Yields of Tomatoes As Influenced By Application of Filter-Press Cake and Starter Solutions

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INTRODUCTION

Tomato growers in Puerto Rico many times use soils possessing low fertility, low organic-matter content, and poor tilth. The newly transplanted tomato seedlings normally suffer from lack of both nutrients and moisture until they develop a root system large enough to utilize the applied fertilizer. Starter solutions with major and minor elements in a liquid form, are applied to each tomato seedling at time of transplanting. In spite of the fact that the beneficial effects of such starter solutions have been known for some time, their use is still not a common practice of some tomato growers on the Island.

An inexpensive source of organic matter known as sugarcane filter-press cake is readily available to the farmers of Puerto Rico. Filter-press cake, or *cachaza*, as it is called in Spanish, which contains major and some minor fertilizing elements, is a byproduct of the sugarcane mills. Little attention is given to the use of this material in tomato culture.

The objectives of this experiment were to study the effect of various starter solutions, as well as filter-press cake, on the marketable yields of the Manalucie variety of tomatoes.

MATERIALS AND METHODS

This experiment was conducted at the Solís Farm of the Agricultural Experiment Station at Río Piedras, on a Vega Alta sandy clay. This is a rather plastic acid clay (pH 5.6) with poor internal drainage. There were eight treatments with four replications arranged in a randomized-block design. Table 1 presents the various treatments. Each plot consisted of two banks, 30 feet long and 4 feet wide. Plants were spaced 3 feet apart in the center of the bank, giving a total of 20 plants per plot. The bank system of planting was used to facilitate drainage.

A few days prior to planting, the filter-press cake treatments received one shovel full of well-decomposed filter-press cake (approximately 4 pounds) to each planting hole which was well mixed with the soil. This gave a rate of approximately 10 tons per acre.

Three starter solutions were used: Folo-food[2], Grow-green[2], and a 9-10-5

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[2] Trade names: Any trade brand or name used herein does not constitute an endorsement of the product by the University of Puerto Rico Agricultural Experiment Station, Río Piedras.

fertilizer. Folo-food is a commercial blue-liquid starter solution with a formula of 8-26-6, plus minor elements, and is manufactured by Kenco Chemical Co., Summerdale, Ala. The dilution rate used was 1 gallon of the starter for each 100 gallons of water, and was prepared just prior to its use. Grow-green is a soluble green-crystal formula of 20-20-20 with several minor elements, and is manufactured by the H. D. Campbell Co., Rochelle, Ill. The concentration used was 6 pounds per 100 gallons of water; the solution was prepared just prior to transplanting.

The 9-10-5 starter solution was made from a regular commercial 9-10-5 fertilizer by mixing 12 pounds of the material with 100 gallons of water. The solution was prepared 24 hours prior to using, allowed to settle, and the clear supernatant solution used. This starter solution was devised

TABLE 1.—*Treatment combinations of filter-press cake, starter solutions, and a 9-10-5 fertilizer*

Treatment No.	Filter-press cake	Starter solution	9-10-5 fertilizer
1	Applied	None	None
2	None	do.	Do.
3	Applied	do.	Applied
4	None	do.	Do.
5	Applied	Folo-food	Do.
6	None	do.	Do.
7	Applied	Grow-Green	Do.
8	do.	9-10-5	Do.

because it was thought that the farmer could prepare this homemade inexpensive starter from the regular 9-10-5 fertilizer he uses to fertilize his tomato crop.

As the seedlings were being set out by hand ½ pint of the starter solution was applied to each. Treatments with no starter received ½ pint of water per plant.

The fertilizer application used was 1,200 pounds per acre of 9-10-5. An equal quantity was applied to each plant by hand in a circular pattern around the stem, and then covered with soil. This was done immediately after transplanting.

Data were analyzed using the covariance analysis, in order to adjust the yields to the variation in stand.

RESULTS AND DISCUSSION

Table 2 presents the total marketable yields and treatment differences of the eight harvests of the Manalucie variety.

Treatment 2, which had no application of any material, yielded 1.61 tons per acre of tomatoes. The use of a 9-10-5 fertilizer alone increased the yield to 4.01 tons per acre, treatment 4. This standard field treatment was a little lower than the 5-ton average for this variety for the March planting season at the Solís Farm.

When filter-press cake alone was added, treatment 1 yields increased to 7.21 tons per acre. Filter-press cake was responsible for a 5.60-ton increase in yield over the unfertilized check and was 3.21 tons better than a commercial 9-10-5 fertilizer. Samuels and Landrau[3] reported that, for the well-drained Coto clay at Isabela, filter-press cake was not as effective as a commercial fertilizer in increasing tomato yields. However, under the conditions of this experiment, and in this type of heavy poorly drained soil, the application of filter-press cake was as effective as a 9-10-5 fertilizer.

TABLE 2.—*Marketable yields for the 8 treatments and their statistical differences*

Treatments in order of rank	Tons per acre of marketable yield	Outyielded treatment at the 5-percent level
8	11.19	1, 2, 4
5	10.97	1, 2, 4
3	10.77	1, 2, 4
7	9.04	2, 4
6	8.16	2, 4
1	7.21	2, 4
4	4.01	2
2	1.61	—

When filter-press cake and 9-10-5 were used together, as in treatment 3, the yield was 10.77 tons per acre. This gave 6.76 tons more tomatoes than when a 9-10-5 was used alone. A combination of filter-press cake and commercial fertilizer proved very profitable. Riollano[4] working with tomatoes on a Coto clay, obtained significant increases in yield by using 12 tons of filterpress cake plus 1,000 pounds of a 9-10-5.

Filter-press cake consists principally of a mixture of sugarcane fibers, sucrose, coagulated colloids including cane wax, albumoids, and phosphates of lime, plus sand and soil. Most of the constituents come from the ground-up sugarcane. The lime is added in process of neutralizing and clarifying the cane juice, and the sand and soil enter as foreign matter clinging to the cane. Physically, filter-press cake is a soft, spongy, light-

[3] Samuels, G., and Landrau, P., Jr., Filter-press cake as a fertilizer, *J. Agr. Univ. P.R.* **39** (4) 198–213, 1955.

[4] Riollano, A., The value of filter-press cake as a fertilizer for vegetable Crops, *Amer. Soc. Hort. Sci.* **42** 547–50, 1943.

weight, amorphous, dark-brown to black material. When used for an agricultural purpose, it should be well decomposed.

It has a high moisture content, as shown in the following tabulation:

Content	*Range of values in percentage*
Moisture	60–80
Organic matter	20–30
Sucrose	2–4
Nitrogen	0.94–1.31
P_2O_5	1.66–2.74
K_2O	0.46–0.89
CaO	3.11–4.13
MgO	0.42–2.38
B_2O_3	0–0.02
MnO	0.10–0.24
Fe_2O_3 and Al_2O_3	1.70

It also has the ability to maintain and hold moisture for a long time. This may have helped in the quick recovery of the newly transplanted tomato seedlings. The high organic matter present, 20 to 30 percent, also benefitted the tomato plants during their growth, and improved the physical condition of the soil. In addition, the high bacterial count found in the filter-press cake may have contributed to the control of nematodes by discouraging them from attacking tomato roots growing in it. It would be of interest to determine in future studies the proper rate of application per acre of the filter-press cake, as well as improved methods of application for commercial use.

From the economic standpoint, filter-press cake is a byproduct of the sugar mills and it is produced annually in Puerto Rico in great quantities. Its accumulation outside the mills creates a space problem; and therefore, their owners are more than happy to supply any amount free of charge to the farmers.

When starter solutions were applied in addition to the filter-press cake they failed to increase the marketable yield significantly. However, when no filter-press cake was applied, the starter solutions Folo-food, Grow-green, and 9-10-5 gave an increase in yield of 4.15, 5.03, and 7.18 tons, respectively, over treatment 4, the standard field practice.

The 9-10-5 fertilizer, the most inexpensive starter, in combination with the filter-press cake gave the highest yield of 11.19 tons per acre. However, none of the starter solutions used showed any statistical yield increase over the others. Either filter-press cake or a starter solution may be used in tomato production in Puerto Rico.

SUMMARY

An experiment using the Manalucie variety of tomato was established on a Vega Alta sandy clay soil at Río Piedras, P.R., with various combinations of filter-press cake, and starter solutions such as Folo-food, Grow-green, and 9-10-5, in addition to the regular commonly used fertilizer, 9-10-5. Filter-press cake increased the marketable yield by 6.76 tons. When filter-press cake was not applied the use of starter solutions failed to increase yields. A starter solution made from a 9-10-5 fertilizer was just as effective as the commercial starter solutions. The use of filter-press cake and/or starter solutions is recommended for tomato production in Puerto Rico.

RESUMEN

La Estación Experimental Agrícola de la Universidad de Puerto Rico llevó a cabo un experimento de abonamiento con la variedad de tomate Manalucie en un suelo areno-arcilloso del tipo Vega Alta. Se hicieron aplicaciones de abono usando cachaza, abonos líquidos de acción rápida para el trasplante, tales como *Folo-food* y *Grow-green*, y del abono corriente 9-10-5, en varias combinaciones, e individualmente.

La cachaza aumentó el rendimiento de la cosecha para el mercado en 6.7 toneladas. Cuando se usaron los abonos líquidos de acción rápida sin la cachaza, el aumento fluctuó entre 4.15 y 7.18 toneladas por cuerda. Cuando se usó cachaza en combinación con las soluciones de acción rápida, no hubo aumento en los rendimientos. Una solución de acción rápida preparada con el abono 9-10-5 fue tan eficaz como las preparadas comercialmente. Se recomienda el uso de cachaza o de abonos líquidos de acción rápida al trasplantar para producir tomates en escala comercial en Puerto Rico.