

THE VALUE OF FILTER PRESS CAKE AS A FERTILIZER FOR VEGETABLE CROPS. PRELIMINARY TRIALS WITH TOMATOES AND CUCUMBERS

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Filter press cake is normally a by-product from the sugar mills of Puerto Rico. In many cases the disposal of this refuse is a sort of a problem since its dumping is rather costly. In other cases, the filter press cake is used for fertilizing the sugar cane plantations where apparently good results have been obtained with it when utilized as a substitute for chemical fertilizers. Some sugar mills have enormous quantities of filter press cake that have been accumulated for several years near the premises of the factory. In one of these sugar mills visited by the author, the filter press cake dump covered an area of approximately four acres in extent and six to eight feet deep. Dumping in that place had been going on for the last ten years.

Samples of filter press cake from this dump were taken at various depths, namely, first 12 inches, 12 to 24 inches and 24 to 36 inches. For each depth, eight samples from different places of the dump were taken. Analyses were made from these samples through the courtesy of Dr. J. A. Bonnet, Chief of the Division of Soils, who made the following report:

As may be readily seen in these analyses, the water content of filter

TABLE I. *Analysis of Filter Press Cake.*

SAMPLES	DEPTH	ORIGINAL MOISTURE CONTENT %	pH	AIR DRY SAMPLES				
				H ₂ O %	P ₂ O ₅		K ₂ O AVAIL. %	TOTAL N %
					TOTAL %	AVAIL. %		
1	0-12"	54.45	5.5	12.76	3.83	.59	.02	3.13
2	12-24"	26.24	6.5	12.04	2.63	.66	.08	2.65
3	24-36"	29.83	6.7	12.96	3.49	.50	.17	2.72
<i>Average</i>						.58	.09	2.83

press cake is rather high, varying from 26.24 to 54.45 per cent in the samples taken. The air dry samples, however, were reduced to a uniform moisture content varying only from 12.04 to 12.96 per cent. The analyses for food nutrients, total and available, were made on basis of these air dry samples. Verbal information was obtained regarding the availability of the total nitrogen reported, to the effect that for practical purposes all this nitrogen was in available form. For the purpose of our trials with vegetable crops, we are considering only as important the following averages of available food nutrients in air dry samples of filter press cake: nitrogen 2.83 per cent, P_2O_5 .58 per cent, and K_2O .09 per cent. The amount of potash contained is so small that it may be considered as negligible. In fact, in other samples that the author had sent for analysis in previous years, the potash content had been reported in the form of traces.

TRIALS WITH TOMATOES

The first preliminary trial with filter press cake was established at the Isabela Experimental Substation with tomatoes, variety "Marglobe", in the type of soil known as Coto Clay No. 20. Bonnet (1) has described the properties of this type of soil of which there are some 7,000 acres located at the northwestern section of the Island. Two treatments were tested, namely, one where filter press in its natural state was applied at the rate of 12 tons per acre plus 1,000 pounds of chemical fertilizer 8-10-15 and the other, where 1,000 pounds of the last named fertilizer were applied alone. The filter press cake as well as the chemical fertilizer

TABLE II. *The effect of filter press cake on the yield of tomatoes.*

CLASSIFICATION OF FRUIT YIELD	MEAN YIELD IN CWTs. PER ACRE		INCREASE IN PER CENT	ODDS
	TREATMENT A 12 TONS FILTER PRESS CAKE PLUS 1,000 LBS. FERT. 8-10-15	TREATMENT B 1,000 POUNDS FERTILIZER 8-10-15		
Large, above .3 pound	69.9	58.5	19.5	18:1
Medium, .2 to .3 pound	70.6	56.4	25.2	216:1
Small, less than .2 pound	16.8	15.6	7.7	2:1
Culls, unmarketable	21.3	15.7	35.6	151:1
Marketable fruit	157.3	130.5	20.5	48:1
Total, all classes	178.6	146.2	22.2	32:1

were applied in the furrow in both cases. Forty plants were used in each plot which measured 20 x 22 feet or approximately 1/100th acre. Each treatment was replicated eight times. The soil was prepared to be irrigated by the surface irrigation system commonly known as the Hawaii system. Upon harvesting the fruit was classified as follows: large, weighing above .3 pound; medium, weighing .2 to .3 pound; small, weighing less than .2 pound; and culls, or unmarketable fruit. Weighings for each treatment were recorded in pounds and tenths of pounds. A total of seven different pickings were made in this trial.

RESULTS

The results of this preliminary trial are presented in detail in table II. Significance of differences in mean yields has been determined by calculating the odds for the *z* values of "Student's" table as modified by Love (3).

As may be observed in this table, there was always a tendency to increase yield when filter press cake was applied to the soil. However, summing up these results in the most practical way, that is, considering mean yields of marketable fruit, it may be seen that this increase amounted significantly to 20.5 per cent. In other words, the application of 12 tons of filter press cake was responsible for a significant increase in yield of 1.34 tons of marketable tomatoes.

TRIAL WITH CUCUMBERS (*Cucumis sativus* L.)

Upon failing to continue the work with tomatoes due to a heavy infection of mosaic, a more elaborate test with filter press cake was established in the same type of soil with the variety of cucumbers known as "Early Fortune". Though compost manure is rather scarce in Puerto Rico and is seldom used with vegetable crops, it was also included in this test as a matter of comparison. Check plots without any fertilizing matter were not incorporated in the test because in previous trials conducted by the author these had resulted in complete crop failures. Twenty tons of filter press cake per acre or twenty tons of compost manure were added to the soil with various combinations of 200 pounds of NH_3 derived from sulphate of ammonia, 200 pounds P_2O_5 from superphosphate, and 200 pounds of K_2O from sulphate of potash. Filter press cake and compost manure were also applied separately and alone without any chemical fertilizer. In all, fourteen treatments with seven replicates each in randomized blocks were included in this trial.

TABLE III. *The fertilizing value of filter press cake for cucumbers. (Yields on basis of all classes of fruit).*

NUMBER OF TREATMENT	FILTER PRESS CAKE	COMPOST MANURE	NH ₃	P ₂ O ₅	K ₂ O	MEAN YIELD IN GWTS. PER ACRE (1)
	(tons)	(tons)	(pounds)	(pounds)	(pounds)	
12	20	0	200	200	200	140
9	20	0	200	200	0	134
5	0	20	200	200	0	126
11	20	0	0	200	200	126
10	20	0	200	0	200	125
14	20	0	0	0	0	118
4	0	0	200	200	200	116
7	0	20	0	200	200	116
8	0	20	200	200	200	115
6	0	20	200	0	200	109
13	0	20	0	0	0	107
1	0	0	200	200	0	103
2	0	0	200	0	200	80
3	0	0	0	200	200	78

(1) Differences in yield greater than 22.2 are significant with odds 19:1.

Plots measured 1/80th of an acre and there were 107 cucumber plants in each plot. The soil was prepared in such a way as to facilitate surface irrigation whenever necessary. The different fertilizing materials were applied in the furrow 12 days before planting cucumbers. A total of 12 pickings were made during a harvesting period of 29 days. Fruit was classified according to the U. S. Standards and weighings were recorded in pounds and tenths of pounds.

RESULTS

The results of this trial are shown in detail in table III. Though fruit was classified according to the U. S. Standards, results have been presented in total yield of all classes because a good correlation was found to exist between both. Yields from each treatment have been presented in the form of hundred-weights per acre. Significance of results has been determined by Fisher's (2) method of statistical analysis.

The 14 different treatments are subject to numerous comparisons,

but a few will suffice to demonstrate the high fertilizing value of filter press cake for cucumbers. Upon comparing treatments 14 and 4 it can be observed that an application of 20 tons of filter press cake alone produced 118 hundred-weights of cucumbers per acre, while the application of the complete chemical fertilizer alone produced 116 hundred-weights of fruit. Thus, it seems that the filter press cake can be a reliable substitute for chemical fertilizers. Furthermore, when the filter press cake and the complete chemical fertilizer were applied together, the yield was augmented significantly to 140 hundred-weights per acre as shown in treatment 12. In all cases filter press cake plus chemical fertilizers, complete or incomplete, caused an increase in yield when compared with complete and incomplete fertilizers alone. Compost manure, in general, ranked lower than filter press cake as an organic fertilizer.

Incidentally, a comparison of treatment 1, 2, 3, and 4 gives a strong indication that the type of soil Coto Clay No. 20 is markedly deficient in available NH_3 and P_2O_5 . However, the requirements for K_2O are not high. In fact, the next highest yield or probably the most profitable application for the grower, was obtained with treatment 9, when 20 tons filter press cake, 200 pounds NH_3 and 200 pounds P_2O_5 were applied. This did not differ significantly from the highest yield obtained in treatment 12 where the filter press cake was applied with the complete chemical fertilizer. Bonnet (1) has also shown similar results with eggplants and cucumbers in regards to the availability of K_2O in this type of soil.

SUMMARY

Filter press cake, a refuse from sugar mills in Puerto Rico can be used advantageously for fertilizing tomatoes and cucumbers grown in the soil type Coto Clay No. 20. When applied at the rate of 12 tons per acre plus 1,000 pounds of fertilizer 8-10-15 it caused a significant increase in yield of marketable tomatoes amounting to 20.5 per cent over the treatment where chemical fertilizer 8-10-15 had been applied alone at the rate of 1,000 pounds per acre.

When 20 tons filter press cake were applied alone and with different complete and incomplete chemical fertilizers, also significant increases in yield of cucumbers were observed. The yield with 20 tons of filter press cake alone was equivalent to the yield obtained with a complete fertilizer having 200 pounds NH_3 , 200 pounds P_2O_5 and 200 pounds K_2O .

Results seem to indicate that the most profitable treatment would be probably 20 tons filter press cake plus 200 pounds NH_3 and 200 pound P_2O_5 .

SUMARIO.

EL VALOR DE LA CACHAZA COMO FERTILIZANTE PARA TOMATES.
ENSAYOS PRELIMINARES CON TOMATES Y PEPINILLOS

La cachaza que se obtiene en las centrales azucareras puede emplearse ventajosamente como abono para tomates y pepinillos en el tipo de suelo Coto Arcilloso Núm. 20. Aplicado a razón de 12 toneladas por cuerda en adición a 1,000 libras de abono de la fórmula 8-10-15 produjo un aumento en producción de 20.5% en tomates por encima de la producción con el tratamiento de 1,000 libras por cuerda de la fórmula 8-10-15.

En pepinillos (*Cucumis sativus L.*) cuando se aplicaron 20 toneladas de cachaza por cuerda se obtuvo una producción semejante a la producción obtenida cuando se aplicó un abono conteniendo 200 libras de NH_3 , 200 libras de P_2O_5 y 200 libras de K_2O . Hay indicios de que se obtiene la mejor producción de pepinillos mediante aplicación de 20 toneladas de cachaza y 200 libras de NH_3 y 200 libras de P_2O_5 .

LITERATURE CITED

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