Ancient methods for modern dilemmas

For centuries old cultural practices like religious ceremonies have been enshrined with scientific value and wisdom. But they are being damaged by 'advanced' scientific agricultural practices. G.K. Upawansa displays the wealth of indigenous Sri Lankan agriculture and proposes to turn to the ancient methods for modern dilemmas.

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Modern agriculture has evolved using an exorbitant amount of fuel, mineral fertilizers and other poisonous agro-chemicals. The disastrous effects became evident after some decades. As they appear as a threat to life, scientific, technological and philosophical communities began searching for 'alternative agriculture' (Altieri 1987) in which crop protection is an important aspect. Desirable practices must sustain healthy agriculture, be ecologically sound, non-polluting, not lethal to life in general, and should not cause a succession of resistant strains of insects and other organisms, as it happens with insecticides and other agro-chemical usage.

Religious ceremonies

Developing alternative crop protection measures in the short run is not feasible. A short term remedial action available would be to analyze and extract time tested practices prevalent in traditional agricultural systems, adopted in different agro-climatic zones and regions scattered in developing countries and reintroduce viable procedures, with scientific expositions. In this regard, Sri Lanka with its long history of agriculture is a rich source of such practices which may surprise the modern agriculturist. Fundamentals of Sri Lankan agriculture are to maintain a healthy eco-system by proper land use, water-shed management, optimum use of natural forests, nutrient recycling and appropriate cultural practices. When there was a disturbance in the form of a surge in some pest insects, mechanical, botanical and cultural measures were taken. A special feature was the integration of some rituals, religious ceremonies and habits to keep the insect population low.

Underground tank systems

Sri Lanka is a tropical island with climatic zones ranging from arid in North-west and South-east costs to a temperate one in the central hills with a peak of 2548 meters high. The annual rainfall ranges from 25 to 50 inches in arid zones to over 200 inches in the hills during two monsoons. The average temperature varies from about 60 degrees Fahrenheit in high elevations to over 82 degrees Fahrenheit in the low country dry zone. Main rivers originate from the central hills and radiate out. The river system serves as the perennial source of water to the dry zone. It was tapped and diverted to large storage tanks, which in turn fed village tank systems in some places. In other areas of the dry zone, a cascade of small tanks was built across the rivers and streams, as shown in Fig 1. There are oral traditions of underground tank systems where surface storage was not possible, in the wet zone. There was nothing but untouched forest.

A farm, according to the present description, consisted of three sections, namely: (a) 'Chena' (b) homestead consisting of trees, shrubs, intertwined creepers and bushes that provided fruits, vegetables, spices, etc. and (c) the irrigated paddy fields below the tank, divided into two or three sections depending on irrigation potential.

Staked coconut fronds to frighten rats and to provide perches to nocturnal birds and bats.

Chena is the term for shifting highland cultivation, which is considered now as a wasteful use of land, but was then a resource utilization in the ecological complexity created by man, as Conklin (1956) stressed. In Sri Lanka it provided food, fuel, timber, pasture for animals and nutrients for intensively cultivated low lands down below. The soil and nutrients washed down settled in benched and terraced paddy fields and tanks. The existence of small village unsilted tanks, over several centuries, indicates that there had been extremely efficient soil conservation measures.

No pests and diseases

The village jungles, which provided land for shifting cultivation, the homestead by the village tank, the tank and paddy fields were knitted together. In such a manner, the ecological balance was maintained by a package of land use patterns, watershed management and agriculture, including animals. The manure was usually heaped up where animals were herded. Similarly, ash and paddy husk were collected in heaps. Both these heaps were taken seasonally to the paddy fields. The dung and urine of grazing animals, manure brought from homestead, and nutrients brought from high land, kept the paddy fields fertile and conserved productivity of the land. Bright sun, selected seed varieties and proper crop mixtures not only gave healthy crops and high yields but also

kept them free of pests and diseases. This was further enhanced by timely sowing, minimal tillage, mixed cropping and adoption of cropping patterns. The objectives of timing cultivation were to utilize knowledge gained from a long experience of climatic rhythm and its yearly and seasonal variations, in order to obtain maximum benefits of seasonal rains, and minimize crop damage, failures and pests and disease incidence (Upawansa 1988). According to a USDA study (Phillips et al 1980), 65% of field grains and soybean in US will be produced by reduced tillage operations by the year 2000. But in Sri Lanka the practice of minimal tillage has been the standard practice from very early days onwards.

Mixed cropping. The humid hot climate in the tropics, with approximately 12 hours of daily sunshine, without distinct seasons, contribute to rapid and continuous growth. It reproduces flora and fauna, pests as well as beneficial insects, crops and weeds, etc. They exist in an equilibrium under natural conditions. Disturbances like monocropping tend to increase the insects feeding on these crops and to shatter the equilibrium. Therefore, in all agricultural systems for the tropics, mixed cropping is an essential condition. This was the practice in Sri Lanka in homesteads and in 'chenas'. The paddy fields and chenas which were cropped with annuals, had definite cropping patterns synchronized with the climatic rhythm. The decisive factors in selecting crops were rainfall daily variations, availability of irrigation water etc. Cropping patterns adopted provided some kind of crop rotation, as well as an opportunity for other salient features mentioned above. The cropping pattern was a barrier for continuous multiplication of specific insects, thus reducing pest problems.

Seed storage. The seeds for the next season were separated soon after the harvest, dried, and stored. Pulses were stored, mixed with wood ash and dried leaves of citrus and margosa (*Azadirachta indica*). Red onion (shallot) bulbs were hung on the roof without removing the leaves. The maize cobs and millet, without hulling were stored on the broad rack of the fire place called 'dummassa'. Well dried paddy threshed in good weather was stored in wooden boxes or in an earthen walled container, called 'bissa'. The smoke, low moisture in seeds, low humidity, and sometimes low temperature due to good ventilation and the repellent effects of botanicals, protected the seeds from insects. There was never a complaint of poor germination, often heard of today. Careful examination of what has been described above clearly shows that crop protection is automatic in this form of agriculture, though changes in climate, and other unpredictable factors, or failure to adopt some principles, like timely seeding, can cause pest incidence. Below traditional agricultural practices directly focused on crop protection are discussed.

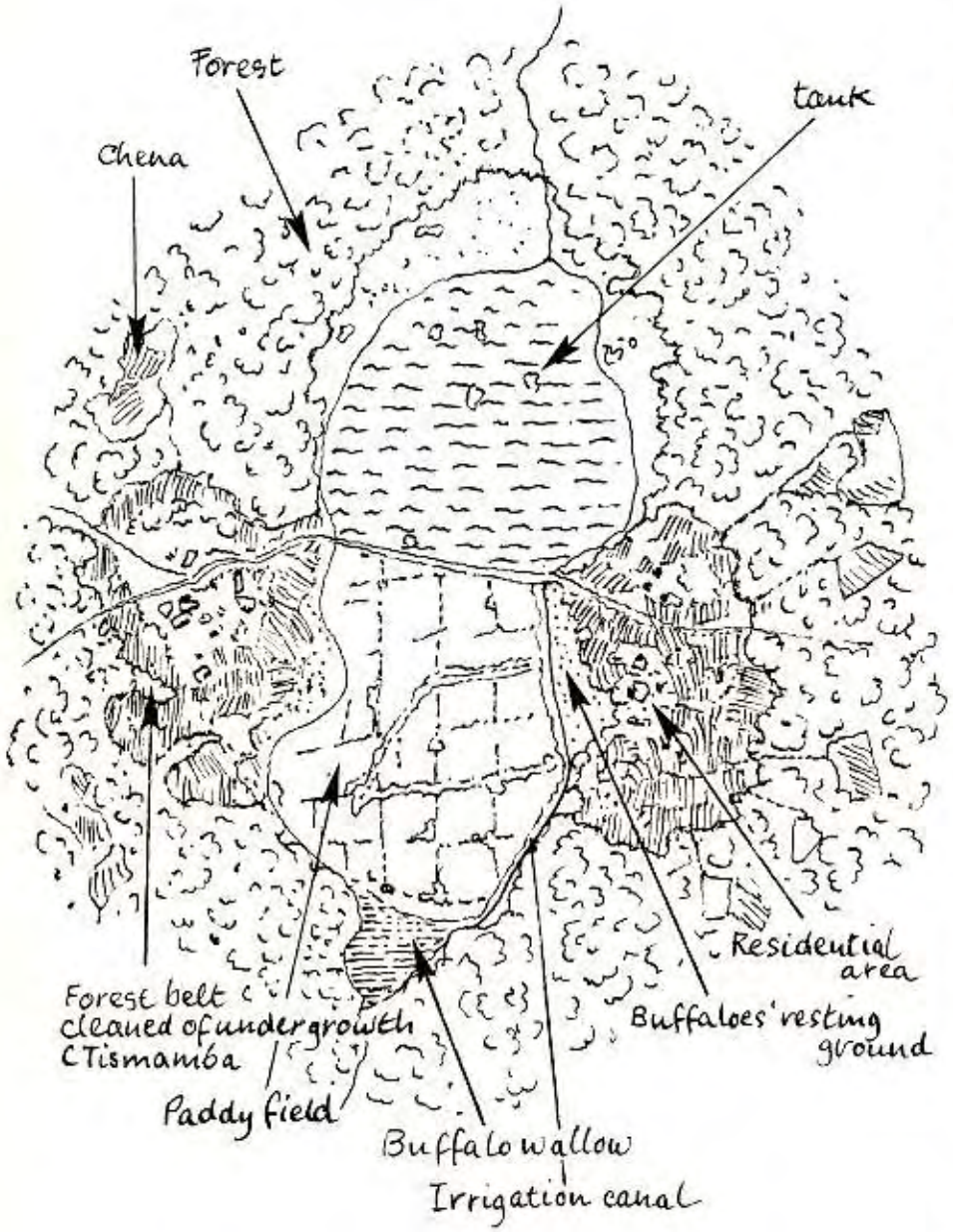
Crop sanitation. The seasonal cultivation commenced with clearing the boundaries of the section of fields to be cultivated. At the same time, irrigation channels were cleaned, desilted and repaired. The bunds of terraces were cleaned and plastered once or twice before sowing. The preparatory tillage was not done hurriedly. It took more than six weeks to complete tillage operations. By this time, all weeds ploughed under have decayed, and pests and disease organisms are mostly destroyed. The fields, bunds and surroundings were clean, free of weeds and insects. There was greatly reduced competition for nitrogen between the crop and the bacteria putrefying organic matter, as the organic matter by this time had completely decayed, (when raw organic matter is present, available nitrogen is utilized by bacteria starving the standing crop). These factors were contributory to subsequent protection of crops from pests and diseases.

Biological control. Rituals, 'kems' and similar practices were mainly meant to attract and foster birds, the main biological agents in traditional agriculture. Offering to local deities in the evenings, before commencement of cultivation consisted of a standard mixture of roasted pulse, food, flowers, and many lighted oil lamps. The lamps attracted insects. The food and pulse attracted birds, and reduced the insect population before the cultivation. Big trees and wooded highland were allowed to stand around the paddy tract and threshing floors, to provide nesting and resting places for birds. Common orchards were established for birds. A section of the paddy field closer to highland or jungle was reserved for birds. It was called 'Kurulupalussa', meaning bird damage. These practices helped to attract birds, and provided food for them. When pest appeared certain 'kems' were performed, (a kem is a practice in which the underlying principle was not explicitly explained to the people. It is possible that this may be due to religious influence which strictly prohibits killing. A kem performed when a paddy swarming caterpillar appeared is as follows. At sunset, an offering of food and light is placed on an unstable plantain disk fitted to a stake. The light attracts the birds in the evening. When birds attempt to perch, the food falls, and in going after the food, the birds observe the caterpillars. In two days, complete control is possible. Here too birds are used. Control of rats too was performed in a similar manner. The big trees served as perches for nocturnal flying bats and birds like owls. Coconut fonds, big end up, were planted in fields. The silhouette resembled an owl, the idea was to frighten rats. But in fact owls perched on these coconuts and looked for rats, (see photo). Another device is made of two bamboo segments and operated by flowing water producing an intermittent beat that scares the rats (see photo). Rat snakes were never killed.

Mechanical methods. The following practices are still followed in rural areas.

- a rough large broom made of bamboo tops, or strong twigs without leaves is used to brush the standing paddy crop.
- a gummed rope is drawn across the

Drum operated with flowing water that scares rats. It may disturb the communication between male and female insects and thus reducing mating and insect population too.



Agro-ecological set-up in a traditional village in the dry zone of Sri Lanka.

field. Sometimes, the back of the winnowing fan, called 'Kulla', is gummed and the crop is winnowed. The insects get stuck to the ropes or fans.

- sand from the base of a sacred Bo tree is thrown hard at the crop. The insects fall onto the standing water, and are devoured by frogs and other aquatic creatures.
- discarded robes of Buddhist monks are ignited in pest infested places. This is a light trap and considered to be a kem.
- a recent practice for BPH control is lighting powerful crackers in infested spots. According to farmers, this gives very good results.
- water impounded and let off after one day to control thrips.

Botanical pesticides. Below, some herbal treatments for pest control are briefly described.

- 'Daluk' (*Euphorbia antiquorum*) chips with milk are placed at the point of impounding irrigation water to control thrips.
- creepers called 'Kaluwel' (*Derris scandens*) are placed in a similar way to control hoppers.
- the plant called 'Mahapatta' is crushed and spread in affected areas to control hoppers.
- arecanut flowers and young coconut leaves are hung in several places or on a rope used to demarcate an affected area.
- fresh *Gliricidia* leaves are applied as a mulch to control virus mosaic disease by controlling the transmitting agents.
- some farmers use a decoction prepared of *Mimosa pudica*, and an extract of cattle urine, margosa leaves and asafetida is used as general purpose insecticides.

Other methods. Timing of religious ceremonies in the night, to coincide with a possible peak of insect population, has some effect. The people come from various directions to the temples and go back, carrying fire torches. These flames destroy large numbers of insects. Another practice is to set aside a little food before eating. This may be intended for birds. A crushed paddy bug put into a dead crab shell is placed in a hole dug to about 18 inches deep. It is said that paddy bugs come down from earheads to the base of the paddy plants; this may act as a pheromone, most probably. There is also evidence to show that sounds have been used in crop protection. The drum described earlier, blowing a conch, writing a stanza on the eye of a particular drum and beating as a protective measure were some of the practices. Land use pattern, resource utilization, rituals and religious performance, cultural practice and use of biological, mechanical, botanical and other methods of control did not eradicate insects, but minimized the number, they did not pollute soil or air, were not harmful to earth worms and other creatures, except for a particular species. All this helped to maintain ecological balance.

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Modern scientific thinking, concepts, definitions and analytical tools, are not appropriate and adequate for accurate study and prediction of consequences of complex changes on planet earth. For answers to modern dilemmas, we must now turn to the ancient methods, which have proved themselves valuable over millennia. ■

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