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Advances in exploitation technology and adoption by small holders

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Abstract

In recent times most of the exploitation research in rubber (*Hevea brasiliensis*) focused on addressing local problems such as shortage of tappers, loss of tapping days due to climatic constraints of rain, soil water deficit, low temperature etc. Even though tapping was irregular due to social or climatic reasons alternate daily tapping of semi spiral cuts worked fairly well with medium yielding clones. This system was extensively adopted by small holders as well. However, with high yielding clones, this system proved counter productive, with high incidence of tapping panel dryness (TPD). Chemical stimulation of yield was not only useful in exploitation of short tapping cuts but also in optimising the intensity of exploitation in combination with frequency of tapping.Third daily tapping with stimulation was found essential to sustain high yield of new clones. Lowering of cost of tapping is an indirect benefit. Though, this system was adopted by estate sector, small holders are yet to take the advantage of the same. With further reduction in frequency of tapping to fourth daily or weekly, more stringent conditions became necessary for complete success with out compromising yield. Thus low frequency tapping (LFT) systems warrant regular tapping with out rest periods, more number of stimulations, rainguarding, dispensing of cash tapping and Sunday tapping, additional collections, payment of production incentive to the tappers, etc. In India, majority of the estates have started adopting LFT in a big way. However in the small holdings lot of problems are encountered for extending the technology. Extensive research has also helped to evolve tapping systems and stimulation schedule to achieve sustainable high yield and longer economic life. Thus, Controlled upward tapping (CUT), gaseous stimulation (RRIMFLOW) etc. have led to increase the productivity in the later part of economic life. These techniques are also not very popular among smallholders.

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In the context of globalization reduction in cost of production of natural rubber (NR) is a major objective to make NR more competitive. Since natural rubber is treated as an industrial product, protection by government is minimum. Planters, including small holders, are expected to face international competition alike in selling their products. Governmental interventions to keep the selling price high will only be minimum.

Increase in land productivity is the traditional approach to increase the net income of farmers. Evolving and popularizing of high yielding disease resistant clones of *Hevea* is a major policy and activity. High yield results in lower cost of production as well. Achieving sustainable high yield through improved exploitation methods is another approach to increase land productivity. Judicious application of stimulant, Controlled Upward Tapping (CUT) etc. are some of the methods used to achieve sustainable increase in land productivity.

Reduction in direct costs involved in NR production is also envisaged for reduction in cost of production of NR. Among the items of direct costs involved, cost of tapping is the major single item. In some countries, it is as high as 70% of the total cost of production. Hence income of farmers can be increased by reducing cost of tapping as well.

Even though tapping was irregular due to social or climatic reasons, alternate daily tapping of semi spiral cuts worked fairly well with medium yielding clones. This system was exclusively adopted by small holders also. However, with the introduction of high yielding clones, the tapping system proved counter productive with high incidence of Tapping Panel Dryness (TPD) and reduced economic life.

Chemical stimulation of yield was not only useful in exploitation of short tapping cuts, but also in optimizing exploitation of half spiral cuts in combination with frequency of tapping. Third daily tapping with stimulation

was found essential to sustain the high yield of new clones. Lowering of cost of tapping was an indirect benefit. Though this system was adopted by the estate sector, small holders are yet to take the advantage of it. In spite of higher sustainable yield and labour reduction, adoption of CUT is also limited to estates and medium holdings only. Low Frequency tapping (LFT), gaseous stimulation by RRIMFLOW and REACTORRIM methods etc are some of the recent developments holding promise for cost reductions and increasing the income of planters. These technologies and CUT which we yet to be adopted by small holders are discussed.

I. LOW FREQUENCY TAPPING

With further reduction in frequency of tapping from third daily (d/3) to fourth daily (d/4) or weekly (d/6) more stringent conditions became necessary for complete success without compromising yield. Thus Low Frequency Tapping systems warrant regular tapping without rest periods, more number of stimulations, rainguarding, dispensing of cash tapping, Sunday tapping and extra tapping, additional collections, payment of production incentive to tappers etc. Adoption of d/4 and weekly tapping frequencies have resulted in substantial reduction in cost of tapping. There is considerable increase in the earnings of tappers as well. In India, estate sector has started adopting LFT in a big way. However, among small holders, majority are practicing either d/2 frequency (77%) or d/1 frequency (14%) of tapping. Only 5% practice d/3 frequency. In other countries also situation is not much different. This situation has resulted not only in failure to realize the benefits of modern clones in terms of yield and economic life but also in incurring of high cost of tapping. However, with proper socio economic approaches and extension work amongst small holders, the situation can be improved.

Even in the estate sector, adoption of d/4 and weekly tapping systems are not without problems. But our experience is that, these can be overcome.

Rubber Research Institute of India is extending low frequency tapping for the last three years. General requirements and conditions for success of low frequency tapping are discussed. Controlled upward tapping and gaseous stimulation also discussed.

A. Regular tapping

When d/4 and d/6 frequencies of tapping are adopted, tapping has to be done regularly without vacant blocks. Too many vacant blocks result in severe yield reduction. When one tapping is missed and subsequent tapping is done only on the next scheduled date, there is severe reduction in per tap yield. Hence there must be sufficient reserve tappers for addressing the problem of absenteeism. However, if some blocks remain vacant, these blocks may be tapped on the next day. In the case of weekly tapping, such recovery tapping may be done on the next day or the day after that. Loss of tapping days due to rain leads to severe reduction in yield because of the resultant difficulty in regular tapping. Hence rainguarding is essential for success of low frequency tapping, especially that of weekly tapping. In India for the success of d/3 frequency of tapping also regular tapping with rainguarding is essential.

Whenever, there is holiday other than the weekly holiday, section of the estate scheduled for tapping on that day may be tapped on the next working day. Subsequent tapping of sections may be rescheduled accordingly. However, too many holidays and social events can hinder success. In India, with rainguarding and with weekly holiday on Sundays around 300 tapping days are practically realized. This was found sufficient for success of weekly tapping.

Under moderate soil moisture stress, summer rest may be avoided. Annual tapping rest can also affect success. Under low frequency tapping system, after rest it takes lot of time for bringing the per tap yield to normal

level. Hence if climatic conditions are not extreme it is advisable to do regular tapping throughout the year. Problems of extreme soil water deficit, low temperature etc. have to be addressed separately.

B. Cash tapping, extra tapping, Sunday tapping etc.

Once regular tapping is ensured, there is no need for Sunday/holiday tapping or any extra tapping for achieving the target. Practice of cash tapping (direct payment of cash on the day of tapping for the entire crop brought on per kilogram basis, the rate of which is three to five times the rate of over poundage) on holidays or at the time of extra tappings can upset the low frequency tapping systems in several ways. Stimulation schedules are usually developed for regular 6d/7 system of tapping. Extra tapping on holidays and other days will upset the rhythm. Scheduled stimulations becomes over stimulation. Tappers invariably perform injurious tapping to bring maximum crop. They tap more than one block on such days and usually go to the fields that give high yield. Such fields get damaged by TPD very soon. Cash tapping results in increased absenteeism on a normal tapping days. Normal tapping becomes less efficient as well.

C. Shifting of entire estate in to the same frequency:

If the entire estate is shifted to d/4 or d/6 frequency there is significant savings in overheads. There is reduction in the requirement of supervisory staff, collection centers, vehicular for transport etc. Absence of d/4 and d/6 CUT causes problem in shifting all field in to d/4 or d/6 frequency.

D. Stimulation:

Ethephon:

Under d/4 frequency 5 to 7 stimulation/year are recommended. For weekly frequency of tapping 12 stimulations per year at monthly intervals are recommended. In newly opened trees under weekly tapping, stimulation has to be more frequent in the initial two years. For clone RRII 105, the

recommended frequency of stimulation is fortnightly in the first two years after opening and subsequently it can be reduced to monthly frequency. Panel application of 2.5% solution was found more effective and economical. In newly opened trees and in panels when tapping is resumed after rest, groove application of 5% solution becomes necessary. In newly opened panels, application of ethephon before the third tapping was found effective.

Interval between ethephon application and tapping is also important. Under weekly tapping application of ethephon between 48 and 72 hrs was found optimum. Rainguarding ensures effective stimulation. Stimulation has to be suspended if d.r.c is less than 30%. Low d.r.c is encountered due to poor sunshine hours, low temperature and due to clonal characters. In India formulations of ethephon available are 39% and 10%. These have to be diluted before use. Vegetable oil is more effective diluent than water. When oil is used frequent stirring is needed and it is cumbersome. Ready to use formulations are more convenient to use.

Ethylene gas:

Gaseous stimulation employing RRIMFLOW/REACTORRIM methods are also successful in low frequency tapping. The method has been recommended in Malaysia for low frequency tapping of high panel.

E.Rainguarding:

In India 60 to 70 tapping days are lost due to rain. Hence rainguarding is practiced extensively. Rain guarding is essential to achieve potential yield. However, rainguarding is not practiced in the Kulasekharam region where much less numbers of tapping days are lost due to rain. In North East India also rainguarding is not practiced.

Experiments conducted by RRII have shown that crop loss due to rain increases with reduction in frequency of tapping. Lower the frequency higher the crop loss. Hence, it is very important that rainguarding is done for the

success of low frequency tapping. Experiments conducted in Kulascharam and in North East showed that even in low rainfall areas where rain guarding is traditionally not practiced low frequency tapping is adversely affected by rain. Experiments on low frequency tapping (d/4 and d/6) with rainguarding are in progress in these regions.

Usually rainguarding is done by fixing frilled LDPE sheets (300 guage) above the tapping cut. With one kilogram of polythene around 30 trees can be rainguarded. Upper end of the sheet is attached on the bark by stapling. Leak proofing is done with bituminous rainguarding compound. Other types of readymade rain guards are also available in the market. These can be directly fixed on the tree. One kilogram of rainguarding compound costs around 35 cents and is sufficient for 10 to 15 trees. Five workers complete rainguarding of around 400 trees in a day. Cost of rainguarding is around US $ 50 per hectare. There are many small scale industries which manufacture rain guard adhesive. Low density polythene sheet of 45 cm width is also produced for rainguarding.

In India usually rainguarding is done in April – May and is allowed to remain on trees up to the end of November. Available rain guarding compounds are not perfect. Leaking starts in two to three months after rainguarding. By October there will be leak in nearly 50% of the trees or more. Our efforts to seal such leaky rainguards have not yet become successful. Further research is needed to achieve the objective.

F. Collection of Latex:

Dripping of latex continues up to evening in the peak seasons and after stimulation. From a block of 400 trees under weekly tapping, at times more than 100 kg of dry rubber is obtained from a single tapping. Latex yield of more than 250 liters/tap is common. Under d/4 frequency also high yield with monthly average of 50 kg rubber per tap is very common.

Under low frequency tapping delayed collection is always necessary and in around 50% of the tappings second collection has to be made. Second collection is done either by the tapper or by general worker. When general worker is assigned the job he has to collect it from three tapping blocks. Unlike the earlier practice, tapper has to remain in the plantation up to late afternoon or evening. There are associated social problems, especially in the case of female tappers.

As per tap yield is very high, bigger collection cups (900 ml) have to be used. Two cups are necessary for many trees. During rainy season more than two collections often become necessary to avoid partial wash off. In spite of second collection, usually scrap percentage is high under low frequency tapping. Requirement of second collection to minimize scrap percentage depends on the type of product that is marketed. Collection of scrap after a period of one week can some times cause quality problems.

G. Wage Structure:

For the success of low frequency tapping provision of over poundage is essential. For the first collection, normal rates of over poundage are enough. For second collection, either daily wage workers are employed or it is given on contract with negotiated rate per kilogram of d.r.c.

Contract tapping (rate/kg of crop or rate/tree), crop sharing etc cannot be effective for successful conducting of low frequency tapping. When rate of wage is fully on the basis of crop without any daily minimum wage, the owner of the plantation may not be interested in low frequency tapping unless there is shortage of tappers. Similarly when there is crop sharing the owner may not be interested in low frequency tapping unless the ratio of sharing is revised to benefit both planter and tapper alike. When wage is fixed on per tree basis without any incentive for the additional crop brought, the tapper does not co-operate.

From the above discussion it is evident that there are many conditions to be satisfied for the success of low frequency tapping. However, our experience in India is that, unlike in small holdings problems are much less in the estates for adopting d/4 and d/6 tapping. Majority of the company estates in India have successfully adopted d/4 frequency. Three estates have completely shifted to weekly tapping. Five estates have 6 to 7 blocks under weekly tapping. In the Kulasekharam region in the southern part of peninsular India, traditionally rainguarding is not practiced. We started new exploratory trials on d/4 and d/7 tapping with rainguarding in this region. In the estate (Hariharaputra estate) where 4 blocks are under d/4 frequency with rainguarding, seeing the initial success, the owner adopted the system to 16 more blocks. Because of the attractive overpoundage and regular tapping, workers are also demanding d/4 tapping with rainguarding. In the estate, where trial on weekly tapping with rainguarding was laid out on 7 blocks, results are highly encouraging. In this estate because of contract tapping benefit is mostly to the tapper.

In India, except in the small region of Kulasekharam, all estates practice rainguarding regularly since long. Stimulation is also familiar to them. All of them have fairly good number of reserve tappers as well. Minimum wage with overpoundage is practiced. Under these circumstances shifting to d/4 frequency was comparatively easier. In most of the estates further reduction to weekly frequency will lead to unemployment of tappers. Hence it will take some more time in these estates for shifting to weekly frequency of tapping. Because of overpoundage, workers are also happy

The estates have good confidence in the team of exploitation scientists of RRII who directly introduced CUT in all the estates and many medium holdings. By adopting CUT all the estates and medium holdings got substantial financial benefit. Because of this it became easy to extend LFT by

the same team of scientists. Another reason for adoption for LFT is conducting of most of the LFT experiments in estates and medium holdings. These were block level RBD experiments conducted for many years.

Major hurdle in introduction of low frequency tapping in the estates in India is the practice of cash tapping on Sundays and other days as extra tapping. On such days, normal wage is not given. Instead of that, high poundage rate is given. The rate is two and a half to five times more than the normal over poundage rate. Staff is also benefited from cash tapping. On days of cash tapping each worker comes with family and taps more than one block. Tapping done is usually injurious and often cash tapping is done in high yielding fields. In such fields the stimulation schedule becomes irrelevant. Hence, we insist on stopping these unscientific practices. Since cash tapping is attractive, initially both tappers and staff opposed low frequency tapping. But once the system progressed, tappers became satisfied, as there was no reduction in their total income. They are able to enjoy holiday also. But staff members are unhappy, as their income has come down. We are persuading the management to give incentive to the staff also. In some of the estates, where low frequency tapping was implemented, Sunday tapping is still practiced with restriction. In one estate with weekly tapping seventh section is allotted for Sunday tapping. In estates under d/4 frequency, including Sunday, methods are being devised to adjust stimulations or to introduce weekly tapping in some of the fields, which can be tapped only on Sundays.

In the estates where low frequency tapping was adopted with stopping of cash tappings and extra tapping, there was considerable improvement in yield. Stopping of cash tapping and forcing holiday on Sundays and other festival days has resulted in reduced absenteeism and have improved the efficiency of tappers on normal tapping. There was spectacular increase in per tap yield in the rainy season. In fact workers are now happier with increased

daily income along with enjoying of weekly off and other holidays. There is good demand by workers for low frequency tapping.

For CUT we do not have recommendation for d/4 and weekly tapping. Our standard recommendation is to do CUT without rainguarding under d/3 frequency for around six months after the monsoon season. During rainy season basal panels are tapped with rainguarding. In estates with complete shifting to d/4 frequency recommendation on d/4 CUT frequency is given on trial basis. Our experience with preliminary experiments on low frequency CUT with rainguarding shows some amount of reduction in yield under weekly tapping.

In the small holding sector high frequency tapping is still followed in many countries. A survey conducted in India showed that daily tapping is followed by 14% of the small holders, alternate daily tapping is done in 77% per cent of the holdings. Third daily tapping is practiced in only 5% of the holdings. Average economic life of high yielding clones is only around 15 years. After the issuing of the recommendation of third daily tapping with stimulation in 2001, only a negligible fraction has shifted to third daily tapping. No small holder is practicing d/4 or d/6 frequency of tapping.

Major constraints for adopting low frequency tapping in small holdings in India, are delayed recommendation of low frequency tapping systems including third daily tapping with stimulation, wage structure without incentive, difficulties in regular tapping, lack of rain guarding etc.

For high yielding clones the earlier recommendation was only third daily tapping without stimulation. The main objective of reducing the frequency to d/3 was to reduce the incidence of TPD. However, the difference between d/2 and d/3 frequencies in yield performance was very glaring. This led to continuation of d/2 frequency of tapping. With the new recommendation of d/3 tapping with three annual stimulations, sustainable yield increase of

more than 20 per cent is possible. Hence there is good scope for adoption of the system. However, our experience is that in the absence of any incentive, tappers do not co-operate. Usually shallow tapping is done purposely to reduce crop.

For the success of d/3 and lower frequencies of tapping, as discussed earlier, rainguarding is essential. When tapping is done in the rainy season panel washing with fungicide at the rate of once in 10 days is required. Small holders often do not practice it. This results in disease related bark dryness. This is another reason for not adopting rainguarding under low frequency tapping.

Unlike in estates, among small holders at present there is no provision for regular tapping with the help of reserve tappers. Tapping is mostly done by hired labour and involvement of family labour is very little.

For popularizing low frequency tapping among small holders strong extension work has to be done with lot of demonstration and other activities. Group farming can help in regular tapping, disease management etc. Weekly tapping can be easy popularized among farmers who practice tapping by themselves.

II. Controlled Upward Tapping (CUT)

Usually there is problem in the productivity of renewed bark due to various reasons. Poor regeneration, uneven surface due to injurious tapping, panel dryness, early completion of virgin bark, clonal characters etc are some of the reasons for poor productivity of renewed bark.

There are situations where basal panels become exhausted due to over exploitation. This leads to severe drop in productivity of even virgin bark.

Controlled Upward tapping (CUT) of stimulated short tapping cuts (1/3S or 1/4S) using long handled gouge knife which was recommended more than 25 years ago has been accepted as a very innovative and useful system

for sustainable increase in productivity in the later half of the economic life. It has also helped in increasing tapping task for high panel exploitation.

In India, CUT was recommended in 1991. Due to the agroclimatic constraint of rain, CUT was recommended with half yearly panel change between high panel and basal panel. Panel change was found to result in sustainable increase in the productivity of both high and basal panels. Recently we have successfully employed one year of CUT for rejuvenating exhausted virgin bark in the basal panels. In the Kulasekharam region, continuous CUT of high panel was done. Yield depression was noticed by third year.

In the estate sector in India, CUT became very popular with in a short period. It replaced ladder tapping of 1/2V cut completely. Though there was initial resistance, long handled modified gouge knife was widely accepted. Now going back to upward tapping with ladder is not acceptable to tappers. In fact medium holdings were the first to adopt CUT in India.

Efforts to popularize CUT among small holders have not become successful so far. Only a negligible fraction of small holders practice CUT. Small holders still misunderstand CUT as a type of slaughter tapping.

Use of gaseous stimulation is a recent development. RRIMFLOW, REACTORRIM etc are some of the methods of gaseous stimulation. This has been recommended in Malaysia for low frequency tapping of 1/4S cut in the high panel. This method is found suitable for irregular tapping also. It is becoming popular in Malaysia. It holds promise in other countries also. This is especially so for low frequency CUT. Rainguarding of high panel is difficult. Even when CUT is done only for six to seven months there is disturbance by post monsoon and pre monsoon rains. This causes serious problem for low frequency CUT. Under this situation gaseous stimulation is expected to be useful for low frequency CUT.

Conclusions:

Small holders are not benefited by modern exploitation technologies. These technologies are essential for getting sustainable high yield of modern clones and for substantial reduction in cost of tapping. With reduction in tapping frequency there is corresponding increase in the conditions to be satisfied for success. Similarly small holders are yet to take the advantage of Controlled Upward Tapping in the later part of the economic life. With the introduction high yielding clones, continuation of old exploitation practices have led to high incidence of tapping panel dryness and reduction in economic life. Benefits of high yielding clones are yet to be realized by vast majority of small holders.

Gaseous stimulation for low frequency controlled upward tapping without rainguarding has also to be popularized.

The new exploitation technologies of low frequency tapping and controlled upward tapping are being successfully utilized mainly by the estate sector and medium holdings.

Scientists are better in extending exploitation technologies. Scientists may take up lab to lab programmes in many holdings to popularize modern exploitation methods among small holders. Increasing the strength of exploitation scientists in the rubber research institutes is essential for this. Creation of separate division/department will be more helpful.

Separate steps may be taken to address socioeconomic issues that block adoption of modern exploitation methods among small holders.

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