STOCK—SCION TRIALS WITH MANGO—I. A PRELIMINARY NOTE

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SUMMARY

AN experiment was laid down in November, 1937, at the Experiment Station, Pelwehera, near Dambulla to test the relative merits of *Wal amba* (Sour Mango) *Kohu amba* (Fibre mango), *Betti amba* (Bombay mango) and *Eta amba* (Wild mango) as rootstocks for the four selected scion varieties, Jaffna mango, *Ambalavi*, Willard and Sabre.

The *Etamba* was the most difficult stock to transplant into the field, and took over 2 years to be ready for budding. The growth of the other stocks of comparable age was uniformly good.

Most of the stocks being overgrown were budded in December, 1940, and January, 1941, by insertion of the buds into the framework branches. The Willard gave 80 per cent. successful bud ' take ', Jaffna 70 per cent., Sabre 60 per cent. and *Ambalavi* 40 per cent. The first variety to come into bearing was the Willard, a few frameworked trees of which bore fruit within 2 years on all the four varieties of rootstocks.

There has been so far no evidence of stock-scion incompatibility among all the varieties.

INTRODUCTION

The Mango (*Mangifera indica* L.) is a native of the Eastern Tropics where it has been grown from time immemorial. It ranks with the grape and pomegranate as one of the oldest of cultivated fruits. In India, which is regarded as the home of the finest mango, several hundreds of choice varieties exist many of which were grown on an orchard scale during the reign of the great Mogul Emperor Akbar from 1556–1605. These varieties, which were probably evolved through centuries of mass selection, have been maintained pure as a result of propagation by the old method of grafting by approach or inarching which was first developed in India.

Some of the varieties grown in Ceylon on the calcareous soils of the Jaffna Peninsula compare favourably with the best Indian varieties in flavour and quality of fruit. Here too the

slow and cumbersome method of vegetative propagation by inarching on seedling rootstocks raised from seed collected indiscriminately finds favour with the local nurseryman, although it is being rapidly superseded by the modern methods of bud-grafting practised with great success in Departmental stations. In the absence of reliable information on stock-scion interactions no attempt is made by the nurseryman to select his seedling rootstocks nor to limit the number of scion varieties grown by him.

In order to test the relative merits of the common varieties of mango which are likely to make good rootstocks on account of their vigour of growth, longevity and ease with which seed could be had in plenty during the season, an experiment was laid down in the dry zone at Pelwehera Experiment Station near Dambulla using seedlings of *Wal amba* (Sour mango), *Kohu amba* (Fibre mango), *Betti amba* (Bombay mango) and *Etamba* (wild mango) *Mangifera Zeylanica*, Hook as rootstocks for the four selected scion varieties, Jaffna mango, *Ambalavi*, Willard and Sabre.

THE ROOTSTOCK VARIETIES

The common sour mango is widely distributed throughout the Island. It is known as *Pulima* in the Jaffna Peninsula and Batticaloa District. The trees are long lived and produce fruits which vary considerably in size and shape. Each seed contains a single embryo which grows into a vigorous seedling. Being the progeny of monoembryonic seeds, the seedlings tend to exhibit variations in growth characteristics. Paul and Guneratnam (1) found from a study of 16 varieties of sour mango showing differences in shape of the fruit at the Farm School, Jaffna, that the variations in growth among the seedlings were not appreciable. They possess numerous lateral roots which enable them to stand transplanting.

The fibre mango which is almost as common as the sour mango differs from it in being more fibrous, sweet and polyembryonic. Each seed contains in addition to the sexual embryo produced as a result of fertilization 3 to 4 asexual embryos produced as vegetative buds from the parent nucellar tissue. These asexual embryos grow into seedlings at the expense of the sexual embryo which is often smothered by them in the early stages. Being of the same genetic make up as the seed parent the asexual seedlings show hardly any variability except in initial vigour which appears to be due to the differences in quantity of food material available for each embryo in the seed. In general not more than 1 or 2 vigorous seedlings can be selected from the progeny of each seed ; the rest being weak and small have to be rejected. Like the *Wal amba* these seedlings have numerous fibrous roots, and are able to stand transplanting.

The Bombay mango, which is more commonly found in the Galle District, is also polyembryonic and comes true to type from seed. The fruits which are of medium size and oval shape are somewhat flattened on the two sides, and have a characteristic bright yellow colour when fully ripe. In flavour they are slightly aromatic and pleasingly subacid. The seedlings make vigorous growth and are not difficult to transplant.

The *Etamba* which is endemic to Ceylon is found growing wild in the jungles in the wet zone where it is highly productive. It is also widely distributed along the banks of the Mahaweli-ganga at Minipe, and in the coastal area of the Eastern Province between Kalkudah and Kalmunai where the water table is fairly high. The trees near the river bank at Minipe are magnificent specimens which are of immense size and of great age.

Many strains of *Etamba* are known to occur which show slight differences in the appearance of the foliage and size of the fruits. The average fruit, which is generally sweet, is about 3·8 cms. long and 2·0 cms. wide. The seed is monoembryonic, and produces a single seedling which takes nearly 2 years to be ready for budding when seedlings of other varieties take only 9 to 12 months. The seedlings are very difficult to transplant as they have only a long tap root with hardly any laterals. Many deaths occur even when the tap root is pruned *in situ* during showery weather to facilitate transplanting a month later. Nevertheless when once established in the field the seedlings grow into hardy trees. If these stocks are to be used they are best raised directly in the field and budded at stake.

THE SCION VARIETIES

The Jaffna mango is about the most popular variety in Ceylon. Two forms of Jaffna mango are recognised of which the *Vellai Colomban* produces fruits that are yellowish green when ripe, while those of the *Karutha Colomban*, whose distribution is limited mainly to the Jaffna peninsula, have an attractive reddish orange colour. The flesh of the former is not so richly coloured as that of the latter, nor is the young foliage so vividly green. The fruits are of medium size, slightly elongated in shape, and of excellent flavour. Both forms produce seeds which are polyembryonic, so that they come fairly true to type from seed. The trees of the Jaffna mango are very productive both in the wet and dry zones, and often bear fruit twice a year during the season from May to June and again from December to January.

The *Ambalavi* is essentially a variety for the dry zone where it grows to perfection on calcareous soils. The fruits are of medium size and somewhat elongated with a slightly curved beak. They acquire a rich golden yellow colour when fully

ripe. The flesh is also of deep reddish orange colour, fairly firm and of excellent flavour. Fruits which are not fully ripe sometime smell of turpentine. They have to be picked quite mature as otherwise the skin shrivels up, and their flavour tends to be insipid. The seed is monoembryonic. The tree can be recognised by its weak habit of growth, the blackened appearance of the young twigs, the dark green colour of the leaves which are smaller than those of the Jaffna mango, and by the copper colour of the young foliage. The trees never grow so large as the Jaffna mango, and can be planted at a closer spacing of 25 feet to 30 feet according to the fertility of the soil.

The Willard, which was introduced into Ceylon from Mauritius by Sir Frank Stockdale during his tenure of office here as Director of Agriculture is a small ornamental tree which comes into bearing earlier than most other varieties. Grafted trees bear within three years in the dry zone, and may take a year or two more in the wet zone.

The fruits, which are small and round, are not unlike a russet apple when immature, but the russet colour, which is mainly confined to the side exposed to the sun, turns into an attractive crimson blush as the fruit ripens. The flesh is firm and nearly free from fibre. It lacks any characteristic flavour though it is quite sweet and nice to eat. The seed is monoembryonic, and seedling trees cannot be depended upon to come true to type. The fruits keep well in storage and are easy to grade. They should find a good market on account of their attractive colour and good flavour.

The Sabre mango is a South African variety which is not unlike the *Ambalavi* in shape and flavour, but when ripe it acquires an attractive crimson blush like that of the Willard. The fruits are borne in clusters and are of medium size. The seed is polyembryonic and according to Webber (2) comes true to type, but such seeding trees take long to come into bearing. The tree is relatively small, and bears well both in the wet and dry zones. The leaves are somewhat long and narrow, and show a tendency to be bunched together on the terminal shoots.

THE DESIGN OF THE EXPERIMENT

The design of the experiment was in the form of a 4 by 4 complex Latin square with split plots in which the 4 scion varieties were distributed at random over the main plots, and the four stock varieties over the sub plots, there being 12 plants per main plot and 3 plants per sub plot at a spacing of 32 feet by 30 feet. The total number of plants in the experiment excluding those in the single border row round the entire experimental area was 192.

The land made available for the experiment was originally a part of the old rotation area which had become infertile for

cultivation of field crops. In most parts of the area the finer particles of soil overlying the gravelly subsoil had begun to disappear through soil erosion.

The necessary planting material was established in bamboo pots, and taken to the experimental area for planting when about a month old. The planting was done during showery weather on November 7, and December 22, 1937, the *Etamba* being planted first and the other three varieties later. In spite of several attempts made to supply vacancies it was not possible to obtain an uniform stand of plants owing to severe drought each year from July to September which killed many plants in the gravelly sections. Casualties were very heavy among the *Etamba* plants, many of which failed to become established owing to the paucity of fibrous lateral roots, and the few plants that remained made poor growth. There was no significant difference in vigour of growth among the other stocks of comparable age.

The stocks of buddable age in the plots allotted for Jaffna mango were budded with budwood from the Jaffna mango tree No. A 9 at the Royal Botanic Gardens, Peradeniya, on October 12 and 23, 1940 ; those in the Willard mango plots with budwood from the selected tree at the Farm School, Jaffna, on December 7, 1940 ; those in the Sabre plot with budwood from the tree at King's Pavilion, Kandy, on December 14, 1940 ; and those in the *Ambalavi* plots with budwood from the selected tree at the Farm School, Jaffna, on January 30, 1941.

Many of the stocks being about 3 years old were overgrown and had to to be budded repeatedly by inserting the buds into the branches of the framework near their points of union with the main stem, the method of budding used being the modified Forkert. One branch was left unbudded as a nurse branch till the scion growth had become sufficiently vigorous, after which it was removed. The Willard variety was the easiest to bud and the *Ambalavi* the most difficult, the percentage of success being 80 per cent. and 40 per cent. respectively, while for Jaffna and Sabre it was 70 per cent. and 60 per cent. respectively. Among the rootstock varieties the *Etamba* presented little difficulty in budding as it had a relatively thin bark which peeled more easily than the thick bark of the other rootstock varieties.

The branches which were successfully budded were ring-barked 6 inches above the bud union to force the buds to shoot out, and were then removed. All the scion varieties which were thus frameworked made vigorous growth when once the buds had shot out. A few buds however remained dormant for quite a long period and then shot out.

The Willard variety showed consistently good growth on all the rootstock varieties of comparable age, and was the first to

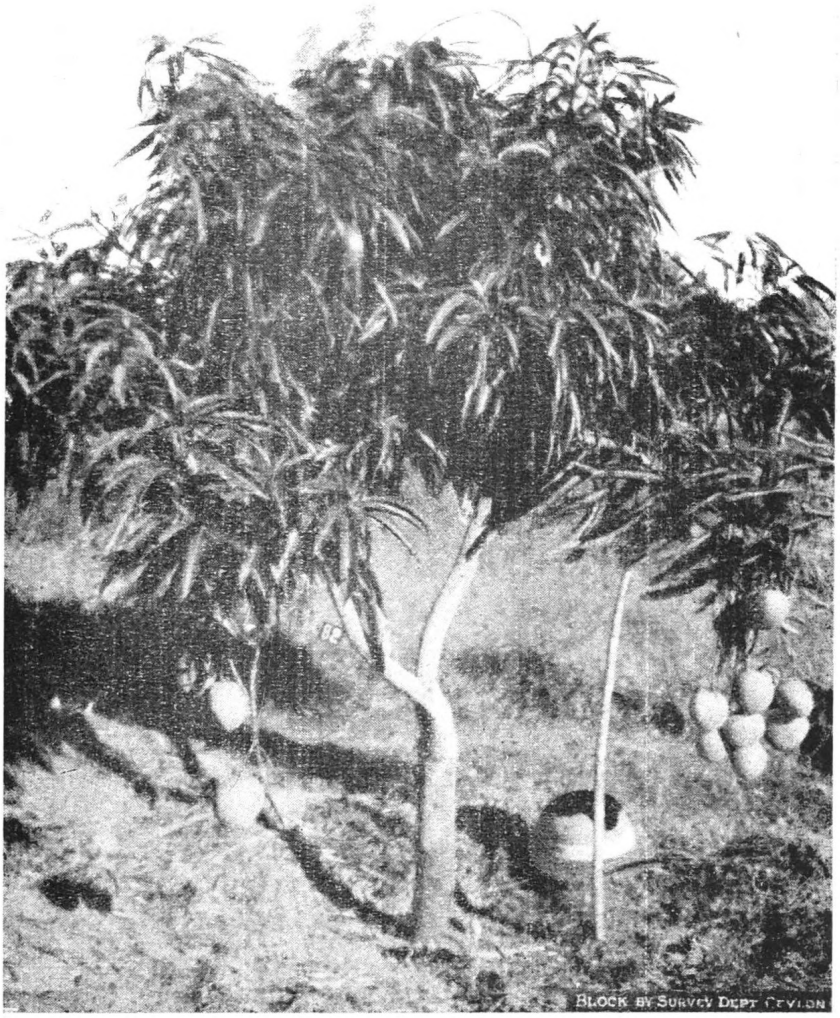

PLATE 1

Willard Mango tree in fruit on *Kohu amba* stock 2 years after frame working.

PLATE 2

Willard Mango tree in fruit on *Etamba* stock 2 years after frame working.

come into bearing within 2 years of budding, most of the fruits being picked on December 18, 1942, for display at the Food and Foodcraft Exhibition, Colombo. A few trees were again in fruit in June, 1943. There was no striking difference in the quality of the fruits produced on the various stocks although there appeared to be a tendency for the fruits to be numerous and small on the *Etamba* stocks (plates 1 and 2). Bagging of the fruits against attack by the fruit piercing moth (*Othreis Sp.*) prevented the development of the attractive crimson blush, and caused the flavour to be somewhat insipid.

Two Jaffna mango plants on *Etamba*, and one on *Betti amba* came into fruit for the first time in June, 1943, nearly $2\frac{1}{2}$ years after budding; while of the other varieties only one Sabre mango of similar age on *Betti amba* stock produced a few fruits. It is too early yet to draw definite conclusions on stock-scion effects from the performance of these few plants propagated by frameworking overgrown stocks.

REFERENCES

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