Latex Collection in Disposable Plastic Bags and the Use of Expanded Plastic Rainguards

W. A. SOUTHORN, Rubber Research Institute of Malaya

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Two further articles on polybag collection appeared in the same issue of the Planters' Bulletin.

The Editor of Harvest *would be glad to hear from rubber growers in Papua and New Guinea who have used this method of collection.*

TAPPING and collection now account for the major cost of natural rubber production. Modern methods of exploitation with higher yielding trees have resulted in longer flow times so that an increasingly high proportion of the crop is recovered as cuplump. Research in progress aims at further extending the flow time. Cuplump is potentially a top grade rubber but can all too easily lose part of this potential by contamination. The possibility of collecting the whole of the crop in one top quality form is attractive but cannot easily be accomplished by traditional methods.

METHODS AND MATERIALS

The traditional equipment for collection from an individual tree is of course a spout and container. If costs can be lowered sufficiently there is much to be said for the use of disposable containers, of a design which affords protection against contamination. The present work concerns the possibility of using light gauge polythene bags. The bag can be left on the tree for several tappings to reduce costs. However, this raises new problems, one of which is protection from rain. An inexpensive rainguard would be advantageous, even for traditional tapping and collection systems.

Rainguards

Rain can get into the collection directly by rain falling on the cut or container, and indirectly by seepage down the trunk. The latter is by far the greater problem. Rain falling on the tree as a whole is drained down the trunk. The rainguards we have investigated are all designed to reduce trunk seepage. They can be either skirts, or canopies, or gutters. In our experience, whatever type of guard is used, it is necessary to attach it to the tree by a watertight seal, otherwise water creeps between guard and bark. Merely stretching a flexible material round the trunk is useless, and some kind of sealing compound is always needed.

Skirts

Perhaps the simplest guard is a sheet of polythene tied round the tree above the cut and extending below the cut. If sealed to the trunk at the line of attachment by some kind of cement, it provides complete protection against rain. Variations on this theme incorporate wire rings in the lower edge of the polythene to make the skirt stand out from the trunk. Pioneering work on polythene skirts has been done by the Rubber Research Institute of Ceylon. Unfortunately there are disadvantages:—

1. If the skirt extends below the cut it has to be lifted for tapping which retards the operation. Also the skirt is apt to be damaged by repeated handling, especially if the tapper feels that it impedes his operation.
2. Experience in Ceylon indicates that long skirts of this type result in a high humidity at the panel which may lead to panel diseases.

These disadvantages can be largely avoided, though with reduced protection, by making the skirt shorter; in which case some kind of frame

is used to make it stand off from the tree and give a canopy effect. This can be done by spreading the polythene by a wire frame, something in the manner of a lampshade, or by using a stiffer material such as galvanized iron. The difficulty is cost of manufacture and attachment to the tree. Trees vary in diameter so that lampshade-type guards need some degree of individual fitting.

Gutters

The Rubber Research Institute of Ceylon developed a rubber gutter of 'U' section which we have tried in the present study. This is effective in stopping trunk seepage if securely sealed to the tree. It is, however, too costly and heavy. We attempted to cheapen and lighten this by using extruded highly filled rubber sections, but these were not very successful in field trials and we then moved on to the idea of using lightweight expanded polymers such as rubber, polythene, or polystyrene blown to low densities. The lightness of these materials offers advantages in material costs and flexibility, also the lightweight rainguards produced can be fixed effectively to the tree with very simple adhesive/sealing compounds. In fact for all these materials field or concentrated latex serves admirably for fixing and sealing. In terms of cost/volume ratio, expanded polystyrene is the cheapest material currently available.

Rainguards can be devised to give almost any degree of protection from rain, but costs are related to performance. The expanded polystyrene rainguard which we shall now describe is the cheapest yet developed. It gives fair protection against light rain seeping down the trunk, but is not proof against heavy showers or driven rain.

EXPERIMENTAL

Expanded Polystyrene Rainguards

Expanded polystyrene is locally available in 2 ft x 4 ft sheets of various thicknesses. One virtue of this material is the ease with which it can be cut using a hot wire. The guards we used were cut from $\frac{3}{8}$ in sheet using a simple hot wire cutter. The sheet was sliced at an angle to give a strip of the profile shown in *Figure* 1. The length of the guard strip required depends on the girth of the tree and the tapping system and was controlled in manufacture by varying the width of the sheet fed into the cutting machine. The strip should be at least 6 to 8 in longer than the tapping cut to give some overlap at each end. The guard strips used in our experiments were made in three standard lengths, 24, 32 and 48 in each, varied to suit local conditions.

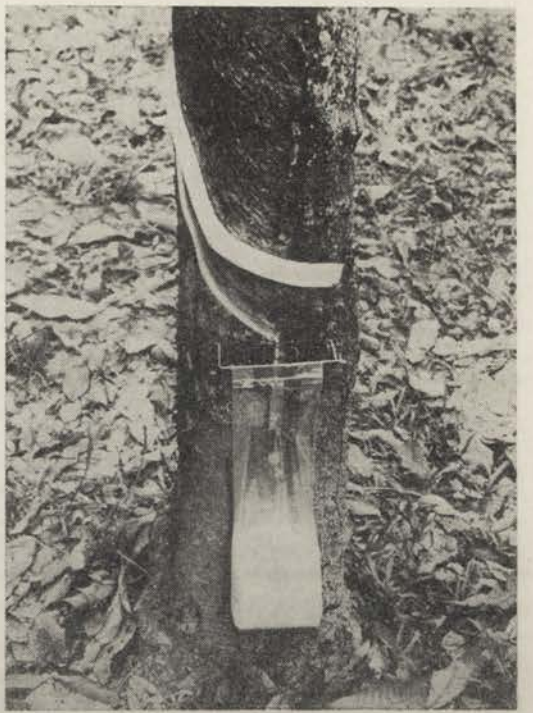


Plate I.—Rainguard and bag collection equipment in the field

To fix the guards, the tree and one face of the guard strip were coated with either latex concentrate or field latex. Concentrate was slightly easier to apply and dried faster. The latex had to be completely dry before any attempt was made to stick the two surfaces together. It was then possible to press the guard on the tree when adhesion was immediate forming a small diversionary gutter above the cut. A few drops of latex were poured into the top end of this and allowed to flow along the whole length. When this dried the gutter was watertight.

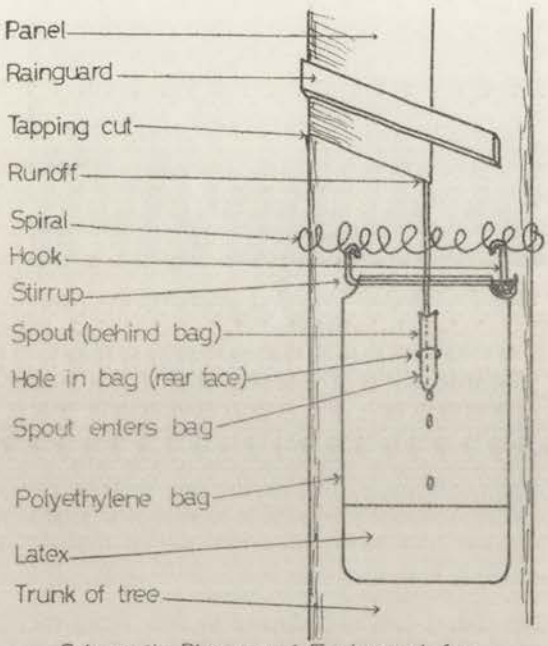
The field operation of fixing the guard was very much simplified if the polystyrene surface was pre-coated with latex. This was done by coating the entire sheet before cutting. It was convenient to add a little colour (carbon black dispersion or coloured emulsion paint) to the latex so that the field operator could identify the coated surface. With coated strips one man

goes ahead painting the trees with latex, while another follows behind at a suitable interval putting the guards in position and sealing them by pouring a little latex along the gutters.

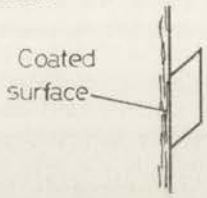
For most trees no other operations are required. The plastic is sufficiently flexible to mould around normal irregularities in the bark such as the discontinuities at the edge of the tapping panel. If the bark is exceptionally uneven or covered with moss it may be necessary to trim or scrape to give a more acceptable surface. The plastic is, however, surprisingly tolerant to minor bumps and hollows.

If any mishap occurs in fixing the guard to the tree, for example if the operator breaks a guard strip or finds the guard not long enough for an exceptionally long cut, repair or extension strips are readily cemented to it with latex. Good butt joints are easily attained.

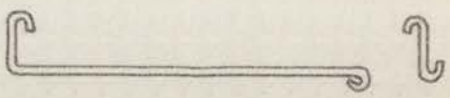
The thickness of the guard strip is limited to $\frac{3}{8}$ in by the need for flexibility. If a deeper gutter is required to take a bigger flow of water, a second guard strip is stuck on top of the first, which gives better protection but doubles the cost. The cost of the coated rainguard strip as we make it works out at approximately 2 ct/ft. If very large quantities were made it is hoped that this could be reduced. Initial trials encouraged hopes that the guards would last for a long time, but subsequent experience showed that they are susceptible to attack by insects and birds, so that 4 to 6 months appeared to be their useful service life. Investigations are being made as to whether their durability can be improved, or whether more expensive but tougher materials would be economically justified.



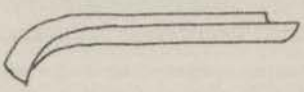
Schematic Diagram of Equipment for Plastic Bag Collection



Cross section of plastic rainguard.



Stirrup hanger and hook for suspending plastic bag from wire of spiral.



Sketch of spout with curved tip.

Figure 1.—Schematic diagram of equipment for plastic bag collection

Plastic Bag and Auxiliary Equipment

An effective collecting bag should be cheap, strong enough for the job, easy to fix and store before use, and more effective in keeping out dirt than the traditional cup. Polythene is a suitable material and several designs have been developed which can be mass produced from polythene sheet or lay-flat tubing. Essentially, these all consist of a bag made from 0.04 mm gauge polythene, sealed except for a small hole facing the tree for inflow of latex and perforated or folded over at the top to take a wire

stirrup on which the bag hangs at the tree (*Figure* 1). This wire stirrup or hanger has an eye at each end through which wire hooks serve to attach it to a wire spiral ring on the tree itself (the normal spiral rings used for cup collection can be used).

To deliver latex satisfactorily to the bag a modified spout is used (*Figure* 1). This is fixed to the run-off in the usual way, it differs from normal spout only in that it is bent so that it does not jut out so much.

In use the leg of the spout should be parallel to the trunk and about $\frac{1}{4}$ to $\frac{1}{2}$ in away from it. To fix the bag to the tree, the tree end of the spout is entered into the hole in the bag and the bag is drawn upwards. The wire hanger is slipped through the top loop of the bag and hooked onto the wire spiral (*Figure* 1 and *Plate* 1).

Tapping is done in the normal way, the tapper collecting only the tree lace. Collection of the bags is a separate task for which unskilled labour may be used, at staggered collection intervals of two or three weeks, each bag receiving the latex from several tappings before being brought to the factory. With such a system the efficiency of the tapper can be greatly increased and the collection can be rationalized.

Collection with alternate daily tapping would be somewhat as follows. Latex from the first tapping flows into a virtually sterile bag and usually stays liquid for at least twenty-four hours after which bacterial contamination builds up to a point where the latex autocoagulates. Due to the considerable bacterial population which will now be present, the second and subsequent tappings coagulate rapidly. The bag can be collected at any time after the last dripping has coagulated. The rate at which this happens is likely to vary somewhat with field conditions.

If experience in a particular plot shows that the bags contain uncoagulated latex over a period long enough to upset the rhythm of collection, the procedure would be to shift the full bag onto a second hanger further round the spiral at the time when the new bag is hung to receive the next collection. The tree then, for a brief period, would have two bags, one full awaiting completion of coagulation, and one empty, to be filled by the next series of tappings. This situation is however unusual and with tapping at longer intervals than alternate daily it will not arise. The tapper is concerned only with his tapping, the collection and fixing of the bags is a separate task, and would be organized so that a steady flow of full bags comes into the factory at convenient times irrespective of tapping activities. Obviously this presents a new organization situation and managements will have their own ideas on how this may be carried out most efficiently. It is in this area that perhaps most investigation still has to be done, the nature of the idea is such that it can only be investigated properly on a fairly large scale and in a real work situation.

Receipt in the factory

The full bags are collected in baskets and brought to the factory by lorry. If the rubber is to be sold to SMR specifications it is absolutely necessary to strip the coagulum out of the bags. The coagulum does not adhere strongly to the polythene but is not so loose that it will merely drop out when the bag is opened. It is necessary to peel the bag away. At present this is done by hand but mechanisation is being studied. Current practice is for the operator to slit the bag with a sharp knife, pull the rubber out by hand and drop it into a tank of water. The polythene is discarded. The lumps of coagulum are suitable for making block rubber.

The possibility of putting the bagged rubber, polythene included, through the whole process, has been studied. The granulation stages shred the polythene and mix it with the rubber. With a low melting point polythene, the shreds of polythene partly fuse in the drier but are still visible as white specks in the finished product. There may be no objection to this for some applications, but for others the particles of plastic would be disastrous. Such rubber could not be sold as a general purpose product, and on SMR testing the polythene would separate on the test sieves and be classed as "dirt". For the production of SMR rubbers it is therefore essential to remove the polythene completely. The waste polythene can be burned, but possibilities of its recovery as a by-product are being investigated.

RESULTS

No problems were encountered in setting up the equipment on the trees. The pre-coated rainguard strip proved much superior to the uncoated strips for fixing in the field.

There is a real tendency for the two faces of the bag to stick to each other, thus reducing the capacity of the bag. This is particularly so when trees are being fitted for the first time with the new spouts; a few drops of latex then exude from the spout wound. If the bags are put on the trees before this flow has stopped, it is apt to cement the bag faces together, for it is insufficient in volume to open up the bag and it dries rather quickly. It is necessary to ensure that the bag is opened out a little before any latex flows into it, which can be done by puffing a little air into the bag or rubbing the faces together before fixing. Bags were tried which incorporated gussets and other devices to make them open by themselves. These were easier to use but fractionally more costly. As the workers became more experienced, the difficulty began to disappear, so that it is doubtful whether the problem is serious enough to justify any modification to the plain bag unless this can be done at no extra manufacturing cost.

The rainguards gave good protection against drizzling rain but were ineffective in heavy showers, when the volume of water coming down the trunk was found to exceed the water carrying capacity of the gutter. Protection was improved by doubling the thickness of the guard strip. Rainwater flooding over the rainguard reaches the tapping cut and runs into the bag. This kind of flooding happened frequently but there was no indication that any of the crop was lost thereby. When the bag filled with water over the coagulated rubber the tapper was required to tilt the bag forward before the next tapping so that surplus water ran out again to make room for the new latex.

No problems were found in tapping and the tapping task was increased by 50 per cent without difficulty. It could doubtless be doubled.

The rainguards deteriorated more rapidly in the field than in laboratory experiments mainly because of attack by insects and birds; experiments with guards chemically treated to discourage such attacks are in progress but no results are yet available. At present the service life of untreated guards at the R.R.I.M. Experiment Station seems to be about four months. After this period the cut will have moved down the trunk away from the guard so that protection is also somewhat diminished.

One curious effect of the polythene bag method of collection is that variations in performance of individual trees are displayed in a rather striking and semi-quantitive fashion. Walking through a field set up with bags it is possible to observe the cumulative performance of individual trees over a number of tappings. In some trees unusual bacterial infection is evident from the distinctive appearance of the latex. This is a feature which has some advantages for estate management.

The bags were collected in baskets and transported by lorry, some of the bags remaining in the baskets and others being heaped on the floor of the lorry. No difficulty was encountered, the bags did not stick together and arrived in the factory in reasonably clean condition. Coagulation was complete in bags which had been left for the full cycle. A little serum dripped from some of them but the operation was still not "messy". In the factory the bags were slit by hand, the lumps of clean coagulum being dropped into clean water. With inexperienced labour, throughput was about two bags/minute/person. A well-filled bag is easier to strip than an almost empty one.

The lumps of coagulum obtained from the bags are much softer than cuplumps. The coagulum was blended by creping and converted to Heveacrumb. There were no problems in handling the material.

Properties of the Rubber

The product has the properties which would be expected from an auto-coagulation process, namely high initial viscosity, fast cure on the TC test and low nitrogen. In colour it falls short of SMR 5L but is paler than a normal cuplump rubber. In contrast to cuplump rubber it is extremely clean, and has a low iron content. It should be a most attractive general purpose material with good market potential.

SUMMARY AND CONCLUSIONS

The advantages of plastic bag collection as we see them at present are:—

1. Increased effectiveness of the tapper.
2. Upgrading of part of the crop especially as regards cleanliness.
3. Elimination of coagulation in the factory.
4. Rationalization of collection, which can be done by unskilled labour over a time schedule not limited by the need to bring in latex in fluid condition. The number of lorries required can be reduced; the need for latex collecting stations disappears.

5. Continuous visual indication of individual tree performance in the field.
6. No costs for cups.

Against these the following have to be offset:—

1. Cost of polythene bags and hangers which over a period exceeds that of the semi-permanent cups.
2. Labour cost of fixing new bags after each collection must be added to the cost of collection.
3. Cost of stripping the polythene from the rubber.
4. Some loss of PRI which may have to be made good by chemical treatment if very long collection periods are required.
5. Risk of theft or costs of avoiding it.
6. The product is darker in colour than the best whole latex factory coagulated rubber.
7. Premium rubbers from latex cannot be produced.

Operating costs of a method such as this on an experimental station are not necessarily those which would be achieved by a commercial estate. (The cost aspect has been covered in some detail by Collier and Morgan (1969) presented at this conference.)

A major item in what has come to be known as "polybag" collection is the costs of the bag, spout and rainguard. At present all are manufactured in relatively small quantities and involve a certain amount of handwork. If these items were required on a massive scale, there is good reason to suppose that costs could be significantly reduced. Even at present equipment prices, it is clear that a substantial saving can be made on tapping and collection costs by adoption of the polybag method.

Whether this can be realised as a profit depends on the market price which can be obtained for the new product as opposed to the alternatives which can be produced under more conventional practices. Broadly speaking the new process upgrades the lower qualities of estate production, but inhibits the production of latex products carrying the highest premium such as latex concentrate, pale crepe, SMR 5L, and the CV rubbers. At present rubber prices and differentials, this would approximately offset the advantages of lower tapping and collection costs.

It is thus obvious that under present day conditions polybag collection could not be recommended for general adoption. Nevertheless there may be circumstances in which it would be useful. On a long term view, we must consider that the viability of the natural rubber industry depends on its capacity to compete at prices dictated by developments in the synthetic rubber industry. Development of the polybag collection method provides an effective insurance for production cost savings should necessity arise.

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