reasons, the evaluation of alternative organic amendments for small-scale vegetable production systems must be studied to elucidate the proper implementation and use of these alternatives for small-scale growers' sustainable production.

Picture 1. Coffee pulp compost.

Objectives

- Evaluate and demonstrate the effectiveness of a single application of various types and quantities of organic amendments in squash, tomato and cabbage at different geographical locations of Puerto Rico.
- Facilitate and implement the adoption of using organic amendments as an integrated farming practice to small scale vegetable growers by region.

Picture 2. Field day at González Farm demonstrating how to collect representative compost samples for analysis.

Field validation and methods

Study 2016 González Farm, Guánica PR (February to August)
RCB design in tomato field with 3 treatments and 3 blocks: coffee pulp compost (CPC), composted chicken manure (CCM) and inorganic fertilizer (IF) based at 100% nitrogen crop needs 150 lbs per acre. Treatments evaluated in squash field were like tomatoes with the addition of the same three compost types at 50% nitrogen crop needs 75 lbs per acre.

Picture 3. Application of compost in field and incorporation one-week prior to transplant tomatoes.

Picture 4. Tomatoes evaluation trial with three blocks.

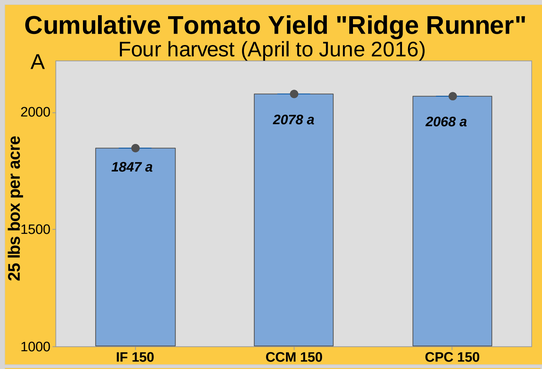
Study 2017 KYV Farm, Adjuntas PR (May to July)
RCB design in cabbage field with 6 treatments and 3 blocks: cured poultry manure (CPM), coffee pulp compost (CPC) and organic pelletized fertilizer (OPF) based at 100% nitrogen crop needs 150 lbs per acre and same three compost types at 50% nitrogen crop needs 75 lbs per acre.

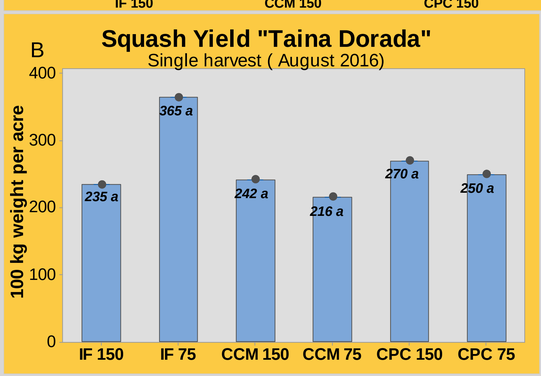
Picture 5. Measuring with 5 gallon bucket the amount of CPM to be applied in the cabbage field.

Picture 6. Manual application of CPC to 100 feet long row one-week prior cabbage transplant.

Picture 7. Cabbage field evaluation trial with three blocks. Estimated 29,000 plants per acre.

Results

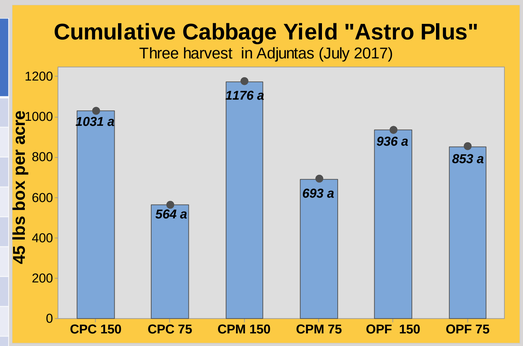




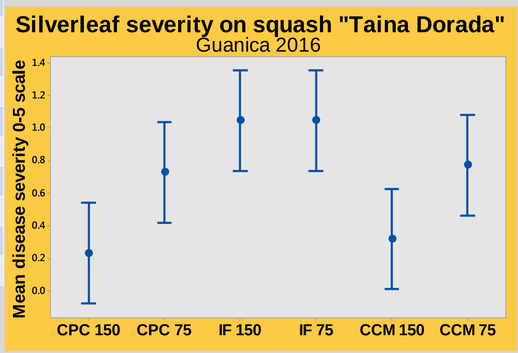
Graph 1 A & B . Total marketable yield among compost treatments in tomato (a) and squash (b) in Guanica 2016.

Soil properties by organic amendments in tomato field 2016	Mean change of soil in 6-month period (January to June)
potash K (ppm)	
CPC (coffee)	**35.1 a**
CCM (manure)	**71.0 a b**
IF (fertilizer)	**8.8 b**
phosphorus P (ppm)	
CPC (coffee)	**25.0 b**
CCM (manure)	**241.7 a**
IF (fertilizer)	**48.6 b**
organic matter (%)	
CPC (coffee)	**16.1 a**
CCM (manure)	**-2.5 b**
IF (fertilizer)	**-4.9 b**
pH	
CPC (coffee)	**3.0 b**
CCM (manure)	**5.6 a**
IF (fertilizer)	**6.0 a**
cation exchange capacity (CEC mg/100g)	
CPC (coffee)	**-5.5 b**
CCM (manure)	**6.9 a**
IF (fertilizer)	**0.4 a**

Table 1. Mean difference change of soil properties by the application of 150 lbs N per acre among compost treatments in tomato field, from prior to planting to post harvest (6-month period).



Graph 2. Total cumulative cabbage yield among compost treatments in Adjuntas PR during 2017.



Graph 3. Severity of squash plants expressing silverleaf caused by whitefly among compost treatment.

Remarks

- When applying organic amendments to vegetable crops based on 50% of crop N (inorganic) needs, yield might be similar than applying compost based on 100% crop N needs. Precipitation amount, agronomical practices and compost effects on soils biota and physical characteristics can play an important role in these differences.
- Higher amount of compost applied can lead to nutrient imbalance in the soil, thus utilizing other management strategies (e.g. green manure, crop rotation, other source of fertilizers) within growing season is recommended.
- The use of organic amendments in squash reduced silverleaf severity up to 78% compared to inorganic fertilizer, thus demonstrating an improvement on crop health.
- These results can help make a better sustainable decision to small vegetable producers when applying compost as nutrient source and understand the impact it can have on their soil and crop health by region.

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