Preservation of Fruit with Latex.

THE following was read by W. Spoon, Chem. Eng., Staff Officer, Commercial Division of the Royal Colonial Institute, Amsterdam (Holland), at the International Rubber Exhibition, Paris.

Introduction.

When preserving fruit, two principal ways may be distinguished.

The fruit may be picked when still unripe and then transported—with the necessary precautions—to the place of consumption. On the way the process of ripening will begin already, to become quite ready at the place of consumption. Everybody knows this system from the banana transport; the fruit leaves the West Indies when quite green and arrives here for the greater part in still unripe condition, to be distributed after a short process of ripening.

This cannot be called an ideal method. The fruits, picked when still unripe, shall never obtain the same taste and flavour, which should have arisen if they could have ripened at the tree. This leads to the second principal way for the preservation of fruits, which makes it possible to pick the fruits in a riper—although not wholly ripe—stage.

After picking the fruits, the process of ripening is much retarded, partly stopped as it were, by a special treatment, so that there is sufficient time for transport and storage, before the fruits are consumed. When applying this method, the taste and the flavour of the fruits will be better than when using the first system.

An example of the second method we find in the preservation of fruits with the latex of *Hevea brasiliensis*. The intention is to supply the fruits with a thin rubber film by dipping them first into the latex and then letting it dry in a thin layer. This layer covers the fruit entirely, thus shutting it off from the air, so that the process of ripening and, at the same time the drying up, cannot proceed as under normal conditions, *i.e.*, must be greatly retarded. By removing the thin rubber coat the process of ripening can go on again and the originally not wholly ripe fruits can become ready for use.

The practical application of the method is, however, not so simple. We shall, therefore, first give a short revue about the results obtained so far, followed by a description of a few experiments of which we were informed.

Results Published Already.

Almost at the same time (in 1923-1924) in the Dutch East Indies and in Holland, experiments were made to preserve fresh fruits in the way just described.

(*a*) *Experiments in the Dutch East Indies.*—We refer to the experiments, made by P. J. S. Cramer and A. P. Cramer-Van Deventer in Buitenzorg (Java), the results of which have been patented by the last-named in 1924 (Dutch patent No. 23599).

For some time somewhat exaggered reports have circulated in the Press about their experiments, which have been rectified by Cramer in the beginning of 1925. At the same time, a short summary was given of the results obtained; so far no further particulars have been published about the experiments in Buitenzorg.

Necessary Precautions.

It appears that several precautions are necessary to obtain good results. First the fruits to be preserved must be quite sound and must have been picked at the proper stage of maturation, *i.e.*, not wholly ripe, but at the moment of ripening, as shown by the change in colour. If these conditions have been satisfied—which is not always easy—then it is possible to keep some kinds of fruits in good condition for a few weeks. We are speaking here on purpose of "some kinds of fruit," as not all tropical fruits can stand for shutting off from the air by a coat of latex. Sometimes a fermentation is produced, which affects the taste, which is, for instance, the case with the mango and the avocado pear, although apparently the fruits have remained unchanged.

Results on Experiments.

The results obtained by treating the mangosteens, are described more fully. It is a known fact that mangosteens, once they are picked, can be kept good for a short time only. It is the more striking that, by covering them with a coating of latex, this period can be increased many times. Even the long journey from India to Europe proves possible, as described by A. Chevalier. In October, 1923, Cramer forwarded some cases of mangosteens, each fruit covered with latex and packed separately in oiled paper, to Paris, where it was received by Chevalier on December 1, 1923. He found that about 60 per cent. of the fruits had remained good. The peel had the normal violet colour and the pulp was still perfectly fragrant. Other consignments by parcel post gave the same satisfactory results.

Tropical Fruits.

So far about the experiments in India. Cramer himself warns not to rush things, especially as regards the possibility of sending all kinds of tropical fruit to Europe.

The only thing which has been clearly proved is that there are some kinds of tropical fruit which—after observing the necessary precautions—can be kept a few times longer than the fruits not treated.

(*b*) *Experiments in Holland.*—Of the experiments made in Holland, those of the Propaganda Department of the International Association for Rubber and other Cultivations in the Netherlands Indies (The Hague) have been described more fully. The first communications— which can be found in the second Annual Report (1924)—agree with the experience gained in India, *i.e.*, that the process cannot be applied to all kinds of fruit, and that the fruits must be treated in still unmature condition.

Experiments were made with strawberries, plums, peaches, pears and apples, of which only the last gave satisfactory results.

In 1925 the experiments were continued on a larger scale at Wageningen. The third Annual Report already gives a short summary of the results, followed by an extensive description of the experiments by J. G. Fol, in the course of 1926.

Before proceeding, the attention must be drawn to an important point of difference between the experiments in the Netherlands East Indies and in Holland.

In India every day there is fresh latex available, which has a high viscosity. After dipping the fruit in this latex, a comparatively large amount of the liquid shall remain on the fruit, which, in most cases, after drying up, gives a sufficiently thick coat of rubber.

Effect of Ammonia on Latex.

In Holland, generally speaking outside the Tropics—only preserved latex is available. For the greater part this preserving is done by adding a small quantity of ammonia to the latex, directly after the harvesting. Provided that it is kept shut off from the air, so that no ammonia can evaporate, the latex remains good for a long time, and can be safely sent, for instance, to Europe for storage. Besides a preserving effect, the ammonia has, however, also another influence on the latex, *i.e.*, the viscocity is very much reduced. For the object described here this is not a very favourable change, for now there shall remain less liquid on the fruit than is the case when using fresh latex. Consequently the coat of rubber is much thinner and also less strong.

Concentrated Latex or "Latex Cream."

This drawback of the latex preserved with ammonia is fully admitted by Fol. It is overcome by concentrating the latex; the increase of the rubber content (in his experiments Fol brings it from 38·3 to 53·3 per cent.) is done according to the method of I. Traube (British patent No. 226440, 1924).

The following table, composed from observations of Fol, may illustrate that the concentrated latex (cream) gives a thicker coat of rubber to the fruit than ordinary latex.

Rubber content of latex.	Weight fruit (pears).	Weight rubber coat in grm.	Weight rubber coat in p.c. of the fruit.
38·3 p.c.	114·2 grm.	0·2	0·175
53·3 p.c.	173·1 grm.	0·9	0·52
53·3 p.c.	133·7 grm.	0·7	0·525

Calculated per 100 grm. of fruit, it appears that, when using latex cream, just three times as much rubber remains on the fruit. The effect of that rubber coat can, therefore, be much bigger than that of the thinner coat of the original latex.

Coming back to the experiments of Fol, we see that an extensive study was made of the treatment of grapes, pears, apples and tomatos, with ordinary preserved latex as well as with "latex cream" made thereof. It was studied how far this rubber coat prevents dessication, and also, how the fruits stand the coating in so far as change of colour, and especially decay, are concerned. As a rule these observations have been continued during a few weeks.

It proved to be desirable to dust the fruits—after the drying up of the attached latex—lightly with talc, in order to take away the inconvenient stickiness of the film. When applying the process on a large scale a means must be found to cover the fruits treated quickly and completely with a minimal layer of talc.

In short, the result of the treatment for the four kinds of fruit mentioned was that, although the coat of rubber strongly retards dessication, it does not always prevent decay. As expected, the film of rubber obtained with the latex cream gave the best results.

For tomatos the results were favourable in every respect, then came apples, and afterwards grapes and pears. Much depended upon the stage of maturation and the soundness of the fruits, which has already been mentioned by Cramer. With not wholly ripe and undamaged fruits it was possible to strongly retard the process of ripening, so that, for instance, the green colour of the pears and apples remained unchanged for a few weeks, to become yellow only after the rubber skin had been taken away.

Fol further emphasises the fact that, although so far the results for some fruits are quite promising, the problem is still far from solved, and it is desirable to make further experiments. As to tomatos, he thinks it possible by a latex treatment to store these fruits for a few weeks, to be put on the market later on,—at least if a means is found to cover large quantities of tomatos at the same time quickly with a rubber skin, which as yet has not been possible.

(*a*) *Experiment in Holland.*—In 1925 Mr. L. Baron van Hogendorp at Zeist tried to preserve apples by giving them a coating of latex. The following account can be given of his experiments.

On September 22, 1925, about 40 apples (Baldwin) were dipped into latex and then kept suspended by string till after about one week the rubber film had dried. The apples were then stored between paper in a room that was heated during the day, but cold during the night, *viz.*, not a very favourable place for storage. The apples used were not specially selected; further, they were not wholly ripe, as the time of maturation of this kind of apples only starts in November.

From the 40 apples two were sent—on November 3, 1925—to Macau (South China), wrapped in paper and then put in a tin, which was not soldered. The apples arrived in Macau at New year. One had perished, the other was still sound. After removing the rubber coat the apple was left alone for about one week; the colour, however, remained green. When the apple was consumed it appeared to be unripe.

From the other apples (at Zeist) gradually one-half perished, the rest remaining green, but getting a wrinkled appearance. When the rubber coat of one of these apples was removed the apple became yellow after a week, without, however, developing its particular flavour. At the end of February, 1925 (after five months of storage) the experiment was stopped, the then remaining apples had a disagreeable taste and had somewhat perished.

The results of this experiment are rather disappointing, which may have been caused by the unfavourable place of storage, as well as by the period of storage, which was far too long (on the average four months). After having been stored for such a long time it is no wonder the apples could not develop their full flavour any more.

(*b*) *Experiment in Surinam with Balata Latex.*—In 1924 Dr. G. Stahel at Paramaribo (Surinam) tried to preserve tropical fruit by applying a thin coat of balata. The method is the same as the above described, only the latex used is different, as so far always the latex of *Hevea brasiliensis* has been used. As known, balata is the chief constituent of the latex of *Mimusops balata*, a tree which occurs in several parts of Northern South America. Balata may be compared with gutta-percha; it is not sticky after having dried into a thin layer, as is the case with the thin film of rubber obtained from Hevea latex.

Experiments were made with pineapples, sapotillas, avocado pears, and oranges. The results obtained with the oranges were as follows :—

On October 10, 1924, from a lot of 404 oranges, 200 were covered with balata. The treated and untreated fruits were then stored till the 23rd of the same month. The examination proved that from the 204 fruits not covered only four had perished, whereas from the 200 treated with balata 106 had perished.

The experiments with the other kinds of fruit neither gave good results. Dr. Stahel made no further experiments, which can be easily understood, seeing the disappointing results. For some reason balata appears to have an unfavourable influence on fresh fruit. In this instance, however, the fruits were treated only 10 days after the picking, and not immediately, as with the other experiments, and it is possible that this may have a bad influence. However, this cannot be traced any more now.

Summary.

Which conclusions may be drawn from the experiments just described, in so far as the problem of preservation of fresh fruit is concerned?

(1) The latex of *Hevea brasiliensis* may be used for this purpose, that of *Mimusops balata,* probably not;

(2) The fruits to be preserved must be quite sound and must have been picked when not wholly ripe;

(3) If latex, preserved with ammonia, is used—which shall be the case outside the Tropics—the concentrated latex (so-called latex cream) gives better results than the ordinary latex preserved with ammonia;

(4) So far satisfactory results have only been obtained with a few kinds of fruit (tropical and non-tropical); with juicy, fleshy fruit no success was obtained.

These four points do not look very promising for the process described. One should not forget, however, that here a relatively new territory for the application of *Hevea* latex is concerned, which only after many experiments may become sufficiently known. A few important results have been obtained in the meantime; it is therefore not impossible that a complete solution of the difficulties will be found.—*The Planters Journal and Agriculturist,* Vol. VI., Nos. 17 and 18.