CHARCOAL - A USEFUL ADDITIVE TO FERTILIZER FOR CORAL SOILS AN EXPERIMENT IN TUVALU

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INTRODUCTION

Growing food on coral soils is often a problem because:

1. The soils are low both in organic matter and in the important plant nutrients nitrogen, potassuim and certain trace elements.

2. Often the concentration of salt is very high.

3. There is a limited supply of fresh water on many coral atolls.

It is possible to grow a good range of vegetables on these soils, but only if expensive fertilizers are used.

In 1981, agronomists from the Department of Agriculture, Tuvalu, began a trial to find a local substitute for imported fertilizer. The trial was carried out on Vaitupu Island, Tuvalu.

FERTILIZER TREATMENTS

The trial consisted of 15 treatments on plots of coral soil, growing Chinese cabbage (variety Chinese Taisai) as a test crop. Each treatment was repeated 4 times, hence there were 60 plots in the trial altogether. Each treatment was a combination of the following conditions.

- cultivation or no cultivation
- fertilizer or no fertilizer
- add ash from coconut wood or no ash
- add charcoal from coconut wood or no charcoal
- add finely ground phosphate rock or no phosphate rock.

Extra sulphate of ammonia (a source of nitrogen) and ferrous sulphate (a source of iron) were added to some wood ash treatments, because it was assumed that wood ash would not contain enough of these nutrients (plant foods).

Table 1 shows the amounts of fertilizer and fertilizer substitutes used during the trial. All the treatments were applied before planting. In the cases of the standard fertilizer mixture, wood ash and sulphate of ammonia they were also applied to each plant once a fortnight at the rate shown.

The trial was designed so that the effects of the various treatments could be seen by comparing pairs of treatments.

RESULTS

Cultivation

There was little difference between the yields produced on cultivated plots compared with non-cultivated plots. This is to be expected on very porous soils. Not much cultivation is needed because the soil particles do not stick together in large lumps.

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* *This article is based on one which appeared in the Alafua Agricultural Bulletin 10(1), 1985, pp. 31-33.*

TABLE 1 RATES OF FERTILIZER AND FERTILIZER SUBSTITUTES USED IN THE TREATMENTS

Treatment	Amount applied before planting	Amount applied after planting
Standard fertilizer treatment	100 kg/ha ferrous sulphate plus 500 kg/ha standard fertilizer mixture*	5 g mixture* per plant per fortnight
Wood ash	1000 kg/ha	5 g per plant per fortnight.
Charcoal (lumps)	1000 kg/ha	-
Ferrous sulphate	1000 kg/ha	
Phosphate rock	1000 kg/ha	-
Sulphate of ammonia	300 kg/ha	1 g per plant per fortnight

* *The standard fertilizer mixture was made up as follows:*
10 kg Ammonium nitrate
10 kg IBDU (Isobutylidene duirea - 32%N)
10 kg Potassium chloride
6 kg Double superphosphate
5 kg Ferrous sulphate
5 kg "Essential mineral elements" - Ess-Min-El.

Fertilizer

The plots treated with the standard fertilizer treatment compared to those without it showed the greatest effect. For example, on uncultivated soil, Chinese cabbages grown without fertilizer weighed on average only 8.7 g; with fertilizer the average weight was 610 g. On cultivated soils the weights were 23.2 g per Chinese cabbage, unfertilized; and 670 g, fertilized.

Wood ash

The addition of wood ash did increase yields compared with the unfertilized control. However the increase was much lower than that obtained after using the standard fertilizer treatment. Adding sulphate of ammonia (nitrogen) and ferrous sulphate (iron) did not make much difference.

Phosphate rock

The phosphate rock treatment had no effect on the growth of the Chinese cabbages. It probably did not dissolve enough and therefore could not be absorbed into the plants.

Charcoal

On its own, charcoal did not have a big effect on the crop. Charcoal combined with wood ash, sulphate of ammonia, ferrous sulphate and rock phosphate gave only a small increase in the size of the cabbages. However, when charcoal was added to the standard fertilizer treatment the average weight per cabbage increased from 670 to 815 g. The charcoal and standard fertilizer treatments together gave a better result than any other combination.

DISCUSSION

In this trial, the charcoal was spread on the plots as lumps, then the fertilizer was added. Both were then dug into the soil together. It is thought that charcoal improves the effect of fertilizer because the nutrients somehow stick to the surface of the charcoal. This prevents them from draining away through the soil.

Thus, this experiment shows that if charcoal is added to fertilizer on coral soils, the effect of the fertilizer is improved. There are still many questions to be answered.

For example:

1. How much charcoal should be used?
2. Should charcoal be applied as lumps or powder?
3. Should charcoal be mixed with fertilizer before applying to the soil?
4. Do other crops respond as well as Chinese cabbage?
5. Does charcoal need to be applied to the same piece of land every year?

In spite of these questions, the author thinks that the use of charcoal as an additive to fertilizer is a promising line of research. It could be of special value on coral islands.

FURTHER INFORMATION

Further information about the trials using charcoal and fertilizers on coral soils can be obtained by writing to:

The Agricultural Officer
Ministry of Commerce and Natural Resources
VAIAKU
Funafuti
Tuvalu

or Chief Agricultural Officer
Ministry of Natural Resources Development
Division of Agriculture, Tanaea
P.O. Box 267, BIKENIBEU
Tarawa
Kiribati

Further information about soils, fertilizer use and land suitability in Papua New Guinea can be obtained by writing to:

Chief Land Utilisation Officer
P.O. Box 1863
Boroko, N.C.D.

FURTHER READING

Lefroy, E. (1981). Growing food on coral atolls. *Harvest* 7(1):7-13.

Tuvalu Department of Agriculture (1981). Annual Report 1981.

Note from Land Utilisation Section, D.P.I.

Coral soils are found in Papua New Guinea exclusively on some of the low coral atolls along the north coasts of the New Guinea mainland, New Britain and New Ireland, and among the Milne Bay Islands.

They are often left uncultivated because of the problems mentioned in this article. Salt spray is possibly more of a problem than high salt content of the soil.

Coral soils should not be confused with the soils on raised coral terraces which are more widespread. These soils are often very shallow, but are also fertile, with high contents of phosporus, organic matter and some nitrogen.

As far as we are aware the method described in this article has not been tested in Papua New Guinea, but we see no reason why results should be different here.

It should be noted, however, that it is essential to apply fertilizer with the charcoal to achieve any benefit. Charcoal by itself is not enough to improve yields.