STABILISING SHIFTING AGRICULTURE

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INTRODUCTION

Although they get plenty of rain and sun, the lowland, humid tropics are not agriculturally very productive. This is mostly due to difficulties in preventing soil fertility from dropping and in keeping weeds under control.

Over many centuries, a system of agriculture, called shifting agriculture, has developed to overcome these difficulties.

In this system, crops are grown on small plots of land which have been partly cleared of forest. The cut vegetation is burned and the crops are planted in the ashes. The plots are used for one to three years and then the forest is allowed to grow back. The plots stay under this forest fallow for up to 20 years before they are cleared again.

Because the land is used for crops for only a short time and is fallowed for a long time, moisture, organic material and plant nutrients are not lost from it, serious erosion does not occur and weeds do not grow there in large numbers.

There are very few problems due to insect pests of crops in shifting agriculture. One reason for this is the large number of different crops grown on each plot. Because there are only a few plants of any one type, their pests find it hard to spread from one plant to another. Natural enemies of pests can enter the plots easily from the surrounding forest and kill any pests which may be there.

In the past, shifting agriculture has been very successful, but a lot of land is needed for this system in which up to 15 hectares are used to feed one person. Now, in many areas of the world, including parts of Papua New Guinea, populations are increasing rapidly and there is no longer enough land for plots to be left fallow for long periods. This means that the forest does not have time to grow back on the plots before they are cleared and burned for the next garden.

Instead of forest, the land becomes covered with grass and the fertility and structure of the soil becomes very poor. This is made worse by repeated burning of the grass.

This article reports work carried out at the Wau Ecology Institute to find an agricultural system which can replace

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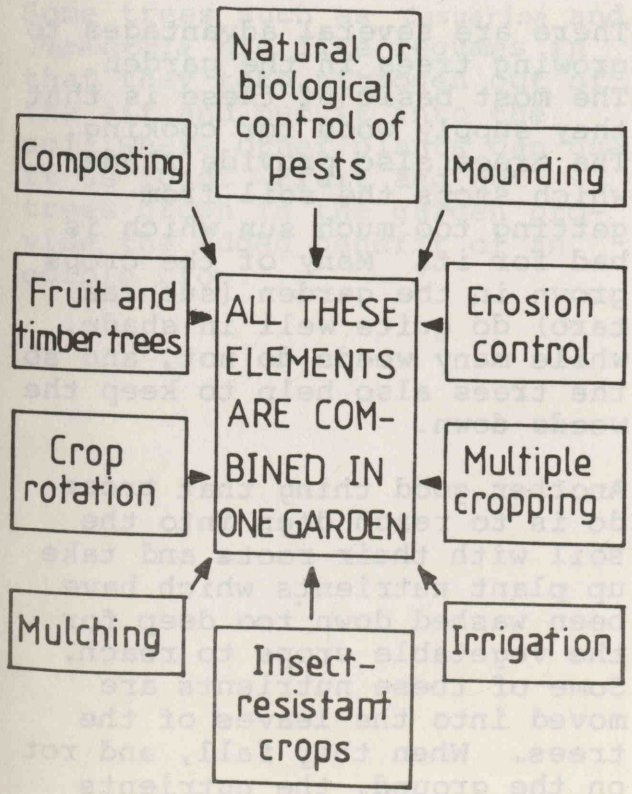
shifting agriculture in heavily populated areas of Papua New Guinea.

THE WORK AT WAU

The aim of the project described here was to find a way of using traditional shifting agriculture practices on a site-stable (non-shifting) plot. The new system had to be carefully designed to prevent any loss of soil fertility or increase in pest or weed problems. It was also necessary that the system gave high productivity but kept social and environmental damage to a minimum.

It was decided to test a system based on agro-forestry in which tree and field crops are grown together. As many traditional subsistence gardening methods as possible were used in the system. This is shown in the diagram below.



The traditional subsistence gardening methods used in the system

Mixed cropping

The two main problems with non-shifting subsistence agriculture are keeping pest numbers down and keeping fertility levels up. Natural pest control, as used in traditional systems, is enough to keep pest damage low on traditional crops, but some introduced crops need extra pest control measures such as insecticides. Only those introduced crops which are resistant enough to insect attack to grow well without extra pest control were included in this trial.

It was very difficult to find a good method of keeping the soil fertile over several years. Artificial fertilisers do not fit in well with the traditional aspects of the system and animal and kitchen wastes

Long mounds of compost following the contours of the land. Trees were kept to give shade (to the crops and soil) and firewood.

are both in short supply. However, there are unused wastes from cash cropping available in many parts of P.N.G. Near Wau, these wastes are in the form of coffee pulp which is usually dumped into the rivers. The pulp from the Institute's coffee plantation, together with grass cuttings and weeds, was therefore used to make compost for the experimental garden.

Compost is traditionally made in the Papua New Guinea Highlands from garden waste and is put into round mounds into which the crops are planted. For this experiment, long mounds were used to make the application of the compost easier. These mounds were made to follow the contours of the land to keep soil erosion to a minimum.

Three different crops were grown in each mound as a pest control measure. These three crops included a legume in each case because legumes supply nitrogen, an important plant food, to the soil. The three crops were planted together in such a way as to make both weeding and harvesting as easy as possible.

There are several advantages to growing trees in the garden. The most basic of these is that they supply wood for cooking. The trees also provide shade which stops the soil from getting too much sun which is bad for it. Many of the crops grown in the garden (such as taro) do quite well in shade, while many weeds do not, and so the trees also help to keep the weeds down.

Another good thing that trees do is to reach deep into the soil with their roots and take up plant nutrients which have been washed down too deep for the vegetable crops to reach. Some of these nutrients are moved into the leaves of the trees. When they fall, and rot on the ground, the nutrients are returned to the top layers of the soil where the smaller plants can reach them.

Building the mounds of compost

Some trees such as *Casuarina* and *Parasponia* are like legumes in that they take nitrogen out of the air and put it into the soil where other plants can use it as food. Fruit and nut trees grown in the garden provide the added benefit of an edible crop.

The garden has now been on the same site for over four years and has not declined in productivity or fertility during that time. After the last crop on each mound has been harvested, the mound is remade in the position of the old furrow and, again, plenty of compost is put inside.

CONCLUSION

The preliminary experimental work on this system is now over.

Although many aspects of the method still remain to be investigated, the compost contour mound technique for stabilising shifting agriculture has been shown to work.

The next step is to introduce it to local people and persuade them to use it in their gardens. It could be that they are in for a nice surprise.

FURTHER DETAILS

Further details of this method and, in particular, of the effect it has on insect pest numbers, are given in the article 'Natural control of insect pests in an organic garden' also by Wayne Gagné, in HARVEST 6 (1): 5-13.