PROCEEDINGS

OF THE

CARIBBEAN FOOD CROPS SOCIETY

SECOND ANNUAL MEETING

BRIDGETOWN, BARBADOS

OCTOBER 19-23, 1964

VOLUME II

COCONUT FIBRE WASTE AS A BASIC MEDIUM FOR THE PRODUCTION OF VEGETABLE CROPS

by

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INTRODUCTION

The cultivation of high-quality food crops in tropical areas such as Trinidad and Tobago is beset by a number of adverse environmental factors. These include impeded drainage and poor structural conditions in relatively heavy clay soils, the prevalence of soil-borne plant pathogens, heavy downpours during the rainy season and the incidence of destructive insects. As a result large quantities of food crops are imported annually in order to satisfy the local demand.

It has been known for some time that coconut fibre waste, the by-product obtained after the removal of the fibre from coconut husks, can be used as a soil conditioner in composts. Use has been made of such composts in Trinidad and Tobago to root cocoa seedlings prior to transplanting in the field.

Experiments have been conducted over the past two years at the Tate and Lyle Central Agricultural Research Station in which coconut fibre waste has been compounded directly with essential nutrients to provide a medium which will support the growth of temperate zone food crops. Various combinations of coconut fibre waste and the essential nutrients have been evaluated. It is desirable that a substantial part of the nitrogen source in the medium should be of the slow-release type so that not too much nitrogen is immediately available to the plant or is leached out of the medium during heavy rainfall.

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The medium not only provides excellent drainage conditions but is also sufficiently hygroscopic not to require the recirculation of water and nutrient solutions as is necessary in conventional hydroponics systems. Coconut fibre waste is of relatively low weight and can readily be moved about. In addition, many of the plant pathogens normally encountered in the heavier tropical soils are eliminated. It is hoped that this simple system of producing food crops, particularly during the unfavourable rainy season, will stimulate sugar workers and others to produce some of their own vegetables at home.

Experimental

The experiments were carried out during 1963 and 1964 in a variety of different containers. The methods are detailed below . The experiments are grouped together according to the crop being studied.

Tomato (Lycopersicon esculentum, Mill.)

Experiment 1.

Coconut fibre waste (CFW) was placed in four 12" clay pots and in large plastic drums. MagAmp (Magnesium ammonium phosphate 8:40:0 NPK + 24% MgO) was incorporated, in granular form, into the coconut fibre waste (CFW) at the rate of 2½% (by weight of CFW). The medium was watered thoroughly. In a second series of four containers,

CFW was employed as the growth medium, without adding MagAmp, while in the third series NPK (15:15:15) at 2.5% (by weight of CFW) and 2.5% MagAmp were incorporated into the CFW. Each of the three different media was watered until run-off was visible at the drainage holes provided at the base of each container. Four tomato seedlings (var. Anahu) were planted in each of the three media. Simultaneously, four seedlings were planted in a Waterloo loam and clay soil, adjacent to the area where the containers were kept. The soil was treated with amounts of MagAmp and NPK, equivalent to those which had been added to the CFW. The tomato seedlings averaged 10.5 cm. in height at the time of planting and were chosen for uniformity prior to planting.

Records were kept of the height of the seedlings two weeks after planting, of the number of floral buds visible on the plants at four and six weeks after planting, the number of plants with visible fruit at eight weeks after planting and the average yield in lbs. of fruit per plant. Results are tabulated in Table 1.

Table 1.

Comparisons of Tomato var. Anahu Grown in Four Different Media

Growth Medium	Average height of 4 Tomato plants at 2 weeks after planting (in cm.)	Visible Floral Buds (+ = Visible buds) (- = No Buds visible)		Number of plants with visible fruit at 8 weeks	Average yield in lbs. tomato fruit per plant
		At 4 weeks	At 6 weeks		
CFW (no fertilizer)	11.1	-	-	0	0.5
CFW + 2.5% MagAmp	15.2	+	+	4	2.7
CFW + 2.5% MagAmp + 2.5% NPK	22.6	+	+	4	4.5
Soil + 2.5% MagAmp + 2.5% NPK	12.2	-	+	0	1.7

Growth of tomato plants was most rapid in the CFW + 2.5% MagAmp + 2.5% NPK. The absence of NPK fertilizer from this mixture resulted in a large depression in the height of the plants.

After four weeks floral buds had been developed on plants grown in CFW + MagAmp, and in CFW + MagAmp + NPK, but not on plants grown in soil + NPK + MagAmp, or in CFW lacking fertilizers. After six weeks floral buds were lacking only in those plants which were grown on CFW without fertilizer.

Those plants grown in CFW + fertilizer combinations bore fruit at eight weeks after planting. Although plants grown in soil had developed small floral buds at six weeks these did not develop into fruit at eight weeks. Plants grown in CFW (no fertilizer) also lacked visible fruit after eight weeks.

The greatest yield of fruit at twelve weeks was obtained from plants grown in CFW + 2.5% MagAmp + 2.5% NPK, while the lowest yield was recorded from plants grown in CFW (no fertilizer). The yields in soil, 1.7 lb. per plant, were somewhat above the average for Trinidad (i.e. average yields on Trinidad soils are approximately 1.0 lb. per plant.)(1)

Experiment 2.

A "trough" 60' long by 4' wide by 1' deep was excavated in the soil. The sides were lined with polythene plastic sheeting and coarse gravel overlaid with fine gravel formed the base of the "trough". Drainage was ensured by the base sloping to one end. CFW was placed in the "trough" to a depth of 10". MagAmp at 2.5% and NPK (15:15:15) at 2.5% (by weight of CFW) were incorporated into the CFW.

Seedlings of the following tomato varieties were planted in the "trough".

10th May 1963 — 4 plants of var. Beefsteak

10th May 1963 — 4 plants of var. Manalucie

10th May 1963 — 4 plants of var. Burpee Hybrid

13th June 1963 — 4 plants of var. H. 56

13th June 1963 — 3 plants of var. H. 5

At harvest records were kept of the weight of fruit obtained from each variety. Results are given in Table 2.

Table 2.

Yields of Five Tomato Varieties Grown in One Medium

Variety	Date Planted	Date Harvested	Number of Plants	Total Weight of Fruit (lbs.)	Average Weight per Plant (lbs.)
Manalucie	10.5.63	9.7.63 19.7.63 2.8.63	4	4.68	1.17
Beefsteak	10.5.63	9.7.63 19.7.63 2.8.63	4	4.04	1.01
Burpee Hybrid	10.5.63	9.7.63 19.7.63	4	1.59	0.40
H. 5	13.6.63	29.8.63 6.9.63	3	3.00	1.00
H. 56	13.6.63	29.8.63 6.9.63	3	3.33	1.11

Yields in this experiment were rather poor. The best yield was given by the variety Manalucie while the Burpee Hybrid variety gave the lowest yield(4).

Experiment 3.

On 27th December 1963 seedlings of three tomato varieties were planted in the "trough" described in Experiment 2. The CFW in the "trough" had been weathered for some time and contained additional organic matter in the form of the roots of a previous crop. Ground limestone at 5%, MagAmp at 2.5% and NPK (15:15:15) at 2.5% had previously been incorporated into the mixture.

The following varieties were planted in the medium.

20 plants of var. Heinz Special

18 plants of var. Grosse Lisse 717

and 10 plants of var. College Challenger

Growth was excellent in this experiment and yields were good. The fruits were harvested between 17th February and 16th March 1964, and the results are presented in Table 3.

Table 3.

Yields of Three Tomato Varieties Grown in One Medium

Variety	Number of Plants	Total Weight of Fruit (lb.)	Number of Fruit	Average Weight of Fruit (oz.)	Average Yield per Plant (lb.)
Grosse Lisse 717	18	90	339	4.2	5.0
Heinz Special	20	137	488	4.7	6.9
College Challenger	10	42.6	138	4.9	4.3

The Heinz Special variety gave excellent yields of tomatoes. Some individual plants yielded up to 11 lb. of fruit and the average yield of 6.9 lb. per plant is very good under Trinidad conditions. Both Grosse Lisse 717 and College Challenger produced good weights of fruit per plant, well above the average for Trinidad.

These experiments demonstrate that with the use of suitable tomato varieties good yields of high quality tomatoes can be obtained by using the CFW-fertilizer medium.

White (Irish) Potato (Solanum tuberosum, L.)

Potato tubers were planted at a depth of 7" in the following media:

(i) CFW (no fertilizer)

(ii) CFW + 2.5% MagAmp

(iii) CFW + 2.5% MagAmp + 2.5% NPK (15:15:15)

(iv) Soil + 2.5% MagAmp + 2.5% NPK (15:15:15)

Data on germination, growth rates and yields were recorded from the plants grown in the different media.

Germination and emergence occurred at 17 days after planting in each of the media containing CFW, but not in soil. Upon examination it was found that the tubers planted in soil had deteriorated, presumably as a result of fungal attacks.

There were no visible differences in the rate of growth, at the end of four weeks, of potato stems grown in the different media containing CFW. But after seven weeks it was apparent that growth in CFW + MagAmp and in CFW + MagAmp + NPK had surpassed that in CFW (no fertilizer).

After nine weeks a crop of new potatoes (approximately 1.5 lb. per plant) was harvested from plants grown in CFW + MagAmp and from CFW + MagAmp + NPK.

This experiment illustrated two points. First, potato tubers often do not germinate or emerge when planted in heavy tropical soils, and secondly, initial growth rates of potatoes in CFW without fertilizer are equivalent to growth rates in CFW + fertilizer. Probably this is so because stored food supplies in the tuber support early growth. After seven weeks of growth, however, it was noted that rates of growth were superior in CFW containing MagAmp and NPK.

Lettuce (*Lactuca sativa*, L.)

Experiment 1.

Seed of the variety Mignonette were sown in the "trough" lined with plastic (as described in Tomato Expt. 2.) They were planted on 6th May 1963 in one section of the "trough." The yield data from twenty-five plants of this variety were recorded at the time of harvest.

Germination of the variety "Mignonette" took place within three days after planting. The lettuce was harvested on 4th June 1963 - 29 days after planting. Twenty five lettuce plants yielded 12 lb. of lettuce - an average of 0.48 lb. per plant.

Experiment 2.

Hollow, clay bricks were used to line the walls of another "trough" excavated in the soil. This "trough" was also 60' x 4' x 1' and the base consisted of layers of coarse and fine gravel sloping to one end to ensure adequate drainage. No cover was placed over the "trough." The "trough" was filled to a depth of 10" with CFW in which MagAmp at 2.5%, NPK (15:15:15) at 2.5% and ground limestone at 5% had been incorporated. Plants of the two Queensland lettuce varieties Early Great Lakes and MR-52 were planted in the "trough" on 19th November 1963. Yield data were kept at harvest.

Growth of the two varieties Early Great Lakes and MR-52 was excellent in this medium. The lettuce was harvested between 3rd and 10th January 1964 - some 8 to 10 weeks after sowing. The yield data are presented in Table 4.

Table 4.

Yields of Two Lettuce Varieties Grown in One Medium

Variety	Area (sq. ft.)	Total Weight of Lettuce (lb.)	No. of Plants Harvested	Average Weight per Plant (lb.)	Average Weight per sq. ft. (lb.)
Early Great Lakes	30	39.67	45	0.88	1.32
MR-52	45	27.43	28	0.98	0.61

The variety Early Great Lakes formed true "heads", a rare occurrence under Trinidad conditions MR-52, however, did not "head."

Experiment 3.

Seed of the variety Imperial were sown in the following media:

(i) CFW + 2.5% MagAmp + 2.5% NPK (15:15:15)

(ii) Soil + 2.5% MagAmp + 2.5% NPK (15:15:15)

Germination and emergence of this variety occurred within 3 days after planting in the medium containing CFW, but required at least 5 days in soil + NPK + MagAmp.

Imperial lettuce was in the 4-leaf stage at 8 days in the medium containing CFW, but required 15 days to reach this stage in soil.

Only observations on the germination and growth rates of this variety were made.

Other Crops

Beet (Beta vulgaris L.)

Seed of tne variety Detroit Dark Red were sown in the "trough" lined with bricks on 14th March 1963. No limestone was incorporated at this stage. After thinning sixty plants occupied an area of sixty-eight square feet. The total root weight harvested from this area was recorded.

Endive (Cichorium endivia L.)

Comparisons were made between endive (var. Full Heart) grown in CFW + 2.5% MagAmp + 2.5% NPK (15:15:15) and in soil + 2.5% MagAmp + 2.5% NPK (15:15:15). Yield data were recorded at harvest.

Sweet Pepper (Capsicum frutescens, L.)

Seed of sweet pepper (var. California Wonder), were planted in CFW + 2.5% MagAmp + 2.5% NPK (15:15:15) on 10th May 1963. The plants were grown in the "trough" lined with plastic. At the same time plants of this variety of sweet pepper were grown in soil treated with equivalent amounts of NPK (15:15:15) and MagAmp. At harvest the yield of peppers from plants grown in each of the media was recorded.

Bean (Phaseolus vulgaris, L.)

Seed of the Contender variety of Bean were planted in CFW + 2.5% MagAmp + 2.5% NPK (15:15:15) on 11th May 1963. Ten plants of this variety matured and the weight of edible beans harvested was recorded.

Carrot (Daucus carota, L.)

Two varieties of carrot (Long Imperator and Chantenay) were planted in soil, in CFW alone and in CFW + 2.5% MagAmp + 2.5% NPK (15:15:15). The seed were sown on 11th May 1963. At harvest yield data were kept from each medium.

Celery (Apium graveolens, L.)

Seed of celery (var. Long Golden) were planted in CFW + 2.5% MagAmp + 2.5% NPK (15:15:15) in CFW alone and in soil on 11th May 1963. Comparisons were made between the yields obtained from each of the media. The yield data for the other crops are presented in Table 5.

Table 5.

Yield Data of Six Crops Grown in Different Media

Crop	Variety	Medium	Total Weight (lb.)	No. of Plants	Average yield per plant (lb.)	Average yield per sq. ft. (lb.)
Beet	Detroit Dark Red	CFW + MagAmp + NPK	7.1	60	0.118	0.103
Endive	Full Heart	CFW + MagAmp + NPK	24.0	60	0.40	0.51
		Soil + MagAmp + NPK	-	-	0.25	-
Sweet Pepper	California Wonder	CFW + MagAmp + NPK	13.1	6	2.18	-
		Soil + MagAmp + NPK	-	-	1.60	-
Carrot	Chantenay	CFW alone	0	0	0	0
		CFW + MagAmp + NPK	5.28	25	0.21	0.35
		Soil + MagAmp + NPK	0	0	0	0
	Long Imperator	CFW alone	0	0	0	0
		CFW + MagAmp + NPK	2.26	25	0.09	0.15
		Soil + MagAmp + NPK	0	0	0	0
Bean	Contender	CFW + MagAmp + NPK	5.64	10	0.56	-
Celery	Long Golden	CFW + MagAmp + NPK	11.15	25	0.45	0.74
		Soil + MagAmp + NPK	0	0	0	0

Beet (Beta vulgaris, L.)

The beet roots were harvested on 5th and 15th July 1963 and a total root weight of 7.1 lb. was obtained from the medium containing CFW + MagAmp + NPK.

Endive (Cichorium endivia, L.)

An average yield per plant of 0.48 lb. was obtained from the endive planted in CFW + MagAmp + NPK while only 0.25 lb. per plant was obtained from soil treated with equivalent amounts of fertilizer.

Sweet Pepper (Capsicum frutescens, L.)

Fruits of sweet pepper were harvested between 9th July and 5th October 1963. Six plants yielded a total of 13.1 lb. over this period at an average yield of 2.18 lb. per plant. Similar plants grown in soil yielded an average of 1.6 lb. per plant.

Bean (Phaseolus vulgaris, L.)

Ten plants of the variety Contender yielded a total of 5.64 lb. of beans in two pickings on 24th June and 9th July 1963 (44 and 60 days after planting). This represents an average yield of 0.56 lb. per plant.

Carrot (Daucus carota, L.)

Both varieties of carrot (Long Imperator and Chantenay) were unproductive in soil + MagAmp + NPK and also in CFW alone. The variety Long Imperator produced 2.26 lb. of carrots when harvested on 13th July and 6th September 1963. The variety Chantenay, when harvested at this time yielded 5.28 lb. of carrots.

Celery (Apium graveolens, L.)

After 12 weeks plants of the variety Golden Wonder yielded an average weight of 0.45 lb. per plant when grown in CFW + MagAmp + NPK. Plants grown in soil were unproductive.

In each case, where direct yield comparisons were made between plants grown in CFW + MagAmp + NPK, in Soil + MagAmp + NPK and in CFW alone, superior yields were obtaired from the crops grown in CFW + MagAmp + NPK.

Experiments with different CFW/Fertilizer Mixtures under Different Types of Cover.

Early in 1964 an area was set aside for growing various crops in CFW under two types of cover. The floor of the area was paved and a "lean-to" building erected. The building is 10 ft. high sloping to 9 ft., and 60' long by 15' wide. It is roofed in part with lumite saran providing 36% shade and part with a rigid neutral vinyl plastic product.

Fifteen rigid polyvinylchloride containers each 10'x 2.75' x 10" were placed on the floor of the building in three rows of five containers. Each container was provided with an external wooden "cradle" as additional support.

Coconut fibre waste was placed in each container to a depth of 9". Three fertilizer mixtures were incorporated at random so that each mixture was present in five containers. The fertilizer mixtures, on the basis of weight of CFW, were as follows:-

Mixture A. 5% Ground Limestone
2.5% MagAmp
2.5% NPK (15:15:15)

Mixture B. 2.5% MagAmp
2.5% NPK (15:15:15)

Mixture C. 5% Ground Limestone
2.5% MagAmp with K (7:40:4 + 12% Mg.)

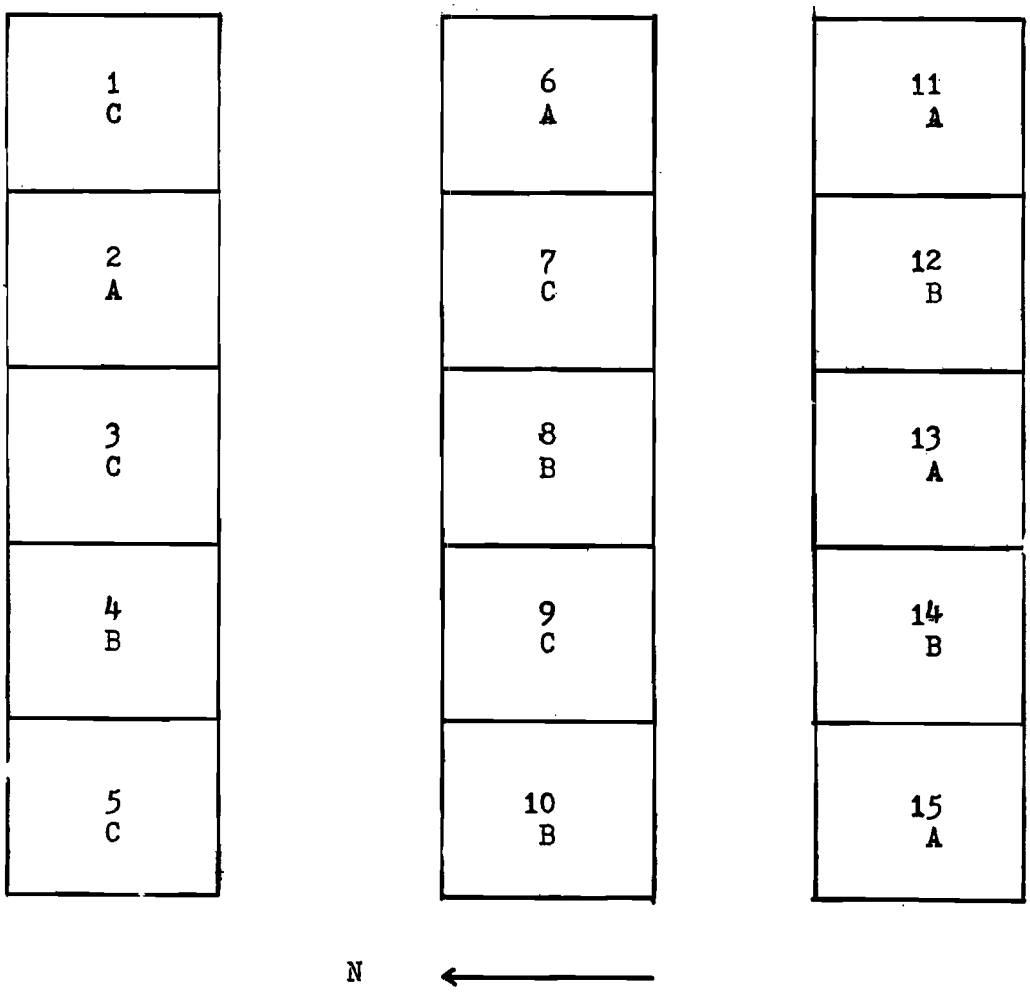

Figure 1. Layout of Different Fertilizer Mixtures in Lean-to Building.

The containers numbered 5, 10 and 15 were positioned under the complete cover.

Planting of the crops in the different media took place as follows:-

(i) Onion (Allium cepa, L.)

Seed of the following ten varieties were sown in each of the CFW/fertilizer mixtures on 23rd March 1964:-

vars. Yates Selection 590
Yates Selection 595
Yates Selection 602
Yates Selection 608
Yellow Bermuda
Early Grano
Hybrid Granex
Excel Bermuda 986
Early Lockyear White
Early Lockyear Brown
Texas Grano 502
and Evergreen Long White Bunching

The onions were sown in tanks 5C, 12B and 15A.

Germination was observed in all varieties and yield data were kept at harvest.

(ii) Lettuce (Lactuca sativa, L.)

Four seedlings of each of the varieties Early Great Lakes, MR 52 and Imperial were planted in the different media on 29th April 1964. The growth of the varieties was observed in each medium and the yields were recorded at harvest. Tanks 2A, 7C and 14B contained the lettuce plants.

(iii) Tomato (Lycopersicon esculentum, L.)

One seedling of each of the following varieties of Tomato was planted in each of tanks 1C, 10B and 11A on 9th April 1964:-

vars. San Marzano Lampadina
A Grappoli Red Top V.9
Spartan Red 8
Spartan Pink 10
Manapal
Floralou
College Challenger
and Burpee Big Boy

Differences in growth in the different media were noted and the yields were recorded.

(iv) Bean (Phaseolus vulgaris, L.)

Seed of the variety Contender were planted in the different CFW-fertilizer mixtures in tanks 4B, 9C and 13A on 9th April 1964. Observations were made on the germination, growth and yield in the three media.

(v) Potatc (Solanum tuberosum, L.)

Tubers of the variety Ona were planted at a depth of 7" in each of the media on 11th April 1964. The tubers were planted between 10" and 12" apart so that each tank contained twelve tubers. The potatoes were planted in tanks 3C, 6A and 8B. The results of these experiments are recorded in Table 6.

Table 6.

Yield Data of Four Different Crops Grown in Three Different CFW/Fertilizer Mixtures

Crop	Variety	Date Planted	Date Harvested	Yield Data (lb.) A	B	C
Onion	Selection 590	23.3.64	17.6.64	0	0	
	Selection 595	23.3.64	17.6.64	0.14	0	
	Selection 602	23.3.64	17.6.64	0.11	0	
	Selection 608	23.3.64	17.6.64	0.52	0	
	Yellow Bermuda	23.3.64	17.6.64	0.54	0	
	Early Grano	23.3.64	17.6.64	0.39	0.10	
	Hybrid Granex	23.3.64	17.6.64	0.86	0.11	
	Excel Bermuda 986	23.3.64	17.6.64	0.55	0	
	Early Lockyer White	23.3.64	17.6.64	0.13	0	
	Early Lockyer Brown	23.3.64	17.6.64	0.11	0	
	Texas Grano 502	23.3.64	17.6.64	3.08	0	
	Evergreen Long White Bunching	23.3.64	17.6.64	0	0	
Lettuce	Early Great Lakes	29.4.64	17.6.64	3.18	2.98	0
	MR 52	29.4.64	17.6.64	2.69	2.86	0
	Imperial	29.4.64	17.6.64	2.53	3.04	0
Bean	Contender	9.4.64	25.6.64	0	0.20	0
Tomato	San Marzano	9.4.64	19.6.64 to 9.7.64	4.00	0	0.15
	A Grappoli Red Top	9.4.64	19.6.64 to 9.7.64	1.63	0	0.04
	Spartan Red 8	9.4.64	19.6.64 to 9.7.64	4.46	0	0
	Spartan Pink 10	9.4.64	19.6.64 to 9.7.64	3.80	0	0
	Manapal	9.4.64	19.6.64 to 9.7.64	3.92	0	0
	Floralou	9.4.64	19.6.64 to 9.7.64	2.76	0	0
	College Challenger	9.4.64	19.6.64 to 9.7.64	4.49	0	0.40
	Big Boy	9.4.64	19.6.64 to 9.7.64	3.83	0	0

No Germination

Onion (A. cepa, L.,

The yield data represent the total weight of onions harvested from a 2' 6" row across a container. The onions in tank A and in tank C were grown under complete cover and were watered as required. Tank B was positioned under the lumite saran and the onions growing in it were exposed to natural rainfall. The force of the rain was reduced by the mesh of the saran.

The results in Table 6 indicate that the composition of the medium has a marked effect on the growth and yield of onions. The onion seeds germinated well in both CFW + Limestone + MagAmp + NPK and CFW + MagAmp + NPK but no germination was observed in the CFW + Limestone + MagAmp with K. However, after germination, the plants in CFW + MagAmp + NPK made very little growth.

It is known that onion cultivars differ markedly in the minimum photoperiod required for bulb formation. Temperature is another factor which is known to affect bulb formation in onions.(2) It is probable that combinations of these two factors have contributed to the wide variations in yield between the different varieties in Tank A.

Lack of readily available nutrients after the food reserves of the endosperm were exhausted may possibly account for the non-emergence of plants in the tank from which NPK was omitted. It would appear from the results that the absence of ground limestone from the medium had an adverse effect on the growth of onion seedlings.

Lettuce (L. sativa, L.)

The lettuce plants in the medium containing no NPK had yellowed badly by the 11th May 1964 (12 days after planting). Both the media containing limestone and that without produced plants which averaged between 0.63 lb. and 0.80 lb. per plant. The different varieties showed slightly different responses in yield when grown in the two media, but in general there was little to choose between them.

Neither Early Great Lakes nor MR 52 produced true "heads" when grown at this time. Both varieties bolted.

Tomato (L. esculentum, Mill.)

Additional information on the numbers of fruit per plant and the average weight per fruit from Tank A is presented in Table 7.

Table 7.

Yield Data of Eight Tomato Varieties Grown in Tank A

Variety	Yield Data		
	Weight per Plant (lb.)	Number of Fruit	Average Weight per Fruit (oz.)
San Marzano	4.00	55	1.16
A Grappoli Red Top	1.63	24	1.08
Spartan Red 8	4.46	20	3.55
Spartan Pink 10	3.80	15	4.07
Manapal	3.92	21	3.00
Floralou	2.76	12	3.68
College Challenger	4.49	15	4.80
Big Boy	3.23	8	6.50

The tomato plants in the medium without NPK displayed acute symptoms of nitrogen deficiency(5). Growth was severely retarded, the colour of the foliage faded to a pale yellow and the plants eventually died.

In the medium lacking ground limestone, flowering and fruit development was very sparse. But in the CFW + MagAmp + NPK + ground limestone most varieties yielded well. The two Italian varieties, San Marzano and A Grappoli Red Top, produced he first fruits but the fruits displayed symptoms of blossom-end rot. It is possible that the two varieties are more susceptible to this disease. Since this medium was partially covered, and the crop was grown during the rainy season, the fluctuations in moisture content which must have occurred to a certain extent, were possibly sufficient to induce the disease symptoms.

The variety College Challenger produced the best yield per plant but the fruits were not as large as those of the variety Big Boy. Spartan Red 8, Manapal and Spartan Pink 10 also gave good yields of fruit.

White (Irish) Potato (S. tuberosum, L.)

Emergence of the foliage in both media treated with limestone occurred at 7 days after planting. In the medium lacking limestone, however, no shoots appeared. Examination of the tubers revealed that, in the absence of limestone, they had all rotted. Similar results were obtained when tubers of the same variety were again planted in this medium.

At about 14 days after the emergence of the foliage in the medium containing no NPK severe symptoms of nitrogen deficiency were observed(5). The foliage colour became very pale green to yellow. Vegetative growth in the other medium was very good.

The haulms began dying off about 70 days after planting and when they were removed from both tanks on 29th June 1964 no tuber formation had occurred. This was probably due to the photoperiod and thermoperiod being favourable to vegetative growth but not to tuberization(3).

Bean (P. vulagris, L.)

Germination of the bean seed occurred 4 days after planting in each medium. Initial growth was good in all the media but within 2 weeks the plants in the medium lacking NPK showed severe chlorotic symptoms and growth was retarded until they eventually died.

Flowering of the plants in the other two media occurred on 8th May 1964 (30 days after planting). But about two weeks later the plants became diseased and they also died. A very low yield of edible beans was obtained on 25th June 1964 from the medium which contained no limestone.

Discussion

The experiments described in this paper illustrate several important points. Most important is that superior yields are obtained when vegetable crops are grown in the combination of coconut fibre waste and fertilizers, than when the coconut fibre waste is replaced by soil. Coconut fibre waste alone is unable to support the growth of vegetable crops and fertilizers have to be incorporated to provide the plants with the essential nutrients.

Different crops vary to some extent in their performance when grown in the different media. But as a general rule the combination of CFW + 2.5% MagAmp + 2.5% NPK (15:15:15) + 5% ground limestone has proved to be the most successful combination used so far.

During the period when the experiments evaluating the different types of cover were carried out, heavy rainfall was experienced (17.93 ins.). Under these rainfall conditions there appeared to be no benefits from using one or other of the types of cover. Any differences there may have been were overshadowed by the different responses of the crops to the constitution of the medium in which they were grown.

Another important point which has emerged is that varieties of certain crops perform better in Trinidad at certain times of the year than at others. This, presumably, is due to their response to differences in photo- and thermo-periods. For example, when grown under shorter day lengths and lower night temperatures in December/January, the lettuce variety Early Great Lakes did not develop flowers and seed stalks, but produced true "heads." However, when grown under longer day lengths and higher temperatures in May/June, this variety

"bolted" and produced low quality lettuce.

From these preliminary investigations it would appear feasible to grow high-quality temperate-zone food crops in the coconut fibre waste/fertilizer medium provided allowance is made for photo- or thermoperiodic requirements of the crop.

Summary

A number of experiments carried out during 1963 and 1964 have shown that high quality food crops can be grown in a medium consisting of coconut fibre waste compounded with fertilizers. Yields from plants grown in this medium are shown to be markedly superior to those from plants grown in soil under the same fertilizer regime.

Experiments are described in which the fertilizer constituents of the medium differ and in which the crops are grown under two types of cover. The results of these experiments are presented and discussed.

Acknowledgements

The authors wish to thank Messrs. K. Hakim and M. Mohammed for their valuable technical assistance in carrying out these experiments and in recording the yield data.

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