Farmers experimentation with cassava planting in Indonesia

Farmers carry out their own experiments with crops. In fact, before the start of institutional agricultural experimentation, new developments in agronomic practices almost completely depended on experiments by farmers. Indonesian farmers are said to be good experimenters. A clear example is the development of the Mukibat system of Cassava growing.

Gerard H. de Bruijn and Bambang Guritno

The Mukibat system is named after its inventor, Mukibat, a farmer from East Java. He found that budding or grafting of tree cassava (Manihot glaziovii) onto a stock of ordinary cassava (M. esculenta) can lead to very high yields of tuberous roots. Tree cassava is a perennial, often grown in East Java and other parts of Indonesia, with support from the Agricultural Extension Service. Hut the system was not generally accepted. In the first 20 years after Mukibat started with his work no systematic scientific research into the agronomy and economic feasibility of the system has been carried out. Some experiments were carried out by the Agricultural Extension Service and by research institutes. However, many trials, often very inventive, have been done by farmers, sometimes in cooperation with the Extension Service. Publications were very scarce and written in Indonesian. A first description of the system in English was written by De Bruijn and Dharmaputra (1974). In 1973 the Faculty of Agriculture, Brawijaya University, Malang, started a research project on the Mukibat system, in cooperation with the Wageningen Agricultural University and supported by the Canadian International Development Research Centre. Research results gave more insight into the possibilities of the system. In this paper a short description of the Mukibat system is presented, and some examples of farmers’ initiatives in the development of the system are mentioned. The relevance of the system is considered and the necessity for studying the system further in close cooperation with farmers and researchers is discussed.

The system

According to villagers from Ngadiloyo, where Mukibat lived, Mukibat got the idea of combining tree cassava with ordinary cassava after following a course given by the Agricultural Extension Service in which participants had to do some individual grafting work. Though initially Mukibat budded the cassava tree onto the stock, grafting became more popular later on. Mukibat planted the budded cuttings in his farm yard on spots where organic matter had been put in the soil before planting. This creates a favourable situation for the cuttings to grow. At present the most common way of applying the Mukibat system is as follows: a scion of tree cassava, length 10-15 cm, is grafted on a piece of stem of ordinary cassava, length 20-30 cm, diameter 2-4 cm, serving as a stock. Scion and stock, which have to be exactly of the same diameter, are cut slantwise. A thin piece of bamboo is put into...
the pith of both scion and stock to facilitate the connection, and both stem pieces are connected often with banana leaf fibre. The cuttings are put under shade and watered daily. After about 8 days sprouts start to grow. Sprouts are removed from the stock. When the sprouts from the scion are about 2 cm long the grafted cuttings can be planted in the field. A hole normally is made before planting in which organic matter is mixed with the soil, after which the holes are filled up with soil and hilled up. The grafted cuttings, one per hill, are planted in a vertical position. Plant care is rather similar to the way in which ordinary farmers protect their plants by supporting them with bamboo. Plant spacing is very variable, especially under intercropping conditions. But normally a spacing of 1.25 m x 1.50 m is quite common. The growing period may vary from 8 to 18 months; harvesting mostly takes place about 12 months after planting. More details about the system are given by De Bruijn and Dharmaputra (1974).

**Farmers’ initiatives in the development of the system**

It is impressive to see how many variations of Mukibat's original ideas have been developed by farmers, in co-operation with the Agricultural Extension Service or not. We mention a number of modifications developed during the first 20 years of application of the system. In various cases the physiological considerations in way farmers think are striking. Much attention has been given to the question of whether budding or grafting is to be preferred. Though the grafting method is currently the most popular, budding is also fairly common. Budding is more difficult; its percentage of success is often very low. Alternative ways to make the scion-stock connection have been tried out in farm yards, like the one which was propagated as the 'Kurur' system (Kurniaatmadja, 1969). In this modification, cuttings of ordinary and tree cassava are planted separately. After 45 days young shoots of tree cassava are grafted on young shoots of ordinary cassava. For the scion material farmers distinguish original tree cassava sterns and sterns taken from a Mukibat canopy. It is not yet clear, however, whether the one is better than the other. Some farmers assert that the percentage of success from grafting can be improved by turning the graft units upside down for about five days, after which they are placed in the soil in normal position. Farmers found that after the first yield the grafted or budded cuttings can be replanted up to two or three times, on condition that the original stock is long enough. At the bottom end the stock is shortened by 5 cm after harvest. The top end is cut at about 10 cm above the original scion. This method reduces the effort of making planting material. It also eliminates the risk of breaking due to wind. Moreover, the yield from replanted cuttings appears to be better, though roots may become too woody after using the same unit more than three times. In order to promote higher yield, farmers often try to increase the number of roots per plant by treating the bottom end of the cutting. This is done by cutting the end slantwise, by making a circular incision in the peel, or by splitting the cutting longitudinally by sawing in the centre up to about 10 cm. The effectiveness of these methods is not known.

Considering that the big tree cassava canopy is not in balance with the stock, Satrawi, another farmer experimenting in his backyard, managed to connect one scion of tree cassava with three stocks of ordinary cassava (Anon., 1973). This system is quite laborious and often fails. Hut the yield capacity is said to be higher than that of the normal Mukibat system. 'Satrawi' plants produce more and smaller roots, and the stocks are sometimes taken from different varieties, each having its own specific flavour. Showing his skill, Satrawi even managed to make combinations of one scion with five and even seven stocks! Some East Javanese farmers even claim that by simple perforation of the pith of
ordinary cassava cuttings by a long bamboo stick, i.e., without using any scion, the yield of tuberous roots can be increased. This is called the 'Masduki' system. It has not been clearly proven whether it works or not. Farmers have developed other different modifications. In our opinion the development of methodology of the Mukibat system in about 20 years clearly shows a dynamic way in which farmers are managing and modifying their technology.

Relevance of the system

The relevance of the Mukibat system has often been subject to discussion. Though the system has been used for many years in different regions of East Java, one may well wonder why it is not more widely used and expanding in other countries as well. East Javanese farmers sometimes use both the ordinary and the Mukibat system at the same time. A clear and general answer to the question of its relevance cannot be given. However, the general adoption of the system in some villages proves beneficial to the farmers. It appears that its relevance depends on a number of factors. We shall consider some of those. In the first place, one should consider that the inputs to the system are quite high, mainly due to the grafting work and the digging of planting holes and filling them with organic matter. Comparing Mukibat and ordinary cassava, Soemarjo Poespodarsono et al. (1976) found that the input and output per hectare of the Mukibat way of planting was Rp. 152,700 and Rp. 295,230 respectively, and those of ordinary cassava Rp. 72,550 and Rp. 192,840 respectively. Thus the benefit margins of the two systems do not differ much, though they vary from one region to the other. It should be noted however that most inputs are local and consist mainly of labour.

The yield benefit of the Mukibat system is often not as high as is sometimes suggested. Though the yield per plant may become more than 100 kgs in some cases, on a hectare basis with normal densities, yield per plant is much less. Experiments at Brawijaya University indicated that under comparable conditions the yield increase by the Mukibat system is about 30%, though increases of more than 100% are claimed in some reports (Sitompul et al., 1982). The relevance of the system is highly dependent on local conditions. The system is very popular for growing cassava on sandy soils along the river Brantas. Experiments have shown that during the long dry season in East Java the leaf area of Mukibat plants is much less reduced than that of ordinary cassava (Bambang Guritno et al., 1981). This may be so because of the perennial character of tree cassava, causing a much faster and deeper rooting system. Thus water and plant nutrients would be more available for Mukibat plants than for ordinary cassava plants. Farmers often use the Mukibat system to increase the yield of varieties with low production capacity but good taste. Research indeed indicated that the yield benefit in low yielding varieties is higher than that in high yielding varieties.

Conclusions

It is evident that under certain conditions the Mukibat system is beneficial for farmers. However, it is not quite clear which considerations make farmers adopt or reject the system. There are still many open questions, Answers could be found by further study of what is more attractive or feasible for farmers. One labour intensive factor is the grafting work. The development of a simple grafting
machine could reduce labour inputs. Another labour-intensive factor is the hole digging. Research indicated that digging holes is not absolutely necessary; the application of organic matter in combination with normal soil cultivation is sufficient (Bambang Guritno et al., 1981). In our opinion further study should be carried out in close cooperation with farmers who have ample experience with the Mukibat system, thus mainly by on- farm experimentation. Intensive participation by farmers into further study of a system which they mainly developed themselves seems to be more than logical. Researchers, however, are in a position to compare experiences from different farmers and from different regions. A good interaction of activities of farmers and researchers certainly could help to bring more light in the complexity of the system.

Gerard H. de Bruyn

Department of Tropical Crop Science Wageningen Agriculture University

P.O. Box 341, 6700 AH Wageningen, the Netherlands

Bambang Guritno

Faculty of Agriculture, Brawijaya University

Malang, East Java, Indonesia