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TECHNOLOGICAL INPUTS AND PRODUCTION TRENDS OF TEA IN SRI LANKA

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INTRODUCTION

The main function of the Tea Research Institute is to carry out research into all aspects associated with the growing of tea and the processing of the harvest into the finished product ready for consumption. The past achievements of this Institute are too numerous and sometimes too technical to discuss here. There is always more to be done especially when the Industry is facing serious problems as it is these days. This Institute has several research projects on its hands, which would result in much benefit to the industry. The broad objectives of such research programmes are: (a) increasing productivity; (b) reducing expenditure and thereby obtaining greater efficiency of production and increased profits; (c) improving existing manufacture techniques to produce better teas more efficiently than is done at present; (d) devising new techniques to produce fundamentally new types of teas and tea-based products from inferior grades and waste teas for new markets.

The ultimate objective of having such a Research Institute is to aid the efficiency and development of the tea industry and thus this Institute has the primary function of disseminating the information gained from Research and Development activities to the actual growers in-charge of tea plantations who are in turn responsible to ensure the implementation of such findings. The achievements of the Institute would only be of academic interest unless the practical recommendations which stem from research findings are conveyed to, and implemented on the estates.

In order to disseminate the knowledge gained from research and to maximize the benefits from research to the industry, the Institute has given the highest priority to its Extension Service. The Institute's staff maintain close contact with the planting community by way of correspondence, visits to estates, addressing Planters' Meetings, conducting Field Days, participation in Symposia, Conferences and Exhibitions. Estate Superintendents, Managers and Agricultural Advisers are always welcome to visit the Institute and its Stations and discuss their problems with the relevant staff. The publication of the scientific journal "The Tea Quarterly", the lay-journal "The Tea Bulletin", Monographs, Advisory Pamphlets and Advisory Circulars, *etc.* are other means of transmitting the recommendations of the TRI to the industry.

The over hundred-year old industry has for several decades been the main stay of this country's economy and still is. The Tea Research Institute is conscious of its role and always endeavours to give of its best to this gigantic industry. Today, the industry is no doubt facing almost a crisis perpetrated by a diversity of causes, and this would pose fresh problems. The ever changing problems will have to be resolved and the solving of such problems often take time and money. The technology that is being presently transferred to the industry is the outcome

of research that has been carried out over the past two decades or so. What the Institute is presently carrying out would be the technology that will be transferred in the future, in the forthcoming decade or so. New problems have to be resolved with meticulous care and patience. The Institute cannot offer instant solutions and one should not view this Institute as an organization that serves as a panacea to resolve instantly the multitude of complex problems that may arise through neglect and non-implementation of sound agronomic practices.

The changing trends in the industry

When one examines the figures on production of Sri Lankan teas over the last 10 to 15 years, a definite decline in total production is observed. This decline could be attributed to a shortfall in total production brought about by a multitude of factors. It is also well known that a significant extent of tea land has gone out of production and a fairly large extent of tea acreage is being under-cultivated in the different tea growing areas. Whatever the cause may be the fact remains that the total production has declined from the highest production we ever achieved in 1965, amounting to 228 million kgs, to around 185 million kgs in 1982 which amounts to an average decline rate of 2.5 million kg. If replanting has been going on the way it was anticipated, by selecting the right lands for such operations and by maintaining high standards of after-care, and at the same time if renovations of old seedling fields had been continued by proper infilling, we should have made a positive progress from the yield we obtained in 1965 and over this almost 20-year period we should have well surpassed the 325 million kg mark, with an annual growth rate of 5.5 million kg. What is sad to note is that despite replanting programmes over fairly extensive areas, the yield trend has been on the decline. It is even sadder to note that some of the replanted areas are being uprooted for further replanting in some of the areas since of late.

No one is yet certain about the economic life span of tea, let alone of clonal tea. Yet, it is also known that following replanting it takes several years to reach the break-even point of cost inputs and this period is somewhere around 14 to 18 years. It is beyond this period that the field becomes a viable economic entity and one should maintain such fields at this economic productivity level for at least another 15 years or so. On this basis one would guess that the economic life span of a fast growing high yielding clonal tea field would be around 30 years, if not more.

The most striking way of increasing yields per acre is to replant with selected clonal tea. The emphasis hitherto has been on high yields and consequently the important selection criterion for clonal selection had been high productivity. It is also a known fact that the high yielding clones are sensitive to other adverse factors such as pest incidence, disease occurrence and drought. With the recurrent droughts experienced over the last few years those high yielding fields have suffered to a great extent year after year. However, the impact of the drought on such replanted areas could have been minimized if sound agronomic practices had been adopted on time, as recommended by the TRI. One certainly cannot prevent the occurrence of a drought, whilst on the other hand, what we could do is to minimize the impact of drought on the plants. The recent experience has shown that vast extents of clonal tea fields have suffered extensive damage on account of recurrent droughts. Land selection for replanting had not been done in the proper manner and consequently marginal areas have been replanted. Another basic shortcoming has been the poor quality of the planting material itself. The proper adoption of a programme of after-care is again a critical factor to minimize the impact of drought.

It is often said and the blame is placed right at the doorstep of the TRI that the removal of shade trees, which was suggested by the Institute many years ago, has been the single main factor that has contributed to decline. It would be futile to continue blaming the removal of shade trees for all the ills confronting the tea industry. The TRI has in no uncertain terms stressed upon the replanting of shade in tea fields, since early 1970s. Unfortunately this programme has not been taken seriously over the years. The planting of shade trees and the maintenance of proper watersheds is absolutely important for minimizing the effects of drought in tea. Mulching and thatching of new clearings is again an important cultural operation that needs to be carried out to reduce the impact of droughts. The mere planting of drought tolerant clones would not be the answer to resolve this problem. No doubt the selection of drought tolerant clones would be an important step in the right direction but what is most critical is the adoption of the right cultural practices to reduce the impact of drought. This Institute has recommended several clones that are inherently tolerant to drought. Drought tolerant clones generally are modest yielders and consequently have not been utilized by the plantation sector to any large extents. No one in the world has ever produced a super clone that has all the best attributes. One has to strike a balance between yield, drought tolerance, disease tolerance, pest tolerance and in the high country in particular, quality.

Since of late the question has often been asked whether clones can be substituted by seedlings, especially bi-clonal seedlings or poly-clonal seedlings. It should be appreciated that such seedling stock vary very widely genetically. The progeny would not obviously be identical to each other and their reaction to drought would therefore be variable. It would be advisable to think in terms of a uniform planting by using drought tolerant clones and here again a mixed stand of drought tolerant clones should be used in blocks. The TRI nevertheless has not dismissed the idea of using bi-clonal or poly-clonal seedlings in the future and experiments are to be carried out with the possibility of resorting to the good old practice of planting vigorous seedling stumps selected from bi-clonal or poly-clonal progeny.

An accelerated replanting programme is possible, and would be readily acceptable to the industry, under the protective umbrella of a steady upward trend in production. Such an expectation is difficult under the prevailing climate of a downward trend in production unless propped up by outside funding agencies, as is being done at present. There is reason to believe, however, that for a time it may still be biologically possible to increase production per acre, even without replanting. The staggering increases in production from early 1950s up to 1965, with an average annual increase of 6.5 million kg, was essentially due to greater inputs of balanced NPK fertilizer mixtures. Fertilizer dosage is the factor by means of which large and quick results could be achieved and no other single factor could be so effectively used.

An additional way is to fill in the gaps in tea fields and increase the population of productive bushes per hectare by adopting a properly worked out infilling programme. Much headway has been made with regard to crop protection, especially in the area of pest management using an integrated approach. The devastations brought about by the live-wood tea termite in the low-country areas is very well known to everyone. Our studies over the last 10 years have clearly established the fact that this problem was created artificially by several factors. The planting of high yielding clonal varieties that were extremely susceptible to die-back and wood-rot has been assessed to be as one of the main causes for having opened up large numbers of avenues for termite entry. This has been further accentuated by the large scale use of straight nitrogenous fertilizers. The removal of the medium-cover shade trees in the low-country has further accentuated the problem.

This problem that has emerged over the years due to changes in cultural practices cannot be solved overnight and recommendations have been put forward by this Institute to manage this pest purely by an integration of good agronomic practices. Clones have been identified that are resistant to die-back and wood-rot. The planting of *Gliricidia* has been shown to be beneficial in cushioning the attack on the tea. The application of wound dressings on prune cuts has been demonstrated to reduce the setting in of wood-rot. The application of modest levels of nitrogenous fertilizers with a balanced input of potash is also recommended. The timely elimination of old infested seedling fields which serve as "sources of swarmers" in the vicinity of newly planted areas, is another important recommendation that needs to be adopted without delay. One of the most important cultural operation with regard to termite management is pruning. The adoption of a light cut across type of prune with very little sanitary measures had been again one of the primary causes for the high incidence of termites in the low-country. This Institute has been recommending the adoption of a sanitary prune since 1972. Unfortunately a sanitary prune has been misunderstood as a drastic low prune. This is not so. A proper sanitary prune is one where an adequate amount of cleaning is carried out carefully and if the bush has suffered a significant extent of die-back and rot over several cycles, this cleaning cannot be achieved in one operation and it has to be phased out over more than two, sometimes three cycles. Badly debilitated bushes have to be uprooted and infilled on time.

The adoption of an integrated approach using mainly cultural practices in the control of tea pests is a novel approach that the Institute has evolved over the last decade. Prior to this, control measures were heavily based on the use of toxic chemicals. We have to be mindful not only of not disrupting the environment but also of residues that will remain in the manufactured tea. Research into pest management is proceeding in this direction. It is no doubt easy to screen various forms of toxic chemicals to control pests temporarily, but our attitude has changed from this thinking.

The institute is also concentrating on product diversification. The tea has been sold in its traditional form as black tea in tea chests from inception. The TRI is now diverting its attention to develop other tea-based products especially from low value teas and waste teas. There is a very high potential for export of such commodities, thus supplementing the income from the sale of the orthodox black tea that is traditionally exported. Modernization of factory machinery is another area where the Institute is diverting its attention. Most of you are well aware of the development of the Fluid Bed Tea Drier that has revolutionized the process of drying by cutting of fuel consumption by almost half. Process Engineering Technology is now receiving a high priority.

A greater emphasis is being laid on the development of the Advisory and Extension Service. As said at the beginning whatever research findings that the Institute could offer to the industry will have to be transmitted effectively. Over the last two years a greater emphasis has been laid on the development of an audio-visual programme for the benefit of planters as well as smallholders. Expensive equipment have since of late been procured and these are being commissioned for use at Seminars, Symposia, Field-days and at Meetings for Smallholders.

The immediate solution

The steady decline in tea production and the falling prices in real terms for tea in world markets is causing grave concern. What is within our immediate scope is to arrest the decline in production and every effort should therefore be made towards arresting the decline in production and increasing the output.

Approximately 60% of the tea lands is now under the ownership of the two State Sector Corporations — the JEDB and SLSPC. Attention should initially be focussed on the rehabilitation of estates owned by these organizations. As certain essential development strategies can be adopted only under a protective umbrella of rising crops or during a boom period of rising prices (in real terms), the present situation does not lend itself for embarking on such an ambitious programme unless propped up by external funding Agencies. It is fortunate that the Government has been able to obtain financial assistance from International Lending Agencies to cover the bulk of the costs of a Medium-Term Investment Programme.

The initial phase of a careful investment planning has already been done jointly by the National Planning Division of the Ministry of Finance and Planning and both the State Sector Corporations. The Tea Research Institute should be actively engaged in developing operational strategies for implementation of the development programme. One way of achieving this goal is through proper representation and active participation at the policy decision level that controls the actual implementation. The Institute should be viewed not merely as an Advisory Body or as an "appendage" of the Plantation Sector but as an essential integral component of this Sector, especially during periods of implementation of such massive development programmes.

There was reason to believe that for a certain period of time it would still be biologically possible to increase production per hectare in Sri Lanka, even without replanting (Fig. 1). As mentioned earlier, fertilizer dosage is a factor by means of which large and quick results could be achieved and no other single factor could be so effectively used. This was the case in the 1950s when the T 500 series balanced fertilizers were used (Fig. 2), and in 1960s when the balanced T 700 series fertilizers were used widely and it was during this decade that we reached the highest production level ever of 228 m kg, in 1965 (Fig. 3). This was approximately 20 years ago. The Fertilizer induced increases on such old tea may have since begun to fade out?

Approximately one-third of Sri Lanka's tea is over 90 years old and another third is between 70 to 90 years old. Nobody yet knows what the economic life of a tea bush is! It could well be that around a third of the tea acreage presently in bearing has already passed this stage? Unless such areas are soon replanted (if the land is yet suited for tea) and the remaining fields renovated by a properly worked out programme of consolidation by infilling, we would be in real danger of entering an even steeper declining phase (Fig. 4).

However, the old seedling tea will continue to form the bulk of the country's acreage for a long time to come. One way of arresting this tendency to decline is by making each bush that survives to yield more. This would be possible as long as such bushes are yet within the *economic* life span and this has been the basis of the large increases obtained in the 1940s, 1950s and 1960s (Fig. 1, 2 and 3). With increasing age, however, we cannot expect this trend to continue for too long.

The early tea was planted at low density and many gaps have appeared in it. One positive way of increasing yields is by filling in the gaps in the tea with vigorous high yielders. This practice of field consolidation had virtually ceased in most parts of the tea growing areas. Besides yielding low, such fields with low populations of bushes and with vacancies have lent themselves to massive erosion of good topsoil—which loss had been further accentuated by the removal of shade trees in the mid 1960s.

TEA PRODUCTION IN SRI LANKA

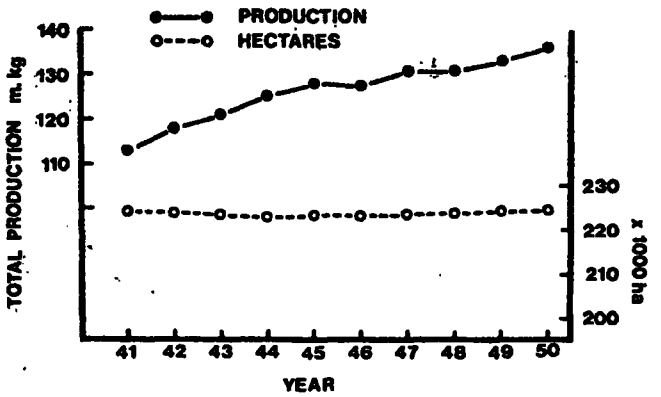

Fig. 1

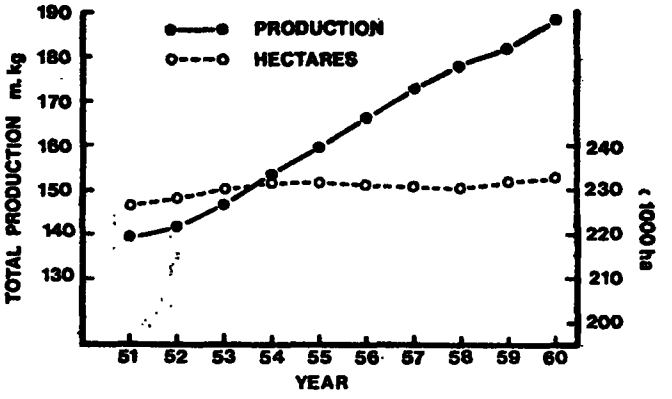

Fig. 2

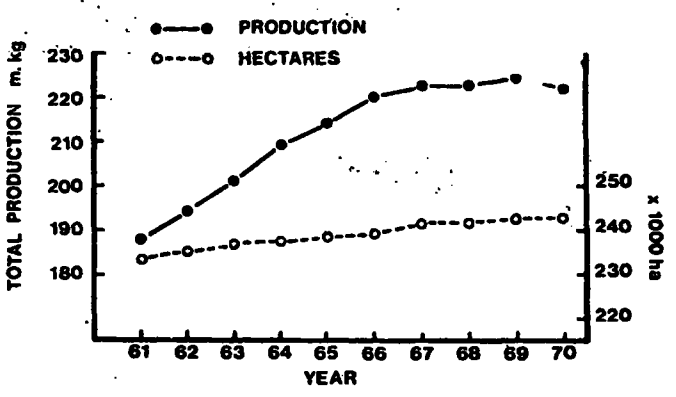

Fig. 3

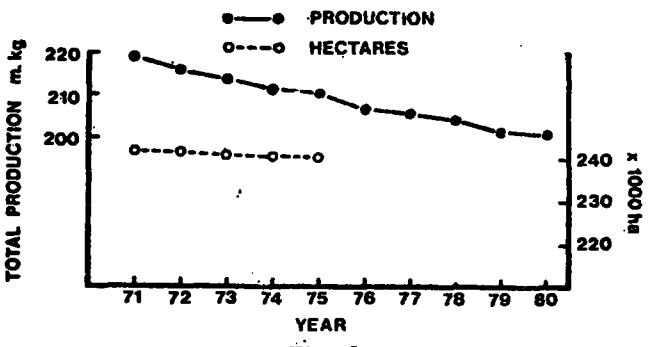

Fig. 4

An immediate and practical means of arresting this trend in decline could be worked out by a combination of a programme of increasing bush population in every good seedling tea field along with a carefully worked out replanting programme (under the protective umbrella of external funding agencies) coupled with a steady and properly worked out fertilizer programme, based on yield potentials. Such a programme would be sufficient to arrest the current declining trend and perhaps even lead to a rising trend until replanting can take over the burden of progress. The provision of a subsidy to clear the huge backlog of infilling operations is certainly a step in the right direction.

Once a rising trend in production level is achieved and costs fall within manageable limits, replanting could be accelerated under the shelter of such rising crops. Such an opportunity did once present itself in the late 1950s. It is a matter for regret that maximum exploitation of such an opportunity was not made and in certain areas where this situation was exploited, replanting operations turned out to be a failure on account of poor land selection. Let us not repeat such mistakes and look forward with optimism.

Fertilizer accounts for as much as 12% of the total cost of production. The use of balanced fertilizer mixtures at the correct times for application becomes very critical. In order to obtain meaningful economic returns of crop for such an expensive input, the quantum of application should be based strictly on *yield potentials* of the respective fields, in the respective years of a pruning cycle. The maintenance of a high standard of supervision to ensure good distribution of this expensive commodity is most essential.

The most critically important step in tea production is *plucking*, upon which everything else depends to ensure the production of a standard quality product. This operation is labour-intensive and absorbs around 70% of the total labour requirements and accounts for as much as 18% of the total cost of production. As this is a very demanding and skilled operation, the employment of skilled labour with very good supervision is a critical step in the implementation of the overall development programme.

A very important component in the immediate programme of work should be an accelerated programme of planting of the right species of shade trees and the establishment of water sheds. With the cost of liquid fuel for tea drying already accounting for 11 to 12% of the total cost of production, the planting of fuel-wood tree species becomes another critical area to concentrate and develop. We are fast reaching the stage when it would be impossible to use liquid fossil fuels for drying our teas and all our factories should be converted to solid fuels. Each factory should be self-sufficient in the supply of firewood and to attain this the projected acreage under such tree species should be around at least 20% of the area in tea, programmed on a regional basis, if not on an estate basis.

The installation and maintenance of proper machinery in the factory is important to ensure the manufacture of a good quality product. Sri Lanka's image as a steady supplier of high quality teas has been eroded since of late and this situation has to be remedied soon before the buyers adapt themselves and become adjusted to other producer countries.

The cost of traditional packaging in wooden chests accounts for as much as 5 to 6% of the total cost of production and the procurement of timber for such packaging is also posing problems. The development of alternate packaging is another area of research that needs intensfication

The above programmes should all be implemented within the shortest possible period. Since of late, the paucity of implementation of the recommendations made by the TRI have been attributed to financial constraints. The timely adoption of the Medium-Term Investment Programme with large investments made with financial assistance from international lending agencies is indeed a long stride in the right direction to arrest this alarming downward trend in production.

Much "infilling" and "replanting" needs to be done amongst the plantation and scientific manpower as well. Positive rejuvenation of manpower resources to an active productive phase is possible only through incentives of attractive remunerations and fringe benefits. This has to go on alongside field operations. We cannot afford to ignore this aspect any longer and must necessarily integrate all these aspects into a package programme to achieve the desired results.