KEYNOTE ADDRESS

PLANTATION CROPS RESEARCH-PRESENT AND FUTURE

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Placrosym Delegates, Ladies and Gentlemen,

Plantation Crops are cultivated over an area of 2.97 million ha in the country. In most of the countries where plantation crops are cultivated, the percentage of small holdings ranges from 54.6 per cent in the Near-east to 71.1 per cent in the Far-east. The average holding size in these countries is in the range of 0.7 ha in the Far east and 2.7 ha in Latin America. In India, a good proportion of holdings in the plantation crops sector are marginal to small in size. (Table 1). Homesteads which constitute a sizeable

Table 1. Distribution of holdings by size*

Crop	Holding size (ha)	No. of holdings	Percentage
Tea	<5	11,292	86.1
	5–50	608	4.6
	>50	1,217	9.3
Coffee	<2	32,653	73.6
	2–4	5,646	12.7
	>4	6,080	13.7
Rubber	<2	1,10,340	85.95
	2–4	11,210	8.73
	>4	6,868	5.32
Coconut**	<1	—	89.9
	1–2	—	7.9
	>2	—	2.2

*Bavappa (1976)
**Kerala State

proportion of such holdings have already been mix-planted indiscriminately with various tree species. Such unscientific planting has resulted in overcrowded stands in millions of homesteads all over the tropical countries. The mid-country of Sri Lanka where diverse species are planted in such gardens, are rightly called "Forest Gardens". In these gardens, the production levels and net return are poor (Mc Connel and Dharmapala, 1973) due to mutual competition and wrong choice of species. In the prevailing context of changing social outlook and land policy, these home gardens have a totally different role in the farming systems of these countries. Many of the families have no other land to farm or other sources of income to support them. In addition, the new 'home-farmsteads' (small farms where the farmer has also his house in the farm as distinct from farmsteads) which are being established under different settlement programmes in limited areas of land per holding will invariably have to support a few heads of animals and poultry thus forming a micro plant-animal-human ecosytem. In most cases, the only source of income of the farmer will have to come from these small holdings.

In India, while the production and productivity of crops such as tea, coffee and rubber grown on an estate scale has shown considerable increase during the last two decades, production and productivity of other plantation crops like coconut, cashew, cacao, cardamom and pepper have remained static or even shown a downward trend during the same period. To check this trend of low production as well as for increasing the productivity of the small and marginal holdings and making them viable units of production, there is an urgent need to evolve production technologies suited to such situations.

Concepts in maximising production

The concepts of production could primarily be based on energy on one side and income on the other. Since conversion of energy into biomass is the primary function in any production activity, a critical analysis of this area is worthwhile. This will mean that the production components such as land, air space, inputs and time dimension will all have to be considered together. It is also necessary that in the place of one crop per unit area and time, more crops are planned to be raised either in sequence or

together. Therefore, it is essential that a clear understanding of the optimum exploitation levels of the above basic components by a crop community alone will enable maximisation of production through this pathway. Biomass in terms of the present content of the small farmer should be capable of providing food, fuel, fodder and timber in additon to being income generating.

Compared to annuals, perennial plantation crops offer better scope for maximising production per unit area. These crops if chosen on the basis of canopy and root architecture and space appropriately, can make better use of the soil both in the horizontal and vertical planes, and air space to greater heights, intercepting solar energy at different strata of the crop canopies, and producing much higher quantities of biomass as well as higher income.

High density multispecies systems with plantation crops

Attempts to raise high density multispecies cropping systems for high biomass production and high income generation have been found to be promising in Sri Lanka. One such system suitable for lower elevations with 13 crop species was laid out with large canopy crops such as jack, breadfruit, avocado, mango, coconut, nutmeg and clove planted 12.2m apart. The crops with medium canopy viz. papaya, arecanut, lime, banana, pepper and coffee (*robusta*) were planted at a spacing of 2.44×2.44m in between the large canopied crops. San Ramon coffee plants having small canopy were planted at 1.22×1.22m spacing, the total population of plants planted being 3606/ha. Among these crops, while jack, breadfruit, avocado, mango and papaw are mostly for home needs, coconut, lime and banana will meet both cash and food needs of the farmer. Similar high density cropping models are also available for higher elevations with coffee, pepper, coconut and other crops. Models for homesteads with crops having different root and canopy architecture and ability to stand varying moisture conditions have also been developed (Bavappa and Jacob, 1982).

Economic analysis

Economic evaluation of the results obtained in Sri Lanka and India has revealed that the return from plantation crop mixes are many times more than the returns from the sole crop. In Sri

Lanka the net return per hectare of tea mix-cropped with clove is Rs. 57,464 as against Rs. 5,900 from the sole crop of tea, Rs. 46,500 in the high density multispecies cropping, and Rs. 17,493 in coconut and cacao as against Rs. 5049 from coconut alone. In India, while the monocrop of coconut gives Rs. 5625 net return, mixed cropped areas of coconut and cacao give Rs. 17,610 per ha. The economic advantages are thus apparent.

New research areas

Research efforts are required for understanding the root and canopy architecture of different crop species, PAR profile of the system, and energy input and output. Studies on the canopy of different species should include inter-plant competition among component crops keeping time dimension as an important factor. The component crops will have to be screened for their sensitiveness to low PAR availability and also amenability to canopy management through pruning. Studies on energy input should aim at understanding the needs of cultural energy such as tillage, fertilizers, irrigation and plant protection of the entire system. While there are strong indications that considerable saving is possible in the input of energy in a high density crop community, this has to be quantified. Indeed the prospects for adoption of some of the practices like zero tillage in these systems is very bright.

A critical assessment of the self-generated energy of the system and the accompanying favourable soil and climatic changes require continued monitoring. A simple system like coconut and cacao had prompted the growth of free nitrogen fixers, phosphate solubilizers and growth promoting fungi (Nair and Rao, 1977). There are also indications that mixed cropping favours mycorrhizae which can suppress plant pathogens, thereby reducing the energy requirement for plant protection. The energy output from the system can also be enhanced by extra system exploitation. Studies have shown that by-products of cacao can be used for biogas generation, and also arecanut husk and sheath for growing mushroom. After degradation, these could be used as cattle feed and manure. A critical economic evaluation of the inputs and outputs extending over decades is also essential. A highly multi-disciplinary approach is, therefore, necessary in this vital area of plantation crop production.

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