

Mechanization of Plantation Agriculture

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Needs and prospects

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Sri Lanka is an agrarian nation, and the inevitability of globalisation, urbanisation and industrialisation must not be allowed to cloud our minds to the potentiality of agriculture as a sociological and viable economic base for the country. Apart from contributing to food security and being an integral part of the life of most of our peoples, Sri Lankan agriculture is a significant source of foreign exchange.

The Significance of Plantation Agriculture

Agricultural exports, as commodities and in value-added form, derive predominantly from the plantation sector: tea, rubber, coconut, spices. Agricultural exports earned US \$ 947 million in 1999 (rather more than 20 per cent of the country's total foreign exchange earnings), of which the share from tea alone was US \$ 621 million (65 per cent). The tea industry is Sri Lanka's highest net foreign exchange earner, contributing 13 per cent of total export earnings both in 1999 and 2000. As much as two-thirds of the food import bill of the country is equivalent to its tea export earnings.

Plantation agriculture is also significant in that it provides employment and entrepreneurship opportunities. Tea alone gives direct employment to about 600,000 Sri Lankans on 180,000 hectares (ha) of registered tea land. Of these, 317,000 are on estates (250 to 400 ha each), and the rest in smallholdings (0.4 to 20 ha each) of which there are 210,000 to 240,000. Tea smallholders make up 7.5 per cent of

agricultural produce have not shown any clear increases over the last decade or two in US dollar terms. Tea prices have been fluctuating between US \$2.47 (1984) and 1.76 (2000), and rubber prices between US \$0.70 and 1.50, per kilogramme.

The amounts of foreign exchange accruing, from tea for instance, have not been increasing in a sustained way, although the rupee equivalents earned by tea have shown a constant upward trend owing to a continuing devaluation of the rupee (from an average exchange rate of Rs. 40.06 per US dollar in 1990 to Rs. 70.39 in 1999 and Rs. 75.78 in 2000).

In such a state of imbalance (increases in COP coupled with no sustained increases in foreign exchange earnings), it becomes important to look for means of reducing the COP because, in a world that is rapidly 'globalising', the producers of commodities (with notable exceptions) have no say in the fixing of market prices.

Overall COP can be reduced by increasing crop yields and the productivity of workers, land and other resources. While worker wages and the costs of imported materials will continue to rise, the extent to which they could be neutralised by a combination of improved agricultural practices, optimised inputs, mechanisation of field operations, and automation and computerisation of factory operations, is the challenge now facing the plantation industry and its research institutes.

Tea yields have, in fact, gone up by about 50 per cent during the last decade, owing primarily to the use of good agricultural practices and improved technology.

This was a decade that saw the proliferation of better-managed tea smallholdings, and an improvement in management and inputs in the case of tea estates following their privatisation during 1992-1997.

The present direction of plantation science into

over the last decade has been only 0.6 per cent per annum. Similarly, the mean replanting rate of rubber has only been about 1.4 per cent annum, which is also considered inadequate for maintaining healthy and productive rubber plantations.

Producers are naturally reluctant to invest money in replanting with new varieties, and to invest in improved technology, owing mostly to the uncertainty of having an adequate supply of labour.

Producers are constrained today to maintain their cultivated lands with average or minimal management, and not run the risk of replanting. However, with the present scarcity of workers, even the bare bones of maintenance management may not be possible, and producers would be compelled to diversify into other crops, or timber, which is less labour-dependant, or even to abandon cultivation altogether.

A bad situation becomes worse when there are stoppages or a slowing down of work. Over the last decade, over 800 strikes in the plantation sector have resulted in a loss of more than 110,000 mandays per year and left crop unharvested in the fields.

The abandonment of cultivated lands, and the impossibility of proper plans for land management, not only reduce national agricultural production, but also create social and environmental problems and imbalances. The total reduction in the tea extent from 1990 to 1999 is reported to be more than 26,000 ha. If this extent was now in production, national production could have been raised, at the present level of productivity, by over 39 million kg of made tea which would have contributed a further US\$86 million to the national exchequer.

pruning (250 bushes per manday) a thorough cleaning of the bush frames can be done as well. Cleaning involves the removal of dead or weak branches and snags following pest and diseases infestations, and this can only be done manually. Frame cleaning is essential because the health and

vegetative vigour of the bush, and therefore sustainable productivity, are dependent on it.

Apart from the work with brush cutters, a new, hand-held tea pruning machine, powered by an electrical generator, has been developed and patented by the TRI, and is now being field-tested. Its efficiency is about five times that of manual pruning. With minor modifications, it can also be used for lopping medium-shade trees and rehabilitation grasses.

The labour requirement for pruning tea bushes, and the lopping of grasses and medium-shade trees, can be reduced by 70-80 per cent by the use of machines.

Harvesting

The harvesting of plantation crops requires a large number of workers, and adequate labour for timely harvesting is now not available, both in large plantations and in small holdings. This has resulted in a loss of crop (in the case of tea and rubber) and in a poorer quality of the end product (in the case of tea). A yield increase of about 15-20 per cent can be achieved by harvesting tea at the proper intervals, rather than in extended rounds.

Some tea and rubber lands have been abandoned owing to the non-availability of workers for harvesting, and growers are moving away from plantation agriculture for this reason alone. The mechanisation of harvesting in the plantation is therefore a priority, and this has justifiably received attention by plantation crop scientists.

In order to maintain the country's current levels of made-tea production (305.8 million kg in 2000), approximately 1,500 million kg of green leaf would need to be harvested every year (during 300 working days), or 5 million kg per working day. Assuming a plucker intake of 20 kg per day, approximately 250,000 pluckers are required per day, which makes harvesting the most labour-intensive field operation in tea cultivation.

The plucker requirement for selective manual plucking depends on the yield potential of the given field, but is estimated to be 10-12 workers per ha per day. With the agreed daily intake (or "plucking norm") of about 20 kg green leaf per day, the cost of manual harvesting works out to about Rs. 30-35 per kg of made tea, which is over 30 per cent of the total COP. This is the highest single component of the COP.

Research on mechanical harvesting has been ongoing at the TRI since the early 1980s. Various types of devices used in other countries have been tested under differing local conditions and at different seasons, and modified in attempts to improve selectivity and output.

Motorised machines with harvesting section 30-100 cm in length gave outputs of 200-400 kg leaf per working day. Although machines may give a much



"The Mechanical Hand Pruner Patented by TRI"

higher output than in manual harvesting, there are drawbacks to their use. The crop has 15 to 20 per cent more coarse leaves than manually-harvested

crop. A two-operator machine could harvest approximately one hectare per shift; however, extra workers are needed for sorting out coarse leaves and stalks, since only a good leaf standard can ensure the production of good-quality black tea. (On the other hand, non-selective machine harvesting is suitable for green tea or CTC-type black tea). Since machines are non-selective, tea yields are reduced by as much as 25 to 50 per cent over extended periods. Also, the use of these harvesting machines is at present uneconomical (capital cost: Rs. 100,000-200,000, petrol consumption per day: 4-5 litres). Efforts are, however, being continued at the TRI to get over some of these difficulties and improve their selectivity and output.

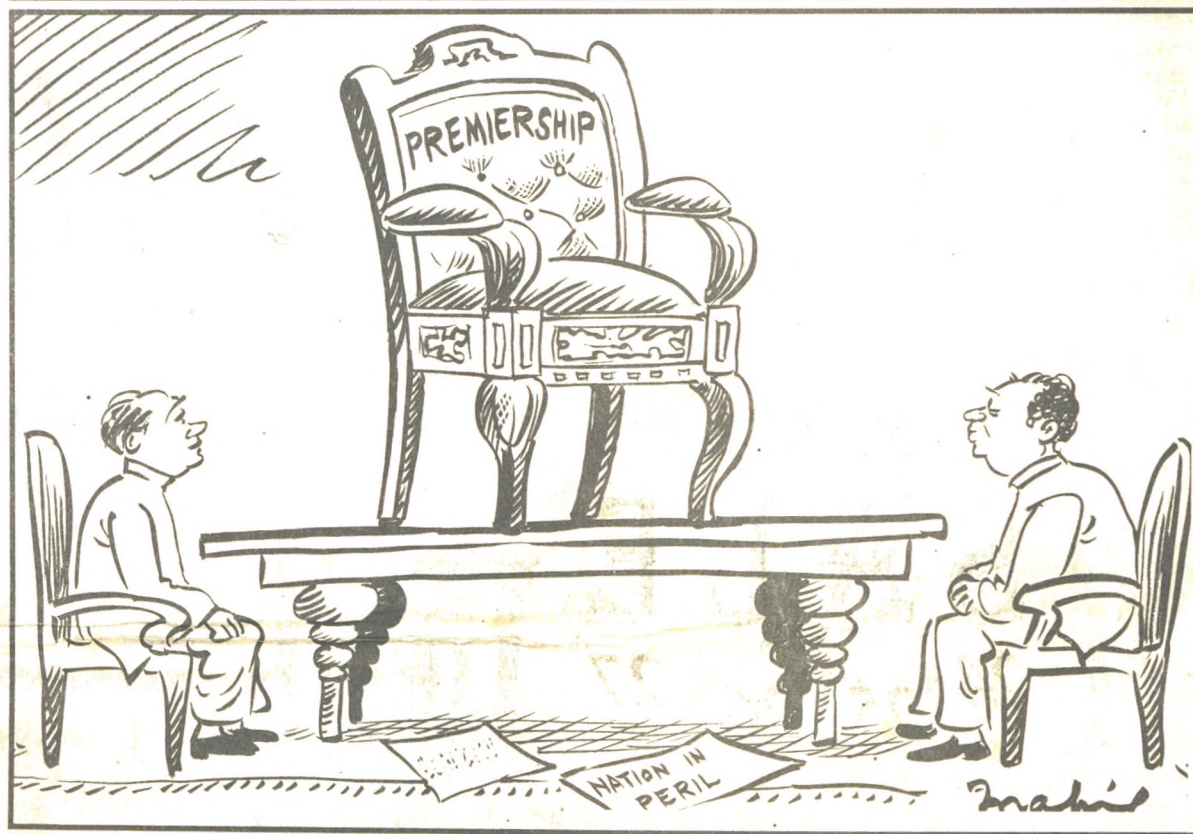
In addition, the TRI has been trying out imported and locally-made hand shears under different field conditions. These are essentially garden shears with long handles.

Although used successfully in some other tea growing countries, they were found to be impracticable, owing to poor manoeuvrability, output and selectivity, and pain and discomfort following their use. Worker intake was about the same or even less than with manual plucking, and there was a 15-30 per cent reduction in yield owing to poor selectivity.

Mechanical harvesters have been invented by Sri Lankans for the harvesting of tea, rubber and coconut. Although recognized locally and internationally in some instances, their impact and adoption rates have been poor.

(Figures and estimations are based mainly on the TRI Corporate Plan 1999-2003, the Central Bank Annual Reports, and the Plantation Sector Statistical Pocket Books for 1999 and 2000.)

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rural households. In all, close to one million people are in tea-related employment.

The smallholdings of tea, rubber and coconut are the means of subsistence of a large number of rural families and, besides ensuring their economic viability, all concerned have to ensure that the continued cultivation of tree crops is socially and environmentally possible and acceptable.

Costs of Production and Market Prices

The profitability from the marketing of produce is decided by a favourable difference between costs of production (COP) and market prices.

In May 1997, the Tea Research Institute estimated the COP of Sri Lankan made tea at Rs. 113.10 per kg in economic terms (operating cost Rs. 88.04, capital cost Rs. 6.50, environmental cost Rs. 5.88, foreign exchange input Rs. 10.38, and cost of subsidies Rs. 2.30).

At the rate of exchange prevailing then, this was about US \$ 1.95 per kg, higher than the COP of other producing countries (Bangladesh: \$1.15, India: \$1.10, Kenya: \$0.96).

However, the border or FOB price (with the tea cess deducted) was Rs. 124.23 for bulk tea and Rs. 136.86 for all teas (for 1996, the closest available figures to May 1997). (In 2000, the corresponding FOB price were Rs. 156.61 for bulk tea and Rs. 178.70 for all teas). The margin between COP and FOB prices indicate that there is a considerable economic return to the country from tea, even though our tea might have the highest COP in the world.

The COP of the major plantation crops, tea, rubber and coconut, has increased by 100 per cent or more over the last decade, owing mainly to inevitable increases in workers' wages and in the cost of inputs, such as imported agrochemicals and machinery.

In contrast, world market prices for our major

more rational, environmentally-friendly research such as agronomic practices based on organic amendments, and pest and disease management using natural enemies and biological control agents, would lead in time to a reduction in the use of imported fertilisers and pesticides, resulting in considerable savings in foreign exchange.

Worker Shortages

The scarcity of workers has contributed to a large extent to low plantation productivity, and plantation agriculture is now under threat from the flight of its workers to other occupations. Thus, a shortage of field and factory workers has for some time now been causing concern in the tea lands of the low country (which produces 54 per cent of the nation's tea), and more recently in the up-country where resident worker communities have sustained, first coffee and then tea plantations, for a century and a half.

The labour force in the plantation sector overall is said to have declined by about 25 per cent over the last decade (despite labour wages increasing by about 140 per cent over the same period), mostly owing to migration by a newly-educated younger generation to what they perceive as better working conditions and a more fulfilling life away from the plantations.

As a result, field operations have often to be curtailed, and the good agricultural practices recommended by the research institutes made difficult, if not impossible, to carry out.

Difficulties in Replanting and Good Management

The productivity of plantation agriculture cannot be maintained at an economically viable level without proper replanting programmes. Our national requirement for the replanting of tea has been estimated as 2 per cent per annum, but the mean rate