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### Editorial

### Ancient Sri Lanka at the Frontier of Traditions in Natural Resource Management

Lifestyle practices and traditions of our ancestors in ancient times had received the highest recognition of mediaeval and colonial commentators. Despite relegated, a vast body of knowledge remained intact with ancient communities which were communicated orally and written in ancient texts, or in cryptic form and transmitted through apprenticeship.

In the late 1970's, UNESCO awakened the world by organizing a seminar in Colombo titled "Traditional Wisdom". Nevertheless, it took more than 15 years for Sri Lankan scholars to resuscitate the utility value and the conceptual basis of indigenous knowledge (IK) for mainstreaming this storehouse of traditional wisdom in development planning.

This initiative came in March 1994, when the "Sri Lanka Resource Centre for Indigenous Knowledge" instituted at the Sri Jayawardenapura University, to organize what was called the "First National Symposium on Indigenous Knowledge". Since then, several such conferences have been held by various organizations which included the World Bank sponsored "Workshop for the Development of a National Strategy for Incorporating IK in Development Practices", the Institute of Biology, the National Science Foundation, as well as NGO's such "Vidyartha" - The Centre for Science, Technology and Social Change", and "CERD - The Centre for Endogenous Research and Development". In 1989, Vidyartha with financial support, from UNESCO and SAREC hosted an International Conference in Colombo to review South Asian contributions to traditional knowledge. Subsequently, NSF took the initiative to constitute a "Working Committee on Indigenous Knowledge" of which the present writer was also a member. Currently the Biodiversity Secretariate at the Ministry of Natural Resources functions as the "custodian" for retrieval and conservation of IK.

A particularly interesting ritual in ancient agriculture that had attracted medieval commentators, was the *Mutti-Mangallya*, practiced extensively in the North Central and Northwestern Provinces of ancient Sri Lanka. This ceremony was an important event to signal the commencement of the paddy cultivation season.

The present writer who undertook extensive studies on indigenous knowledge during the past four decades, was able to retrieve, collate and publish this material as research papers, chapters and books for the benefit of future generations.

M. Asoka T. De Silva

### Science behind the Traditional Agriculture

**DR P.B. Dharmasena** 



"Systems of knowledge are many. Among these, modern science is only one, though the most powerful and universal. Rural people's knowledge is in contrast 'situated', differing both by locality and by group and individual, and differing in its modes of experimenting and learning: different people know different things in different places, and learn new things in different ways." – Robert Chambers, 1994

### Introduction

Over the course of history, various communities have developed a culture and lifestyle that is intricately tied to nature and the local ecosystem. The knowledge they gained is firmly incorporated into their belief systems, myths and folklore of society and it exhibits local practice. It supports decisions regarding the use of resources and environmental conservation. It helps avoiding the incidence and negative impacts of natural disasters. It provides guidance on agricultural practices and food preservation, health care and a host of other activities. It constitutes an environmental management system that is largely community led (Samuel Mwangi, 2002). Enforcement of these customs and norms is often ensured by social conformity and by codified threats. Agriculture has evolved in Sri Lanka without any exception to

other countries based on the nature of climate, geomorphology and hydrology.

In the past 2-3 decades, a growing evidence has indicated a strong relationship between traditional knowledge and sustainable development. Large populations in developing countries owe their survival to the time-tested application and use of their own knowledge in environmental protection and reduction of the impacts of natural disasters.

There is an increasing trend of attempting to use science and technology together with traditional knowledge to find mutually beneficial results such as best practices, which could be adopted in development projects. Such attempts would only be successful if the plans are dealt through cooperation and mutual understanding, combined with an understanding of the traditional rights of rural people.

The earliest agricultural settlements established in the country were in the seasonal river valleys such as Yanoya, Malwathuoya, Kalaoya and Deduruoya. The main crop cultivation was initially finger millet then paddy under rainfed conditions. The civilization innovated irrigation technology and constructed thousands of small irrigation tanks of varying sizes and shapes, particularly in the dry zone to provide water for paddy cultivation. With the dawn of this water civilization era, paddy was cultivated only in one season, and during the dry season the lands were left fallow. Uplands were cultivated under rainfed conditions with subsidiary food crops on shifting cultivation basis (Chena). Until the 19th century subsistence agriculture continued to be the mainstay of the country.

Chena is regarded as the oldest form of cultivation in Sri Lanka, extending as far back as 5000 years in Sri Lankan history. The chena cultivation was a traditional practice and ancient Sri Lankans ensured that the environment was unharmed in this process. The techniques used to cultivate a chena depended on a range of variables including the climate, nature of soil as well as other environmental and topological factors of the area. Chena cultivation in Sri Lanka was mainly practiced by men; however, women and children also provided their inputs in various ways such as protecting crops from chasing birds and animals.

*Chena* was cultivated collectively; where each village had one *chena* plot which was divided into individual shares among the villagers. The wisdom behind this collaboration was borne out of desire to protect the surrounding forest. If each villager was allowed to clear their own plot of land for cultivation, the forest would soon disappear. Thus, the village would collectively select one area of land for cultivation and share the yield.

Knowledge on various practices and technologies had been built up over time. They found best practices on how grains should be stored for consumption as well as for seed requirements without any quality deterioration. Beliefs are associated with disasters, worries, failures and successes experienced through generations. They protected forest, watersheds, medicinal species and various pious places and materials. Simple tools and implements were developed to deal with many operations that the community had to perform in their daily life. Religious festivals were organized with different objectives but led to strengthen their social solidity and self-motivation. Materials had been identified from natural environment to be utilized for housing construction, basketry and other craft industries.

### History

With the progressive acceleration



of cognitive abilities and technology in the later pre-historic period (3000-1000 BC), the stage was set for a radical transformation in the interactive balance between man and environment. People steadily proceeded to dominate nature and blend it with collective will. The advent of iron technology in Sri Lanka around 1000 BC witnessed ascendance of man. Excavations in the citadel of Anuradhapura have produced important evidence of iron technology, breeding of horses and cattle, and paddy cultivation, from cultural horizons nearly ten metres below the present ground surface. There is incidental evidence (faunal, sedimentological) for water management associated

with paddy cultivation. Agriculture would undoubtedly have been dominated by paddy, which can only be intensified in the Sri Lanka dry zone, by the adoption of water management measures to control supplies from seasonal rainfall, streams, and perennial rivers (Deraniyagala, 2002).

The early hydraulic societies thrived on small irrigation systems with unique assemblages of land uses and agricultural attributes (Leach, 1959). Possibly these systems

evolved from early rain-fed shifting agriculture into small scale irrigation that, in turn, led to major systems. The sedentary way of life facilitated by this hydraulic base led to land tenure, property inheritance, and social organizations that persisted for centuries. Community leadership patterns had to be strong and effective with increasing size and complexity of irrigation systems. These conditions eventually

led to centralized authority representing a form of oriental despotism (Wittfogel, 1957).

Conveyance of irrigation water over long distances needed efficient control over distribution and allocation between the top and tail-ends of the system. Smooth functioning of all hydraulic structures required efficient maintenance. Irrigation depending on micro-catchments required careful watershed management to reduce siltation and ensure catchment water yields. The land and water use system that developed over centuries to satisfy these requirements has been described as a 'cascading system' (Madduma Bandara, 1985).

Organization of small tanks into a cascading sequence within micro-catchments allowed greater efficiencies in water use. Drainage from the paddy fields in the upper part of the cascade flowed into a downstream tank for reuse in the paddy fields below. The system fully expressed the well-known dictum by the King Parakramabahu (1153 - 1186 AD) that "not a single drop of water received from rain should be allowed to escape into the sea without being utilized for benefitting the world".

The establishment of forests and construction of ponds, reservoirs and irrigation systems were considered great meritorious acts in accordance with popular Buddhism, the faith of the leaders and the large majority of the people. Sri Lanka's history is full of achievements of kings who contributed to the development of water resources. Since the first century AD kings such as Vasabha (67-111 AD), Mahasena (276-303 AD), Dhatusena (455-473 AD), Agbo II (575-608 AD), and Parakrambahu (1153-1186 AD) built numerous reservoirs and irrigation systems, which fed vast expanses of paddy field in the dry zone. Construction and upkeep of these irrigation systems became massive undertakings. An indigenous expertise developed over the centuries, which appears to have been called upon by other countries of South Asia.

The ancient hydraulic civilization of the dry zone disappeared after the 12th century AD. Climatic change, malaria, depletion of soil fertility, foreign invasions and famine are some of the reasons cited. The breakdown of the efficient irrigation management system may have resulted from annihilation of the *kulinas* (the dry zone nobility who possessed irrigation expertise) by invading South Indian forces (Paranawithana, 1960).

### Land Use Strategies

Traditional agriculture is based on more realistic principles. People observed natural phenomena operating around them and studied how it could be manipulated for their needs. They could see the forest, its anatomy, association of different species for coexistence, regeneration after fire, spatial variations etc. The farming system, which includes *chena*, paddy and home garden cultivation has been evolved with interaction of man with the environment and developed in harmony with natural ecosystems (Dharmasena, 1993). Their experience and observations on rainfall pattern, wind, temperature, humidity and soil



behaviours have used to adjust their cultivation activities. When they found that some of the constraints they faced in farming as reasons beyond their control, they appealed the support from the religion and spiritual and cosmic influences. Most important fact they realized on top of others that without giving due respect to the resources using for farming they could not expect the sustainability of their food sources.

The land use associated with traditional agriculture demonstrated a profound knowledge of resource management in a challenging environment essentially transformed from natural ecosystems into agroecosystems (Abeywickrama, 1990). Integrated land and water resources management in ancient times is reflected in the zonation of land use within the micro-catchments. The tanks and the paddy fields occupied the valleys, where Low Humic Gley (LHG) soils with poor drainage had limited use other than for cultivation. Ridge summits, often strewn with rock outcrops and inselbergs, were converted into works of art and places of worship and spiritual retreat. The influence of Buddhism led to the establishment of sanctuaries early in history and the enduring

> protection of wildlife unusual in many parts of the world.

### Three-Fold Farming

The farming system is characterized by its threefold pattern of land use. Rice, the Sri Lankan's staple food crop is grown in the

irrigable lowland mainly in *maha* season and perhaps in *yala* season depending upon the availability of water in the tank. The village hamlet (*Gangoda*) is in either side of the rice grown area (*Welyaya*) usually below the tank and cultivated with perennial crops and vegetables. Due to the influence of tank water and lower elevation, where the soil is

imperfectly drained, most of the fruit crops such as mango, jak etc., coconut and some vegetables are easily grown in the home garden. 'chena' the third component, is the oldest farming practice of dry zone villagers in the upland using direct rainfall. Further, to the three-fold pattern cattle and buffalo play a significant role in the traditional farming system.

With respect to agriculture, some of the strategies adopted by the rural communities are mentioned below (Dharmasena, 2004). **i.** Risks of farming due to factors such as rainfall, drought, pest and diseases, damages from wild animals etc. were reduced through adoption of auspicious times and spiritual powers in farming operations, timely cultivation, crop management etc.

ii. Maintenance of favourable environment for crops by adopting relevant conservation practices.
iii. Maintenance of the land productivity by adjusting the farming practices with least disturbance to soil and addition of organic biomass.

**iv.** Adoption of diverse crop combinations in agriculture to cope up with the variation of climate, soil and other biotic as well as abiotic stresses.

v. Use of simple farm implements with lesser energy consumption vi. Making use of natural processes to minimal use of inputs in cultivation i.e. introducing and maintaining crop diversity (to minimize pest attack), planting Mee (*Madhuka longifolia*) to attract bats to improve fertility, maintaining natural vegetation around the tank to conserve water storage etc.

Land ownership of the paddy

tract is distributed among villagers in a manner so that each farmer could have similar access and right to the irrigation water. Decision making on cultivation of a portion of paddy tract is shared proportionately among farmers in water shortage seasons (bethma cultivation) is a good example of their unity. Cultivation of the upper tank bed area (thavulu govithena) during extremely dry seasons taking adequate precaution to prevent sediment flow into tank is an example showing their cultivation wisdom.

Shifting cultivation is traditionally practiced in many tropical countries called by various names. However, the traditional knowledge acquired in the evolution of *chena* has many important environmental qualities towards conservation and protection of natural resources. In the dry zone of Sri Lanka, clearing of chena land begins in July or August, a rainless dry month, and farmers prepare the land by burning the vegetation, which was cut and heaped for drying. They complete the land preparation before mid-September, when the first rain is expected. The chena is usually planted with a variety of crops such as finger millet, maize, mungbean, mustard, vegetables etc. at the beginning of maha season. During the yala season, chena is planted with sesame, some millets and pulses. After few seasons of cropping, the land is left to fallow. In the dry zone, in places where there is no limitation on the availability of forest land, the intensity of land use in chena cultivation does not exceed more than 10 percent.

Identification of a suitable land for *chena* cultivation, selection

of crops, sharing of the land block among the group, time of cultivation, crop management, protection and all other activities taking place in *chena* are merely based on sound scientific reasons.

### **Upcountry Farming**

In the hill country the people modified their life to suit the wetter and more rugged terrain. Paddy cultivation in the deniyas (valley bottoms) was irrigated during the drier periods through canals that collected water from springs in the hill slopes. Hills perform the function of the reservoirs, and the management of the watersheds necessarily formed an integral component of the agricultural enterprise. Different ecological segments of the slopes were recognized, as reflected on village names such as Ovita, Ovilla, Övilkanda etc. according to their location. Valley bottoms around which settlements arose were named after the valley with the suffix of deniya (Gurudeniya, Aladeniya, Peradeniya). At the lower segment of the catena, forest gardens were developed in the homesteads. Further up, chena cultivation was practiced occasionally on a largely sustainable basis. Hilltops were permanently kept under a thick forest cover, which helped control soil erosion and regulate water flow.

The Kandyan Forest Garden became a man-made forest consisting of various fruits and other economically useful tree species such as nutmeg, cloves etc. It essentially copied diversity and intricate inter-relationships of the natural forest. Kandyan Forest Gardens are located between the valley bottoms and high slopes to avoid damp conditions and benefit from a deep soil cover and seepage of moisture from the upper regions. The micro-environment of a Kandyan homestead provided a suitable base for the community of human settlements in a wet montane setting.

Farming system in the wet zone is mainly characterized according to the topography, climate, soil and other geographical and environmental features. Upper portion of the landscape mostly consists of natural vegetation, which varies from grasslands to dense forest cover. Below that forest home gardens are located, where a stratification formed by different canopy layers consisting of trees, shrubs and herbs species of economic importance. These forest home gardens consist of timber tree species, fruit trees, roots and tuber crops, vegetables and medicinal herbs. Hence all the conservation and protection functions, which are provided by the natural forest, are also provided similarly by these forest home gardens. Therefore, forest home gardens found at mid and high elevations play a major role in socio economic sustainability and environmental sustainability of rural areas.

Paddy fields are located below these forest home gardens on terraced lands according to the terrain condition. Forest home gardens and natural forest cover situated in upper elevation of paddy field help to conserve and store water, which could be utilized in the dry season of the year for paddy cultivation and to maintain the dry weather flow in water streams. There are two types of paddy fields in these areas. One is fed by its own springs. The other is cultivated by diverting water from a stream. Villagers living in these areas traditionally were self-sufficient because rice was provided by paddy field all other requirements such as vegetable, fruit, medicine, fire wood and timber were met by the forest home gardens.

In hill country, the water source is not from wells or tanks, but fountains or streams, which are more or less perennial because of the forest cover on the upstream traditional agriculture, is a mixture of many aspects derived from religious and spiritual origins, cosmic influence (astrology) and natural phenomena. Beauty of traditional agriculture is that, it has been followed in many instances the rules, principles and phenomena of nature. This is the vital reason for the sustainability and the environmental compatibility of these systems, which prevailed for centuries under very harsh climatic conditions tolerating sudden shocks of natural events.



Fig. 1. Three dimensions of the traditional agriculture

hill slopes. Paddy was grown with the supplement of water from those sources through construction of small weirs or anicuts across them. In addition to these ponds called *'pathaha'* located nearby fountains were also used. The unique culture in this area is the well-known Kandyan economic type home gardens, which can be described as forest gardens or analogue forest.

# Three Dimensions of Traditional Agriculture

Indigenous knowledge which evolved through centuries in

Unlike in western agriculture, traditional agriculture has evolved not only as a result of bio-physical process, but it has been blended with socio-cultural and cosmospiritual aspects (Fig. 1).

Many agricultural practices found among rural communities in the past had aimed at minimizing the losses and failures of crop due to climate, wildlife and other natural disasters. However, with the launch of green revolution and intrusion of western culture into the rural life centuries old traditional wisdom began to disappear mostly forever. There are three categories of traditional practices to protect crops from wild animal damage. The first group is based on astrology, the second on the powers of the spirits and Gods, and the third involves the chanting of verses and the use of specific symbols. Often these different practices are combined.

Astrological practices – One example for use of astrology is the time of cultivation. It includes i). fencing - on Monday, half an hour before sunrise; ii). a tree branch is cut into four short sticks; iii). three sticks are pegged down facing east; iv). the fourth stick is tied across the others with a vine (*kiri-wel*); and v). a small area is cleared and a few seeds are sown.

**Spirits and Gods** – If the people realize that the issue cannot be addressed by their strategies then they expect the support of Gods and spirits. One such example is that all farmers visit the temple and make offerings before they start cultivating their crop. Then a coconut is hung to please the God. After the harvest, farmers perform a ritual in the field before use. They believed that such practice could painted on an ola leaf and hung in the corners of the field. However, the performer is said to be a pious person and he should refrain from robbery, sexual misbehaviour, eating animal protein or drinking alcohol.

Manthra – The *manthra* is also chanting with specific sounds repeating the same version specific number of times. This causes a vibration in the environment. Yanthra - A symbolic drawing preferred by a particular spirit is hung or kept in a specific place expecting the blessings of unseen power to carry out their activities or to live without any threats.

### **Disaster Risk Reduction**

Paddy cultivation under rain-fed conditions or with supplementary irrigation water from reservoirs of varying sizes evolved to become a sustainable farming practice in the dry and intermediate zones of Sri Lanka. Basic problems faced by farmers were shortage of water in less rainy seasons, development of salinity in certain parts of the field, and damage from wild animals, pest, and diseases. Strategies emerged to address these problems are not specific to a certain problem but collective. The following strategies could be traced:

a. 'Bethma' practice—It is a practice that temporarily redistributes plots of land among shareholders (paddy landowners) in part of the command area (territory) of a tank (reservoir) during drought periods. b. 'Pangu' method—The tank had to be maintained properly to avoid breach, leak, and excess seepage. Repair and desiltation of tanks and cleaning of canals during dry periods are shared tasks assigned to each farmer in proportion to land ownership.

c.'Kekulama'—Farmers advance the cultivation time using early seasonal rains whenever they feel that tanks would not get enough water to cultivate the command area. They have the experience that if September (2nd inter-monsoonal) rains are high, the total seasonal rainfall is not adequate to fill the tank. d. 'Karahana'—This is a water distribution device fixed across the canal made up of log with two or three weir-shape cuts (Fig. 2). The size and bottom level of the secuts are made according to flow requirements of the canals below,

> and the *karahana* is fixed by th evillage head ('Gamarala'). e.Village commons micro-landscapes are utilized to reduce tank water losses, mitigate salinity effects, prevent tank sedimentation and so on (Fig. 3).

Sustainability of the traditional tank-village system had been maintained in the past simply not only from structural maintenance.

please the unseen forces. These activities are still taking place in some rural villages. Pirith - Chanting specific verses extracted from Buddhist teachings is done in a group. The verses are used to charm sand and water. In some areas symbols are





Each and every component of the eco-system was given due consideration. attention was paid not only on macro-land uses such as paddy land, settlement area, chena (shifting cultivation) lands, tank bed etc. but also on micro-land uses such as goda wala (upstream water hole), iswetiya (upstream bund), gasgommana (upstream tree belt), perahana (grass filter), kattakaduwa (downstream reservation),

*tisbambe* (land strip around hamlet), *kiul-ela* etc. (Fig. 3). It is vital to understand why these commons have been maintained purposely. Only reason one could think of is that these communities owned the wisdom of mitigating the effects of natural disasters such as drought, flood, cyclone and epidemics by managing their land, water and forest resources. Descriptions and importance of the commons are discussed below.

Gasgommana (tree belt) – It is the naturally grown vegetation in the upstream land strip (Vaan gilma) above the tank bed, accommodating water only when spilling. Large trees such as kumbuk, nabada, maila, damba etc. and climbers such as kaila, elipaththa, katukeliya, kalawel, bokalawel etc. are found in this area. This vegetation is natural and seeds



Fig. 3. Land Use Management for DRR in the Dry Zone

float on water. The *gasgommana* acts as a wind barrier reducing effect of strong winds, minimizing evaporation from the tank and lowering water temperature. It gets closure to the bund from either side where roots of large trees make water cages creating breeding and living places for some fish species. This strip of tree demarcates the territory between human and wild animals.

Perahana (grass filter) – It is the meadow developed under gasgommana and filters the sediment flow coming from upstream chena lands. This helps maintain the tank capacity reducing the threats of flood and drought.

Iswetiya or potawetiya (soil ridge) - An upstream soil ridge constructed at either side of the tank bund to prevent the entry of eroded soil from upper land slopes. Godawala (water hole) - A manmade water hole to trap sediment which provides water to wild animals. This had been a strategy to evade man-animal conflict.

✤ *Thawula* – Upper part of the tank bed, where shallow water body is found on almost a flat area. Water will disappear 2-3 months after *maha* rains.

✤ Wew-pitiya – This is the deep area of the water body, which accommodates major part of the tank water and it is covered with water for more than 8 months in a year.

✤ Mada-kaluwa – The portion of the water mass found during dry months of the year and located closer to the tank bund. This water cannot be moved through the sluice as it is below the sill level.

\* *Kuluwewa* - A small tank constructed above a relatively large

reservoirs only to trap sediment and not for irrigation purpose. It provides water for cattle and wild animals.

\* Tis-bambe (hamlet buffer) - It is a fertile land strip found around the settlement area (gangoda) and does not belong to any body. Tree species such as mee, mango, coconut etc. are grown in scattered manner. Mostly this area was used for sanitary purposes as the resting place of buffaloes. Buffaloes were used as a protection mechanism from wild animals and malaria. \* Kiul-ela (drainage) - This is the old natural stream utilized as the common drainage. Tree species such as karanda, mee, mat grass, ikiri, vetakeya etc. and few rare small fish species are also found in water holes along the kiul ela. Most importantly it removes salts and iron polluted water and improves the drainage condition of the paddy tract.

\* Kattakaduwa (interceptor) -This is a reserved land below the tank bund. It consists of three micro-climatic environments: water hole; wetland; and dry upland, where, diverse vegetation is developed. This land phase prevents entry of salts and Ferric ions into the paddy field. The water hole referred to as 'yathuruwala' minimizes bund seepage by raising the groundwater table. Villagers plant vetakeya along the toe of the bund to strengthen the bund stability. It appears to be a village garden, where people utilize various parts of the vegetation for purposes such as fuel wood, medicine, timber, fencing materials, household and farm implements, food, fruits, vegetables etc. (Dharmasena, 1995). Specifically they harvest raw materials from this vegetation for cottage industries.

### **Present Status**

Traditional knowledge that has not been documented survives today usually as a "family secret" similar to a trade secret. The knowledge is passed down from generation to generation and is closely guarded from those outside the immediate family. However traditional knowledge maintained as family secrets tend to leak or gradually move into the public domain and their leakage cannot be effectively prevented unlike trade secrets in the corporate sector.

Non-formalized traditional knowledge in agriculture has been largely lost. There are a few sources of food materials, which are generally consumed by minor sections of the community, but with the assimilation of these communities, this knowledge has also become public and the habits popularized. Traditional seeds were regularly used in the past but they have been replaced over the years. The Green Revolution saw most of our farmers moving away from traditional rice to modern hybrid varieties. Some of the germplasm has been preserved locally but most of them are available in International Germplasm Depositories. It is unlikely that Sri Lanka's prior consent will be obtained or that it will share in any benefit if its traditional germplasm available in these depositories is used in the development of new commercial seeds.

Identifying, documenting and incorporating indigenous knowledge in agricultural extension organization is essential to achieve sustainable agricultural development. Indigenous knowledge systems provide a frame of reference for strengthening agricultural extension programs and this led to reorganization of interventions made by extension personnel. The participatory technologies that are developed through integration of indigenous knowledge will i) 'provide diversified technological options, which would enable farmers to choose using their own decisionmaking systems; ii) originate from the farmers' own knowledge and iii) use diversified sources in active participation of research minded farmers' (Rajasekaran, 1993).

The content of an indigenous knowledge of a country varies depending upon the needs and problems that the nation faced during the history. It can be categorized according to its variability of importance. It is an information base for many aspects in the community such as agriculture, climate, history, tradition, medicine, religion, belief etc. For example rural people understand the salinity status of soil by observing the plants found in an area. Diwul (Feronia limonia), keeriya (Acacia chundra), indi (Phoenix zeylanica), ikiriya (Hygrophila spinosa), pothu-pan (Scleria poaeformis), vetakeya (Pandanus kaida), illuk (Imperata cylindrical) can be grown in saline soils. Good rains are expected if they observe more flowers in wood apple trees. Occurrence of heavy rains in the Binara (September) indicates a maha season with low rainfall (Dharmasena, 2007).

Knowledge on various practices and technologies has been built up over time. They could find best practices on how grains are stored for consumption as well as for seed requirement without any quality deterioration. Beliefs

are synthesized with disasters, worries. failures and successes experienced through generations. They protected forest, watersheds, medicinal species and various pious places and materials. Simple tools and implements were developed to deal with many operations that the community had to perform in their daily life. Religious festivals were organized

with different objectives but led to strengthen their social solidity and self-motivation. Materials had been identified from natural environment to be utilized for housing construction, basketry and other craft industries.

Sri Lanka's traditional knowledge has been lost and is being lost because of modernization. This brings up the question as to whether developing countries should attempt ensure the preservation of traditional knowledge by preventing changes in the life styles of the holders of traditional knowledge. Such a strategy will in effect be a denial of the benefits of modernization (improvement in living standards, social mobility, etc.) to these communities. Although the benefits of modern lifestyles over traditional lifestyles can be questioned, there can be no justification for preventing the modernization of communities with traditional lifestyles merely to preserve traditional knowledge. The only way of preventing the loss of traditional knowledge is through documenting the traditional knowledge.



However, the conventional system of intellectual property right not only does not encourage the disclosure of traditional knowledge for documentation but also appears to militate against the rapid documentation of traditional knowledge.

In Sri Lanka, so far no concerted efforts have been taken to preserve its indigenous knowledge. On the other hand legitimized knowledge system of the country is also on the verge of extinction. Within the next few decades most of the records of this knowledge (palm leaf manuscripts), heaped in Buddhist temples here and there will be destroyed due to neglect. Preparation of bibliographies alone does not preserve these manuscripts. They are immediately to be copied, classified, indexed and preserved.

Vast amount of true indigenous knowledge of the country, the oral knowledge has already vanished since the word by mouth tradition does not exist in modern society. The verbal tradition is on the wane. Young generation of the

> country is not interested in the practicing of verbal traditional knowledge. Therefore, if no immediate actions are taken, it is inevitable that the verbal indigenous knowledge in Sri Lanka will be lost by the end of the present generation of elders. Hence, it is to be immediately collected, recorded, preserved and made available to the future generations.

## Diversity and Conservation

Crop diversity is the most effective strategy adopted in the past for pest management in the *chena* farming (Bandara, 2007). The home gardens constitute a traditional system of perennial cropping for a wide range of useful plants, including timber, fruits, yams, medicinal plants, flowers, spices and vegetables. They are located in slopes ranging from 5-30%, and the rice fields are located in the valley, at the base of home gardens. The multi-storey vegetation in traditional home gardens consists of trees, shrubs, vines and herbs.

The diversity of the ecosystems provided a natural setting for the adaptation of agricultural system capable of producing foods to sustain large population. Traditional wisdom in agriculture and the living have not evolved within few decades. It is a long timetested knowledge, which created an environmentally adapted, disaster tolerant and sustainable living system. Their agriculture had been adjusted to absorb any weather vagaries by shifting the cultivation time and selecting farming practices. They cultivated *chena* and paddy lands according to the seasonality of rains thus; at least they could get s successful harvest from cultivation. *Kekulama* (dry sowing), *Bethma* (shared cultivation), *Thaulu govithena* (tank bed cultivation) etc. are the best examples showing how they could

avert the drought effects on their farming. Traditional communities made every attempt to conserve soil, water, and natural habitat. Food security was one of the in-built aspects of their culture. Use of groundwater for agriculture was never

practiced by them, and it assured the water security. An adequate dead storage was found in tanks to be utilized during dry period for all purposes and had been the only source of water for cattle and wild animals. There was a broad diversity in flora and fauna and the availability of water in the tank during the dry period assured the survival of them. Sharing resources equally and the equity of ownership were the most striking features of their culture, which led to build up a peaceful and sustainable rural society. Environmental pollution was not a topic for discussion. With the disappearance of the features discussed above the whole system was subjected to deteriorate socially, physically and economically leaving vulnerability to disasters with them.

It has been realized by many, the fact that bringing the agricultural technology developed in western countries to many peripheral countries jeopardized their century old ingenious agricultural systems and the wisdom, which had created sustainability and environmental harmony. It has resulted in many disastrous situations such as bio-degradation, soil fertility depletion, pest and disease invasion, food poisoning, collapse of food sovereignty etc. At present, attempts are being made



to study this burying knowledge by few international organizations and restore under the prevailing environmental, economic and sociological conditions.

Many agricultural practices found among rural communities in the past had aimed at minimizing the losses and failures of crop due to climate, wildlife and other natural disasters. However, with the launch of green revolution and intrusion of western culture into the rural life centuries old indigenous wisdom began to disappear mostly forever. Some of the traditional skills are described below.

There are three categories of traditional practices to protect crops from wild animal damage. The first group is based on astrology, the second on the powers of the spirits and Gods, and the third involves the chanting of verses and the use of specific symbols. Often these different practices are combined (Upawansa, 2000).

It is evident that more than 2,000 rice land races were grown in Sri Lanka during the known period of our history. These varieties varied with the location, purpose, tolerance to soil, water and climatic stresses and their unique taste and aroma. For example, heenati rice was grown for lactating mothers. Kanni murunga, another variety, was grown for men going out to work in the fields. Suvandel was cultivated for its extraordinary fragrance. Monks who did not eat after noon were given a special variety grown over six to eight months called *mawee*, which possesses high-protein content. There were varieties for different meals in the day, preparations, patients, elders, infants etc. Also there were varieties, which could stand for salinity (pokkali wee), flood and drought. There is a need to investigate, classify and use them for breeding purposes depending up on the purpose and for different environmental conditions.

### Way Forward

✤ Inability to interpret any phenomenon does not mean that it is a myth. Many practices adopted in the traditional communities are blended with religious and spiritual beliefs and cosmic influence. Thus, it is wise to use a 'package effect approach' rather looking for effects of each component separately. For example, the *nawa kekulama* is an improvement of the traditional kekulama considering the present environment, where it is to be practiced. Irrespective of the unknown and unseen influence of certain components, the null hypothesis can be tested for the whole package of *kekulama*. A research methodology should be developed to conduct experiments with real practitioners of the indigenous knowledge and in real environment, where it is being practiced.

The investigation should not be biased due to previous experience. The investigator and the practitioner should have close association but the interpretations should not be supported by past stories.

✤ In analysis there may be a possibility of separating the effects of physical and spiritual components, however, it should not be done in this package effect experimentation. Effect of western and traditional medicines cannot be compared by analyzing the known ingredients only as the traditional medicine has many unknown constituents, specific way of application and post application practices.

✤ In developing a strategic mechanism to promote an alternative to present agriculture, cognizance must be taken from deep rooted customs and traditions and the time tested agricultural practices to assure the sustainability in the agricultural sector. Farmers' dependency mentality evolved due to modern agriculture and the government policies dealt with agriculture from time to time should gradually be removed by developing self-confidence, selfmotivation and empowerment. ✤ National policy on agriculture should emphasize the use of traditional knowledge in agriculture, which ensures preserving and utilizing traditional crops and varieties, resources conservation practices, medicinal plants, cottage industries and agricultural heritage of the country.

✤ Reorientation of agricultural research agenda from crop based



agricultural heritage. Under relevant policy directives a national institute for indigenous knowledge needs to be established in Sri Lanka. Such institutes have already been established in many countries. Several past attempts of IK centres are found in literature, but at

present not even a single centre is operational. Such institutes have already been established in many countries and some are functional at present.

to resource productivity based is essential to achieve sustainability. Promotion of endemic fruits, vegetables and medicinal products for both local consumption and foreign markets can be initiated through research. Knowledge on conservation of natural resources at present is dispersed and available in various institutions. Gaps need to be identified where further studies are needed and organized by networking them so that any would have the access for utilization. ✤ A strategic mechanism is essential from policy directives to ground level activities for revival of indigenous technology under

the present circumstance of agriculture. This may include an attitudinal change of our nation through enormous efforts to build up the proud of our indigenous



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### 1. Introduction

Traditional knowledge can be defined as people's awareness and understanding of the system and other information, which is passed on from one generation to the next, usually by word of mouth or within a specified group of people. The word indigenous knowledge is often used interchangeably with traditional knowledge. Traditional knowledge has been widely recognized in the fields of agriculture, agroforestry, traditional medicine, biodiversity conservation, natural disaster preparedness and response etc. Traditional knowledge contributes to climate science by offering observations and interpretations.

In agriculture, traditional knowledge of farmers is important in many ways. For example, in forecasting weather patterns, the development and adaptation of plants and crops to different ecological conditions (soils, rainfall, temperature, altitude) etc. Since paddy is an ancestorial crop most of the farmers still use traditional methods in agriculture activities. Continuous farming practices specialized their knowledge in several areas, especially knowledge of science in forecasting weather patterns and adopting cultivation practices.

Agriculture is an important sector in the Sri Lankan economy which contributes to nearly 8 percent of the Gross Domestic Product (GDP)[1]. Further, approximately 25 percent of the labour force[2] is engaged in agriculture. Although, the importance of the agricultural sector in GDP is gradually declining in the present context, it continues to play a dominant role in the economy where nearly 75 percent of the population still falls into the rural category, most of whom are engaged in agricultural activities. Further, the Sri Lankan main crop paddy cultivation covers nearly 34 % of the total cultivated land area and nearly 1.8 million farmer families are involved in the sector[3]. Paddy is cultivated during two seasons in Sri Lanka; Yala season from April-September and Maha season in October to March. Paddy cultivation is based on the rainwater in wet zone and irrigated water in the dry zone of the country. Weather forecasting of rain, wind, humidity etc.





Figure 1: Use of Traditional Weather Forecast Techniques Source: Author calculation based on the study on Institute of Policy Studies of Sri Lanka. (2018).

pays a pivotal role in agriculture and it significantly impacts the productivity of the sector. Therefore, farmers knowledge of science in weather forecasting is imperative in the success of the agriculture sector. The remainder of the article is organized as follows; the next section will discuss traditional knowledge on weather forecasting and climate. The subsequent section will explain few examples from Sri Lanka and other few selected countries in using traditional knowledge for weather forecasting. The next section highlights the link between traditional and modern weather forecasting and the challenges associated in traditional weather forecasting in modern days. The final section provides the way forward and the conclusion.

### 2. Traditional Knowledge on Weather Forecasting

Most farmers in Sri Lanka, especially the paddy farmers use techniques and methods inherited from their ancestors to identify seasonal variations and predict weather patterns. In reality, the previously mentioned Yala and Maha seasons were formed based on such knowledge and observations. Farmers begin their cultivation based on these



**Figure 2 : Consistency of Traditional and Scientific Weather Forecasting** Source: Author calculation based on the study on Institute of Policy Studies of Sri Lanka. (2018). predictions and patterns, which are usually accurate. They make agriculture decisions based on the observations of the changes in nature which includes animal behavior, blossoming of certain trees (mostly indigenous trees), appearance of various insects, etc. Occasionally, these practices and the decisions on observations differ from place to place. a consistency between traditional and modern weather forecasts. 60% of the surveyed farmers have agreed on the statement that there is a consistency between the two forecasting methods.

Farmer predictions can be seen in different stages of the cultivation process, such as; onset intensity and duration of rain fall, wind speed and wind direction,



The study on "Integrated Climate Management System" done by the Institute of Policy Studies (IPS) with other partner institutes[4] amongst nearly nine hundred farmers in few selected districts identified that farmers are still using their traditional knowledge on weather forecasting when taking decisions on agriculture. As described in Figure 1 the highest percentage of the farmers who were interviewed for the study are using traditional knowledge in making weather forecast. Most importantly, the farmers who are using traditional knowledge have stated that there is temperature, humidity etc. Figure 2 illustrates the consistence of the traditional weather forecasting with the formal forecasting. It is imperative to note that most of the climatic information and TK weather forecasting are moderately consistent (its more than 50 %).

Some of the farmer's predictions are based on their years of experiences and engagements with the natural environment. They observe the pattern of stars, animal behaviour, appearance and disappearance of reptiles, migration of bird species, cloud cover, blossoming of trees etc. Some of the examples are elaborated in the Box 1.

### Few Examples of Traditional Knowledge used by Sri Lankan Farmers

### Animal behavior

Predictions are mainly based on birds behaviour and appearance of insects. The behaviour of birds such as eagles, crows, owls, baya weavers provide predictions for paddy farmers. "If eagles fly high in the sky, if there are more than two young crows in a nest, if owls make noise at night and if baya weavers built nests in neem trees, farmers know that rain is coming soon. Also, if birds fly in the same direction in groups farmers predict the rain soon. Furthermore, appearance of certain insects helps farmers predict weather changes. "Meru flies appearing in November predicts the start of the rainy season for maha season. If termites appear in rubber trees, that is a foretelling of the rainy season

### Flowering in trees

Farmers use appearances of budding and flowering in trees, especially in indigenous trees such as more and wood apple trees for weather forecasting and climate prediction. "Ceylon iron woods (palu trees), covered with fruit indicate heavy rain fall. Normally, blossoming of palu will happen in May. Further, if there are more than an average number of mango fruits in mango trees, it indicates that there will be good rainfall for agriculture and farmers can harvest in both yala and maha seasons".

### Cloud cover and its colour

Farmers in Sri Lanka also make climate predictions by observing patterns and colours of clouds. "Dark, clustered clouds usually in August indicate heavy rainfalls. Moreover, "dark clouds around the moon foresee raining and also appearance of a rainbow indicates of future rain. Dark cloud cover in month of July and August in east predict heavy rain falls in future. When the East sky is dominated by red colour, it predicts heavy rains, and it is a good start for a maha season for farmers.

### Rainfall and wind

Apart from these observances there are some specific predictions to identify seasonal variations. In some districts farmers believe that if rain falls between October 10th-15th (they called it Akk Wessa) they could cultivate both yala and maha seasons successfully. Moreover, farmers use their religious calendar (Panchanga litha) for predictions and also to select what crops to grow. In some areas where farmers who are close to the sea are using



sea- wind direction when making decisions. And also, they check on ocean currents when making decisions. Moreover, farmers are also concerned on wind speed and wind direction when predicting rainy season. These are some of the selected environmental changes which are consistent in most occasions that farmers are using seasonal variations.

### Source:

Institute of Policy Studies of Sri Lanka. (2018).

Farmers around the world too are using traditional knowledge Few



examples are highlighted in Box 2.

### Examples from a few Selected Countries on Using Traditional Knowledge for Weather Forecasting

Traditional knowledge of observations and interpretations of weather forecasts have guided seasonal and inter- annual activities of farmers around the world for several thousands of years. Few selected examples can be explained as follows.

In India, farmers have used traditional knowledge to understand weather and climate patterns in order to make decisions about crop and irrigation cycles for several years. Farmers use different kinds of traditional knowledge to predict rainfall based on their observations. For example; wind movement, lightning, animal behavior, bird movement, halos or rings around the moon, and the shape and position of the moon on the third to fifth days from the new moon.

In Africa, farmers use the budding and flowering of fruit trees and other indigenous plants for weather forecasting and climate

prediction. In Western Kenya, inhabitants use birds, toads, and white ants to predict the summer season and onset of rains as well as temperatures. In Tanzania, they look at the behavioral patterns of birds and mammals to make the weather predictions. In Puno region of Peru, peoples use traditional knowledge about the environment and about wildlife (i.e. frequency of rains, flowering of certain plants, appearance of certain animals, mating of animals, incidence of pest infestations, etc.) to determine agricultural decisions on planting and harvesting. Bolivian farmers monitor the wind, snow, clouds and stars to determine what species to plant and when and where to plant.

Moreover, traditional lunar-based calendars are also important in the structuring of traditional agricultural practices. In Tuvalu islands, traditional seasonal calendars have been used as the basis for interpreting weather. In the islands of Tuvalu, these include a wide range of traditional forecasting techniques relating to anticipating extreme weather events. Such techniques rely upon observations of the sea and lagoon (e.g. the sizes, strengths and sounds of waves, the colour and smell of the water, and the amount of seaweed deposited on the beach); the sky (e.g. type and colour of clouds, the appearance of the moon in a particular way); and the winds (e.g. primarily direction and speed).

### 3. The Link between Traditional Knowledge and Modern Science

In the process of development, several environmental changes have

occurred with the infrastructural development projects. Presently, on some occasions farmers aren't able to rely only on their traditional knowledge as most of the environmental factors have changed and some of the traditional indicators that their ancestors used are not available at present. Some farmers have mentioned that "We can't predict the weather like we used to". Thus, with the recent changes in the environment, sometimes these predictions have become less reliable. Therefore, in most occasions, they rely on both traditional knowledge and science -based climate weather forecasts provided by the Department of meteorology of Sri Lanka.

The scientific forecast provides large scale weather predictions based on the meteorological indicators and are provided for a larger area. However, the traditional predictions provided for local areas may be for a particular village or a group of farmers. The previously mentioned research too has identified as the best suited solution to partner farmer's traditional knowledge with science -based climatic weather forecasts in predicting climate changes. Thus, climate or environmental observations will harmonize with climatology in order to produce reliable results. Finally, it is essential to provide weather forecast at local levels rather than in large scale levels for higher accuracy and also to optimize the use of farmer's traditional knowledge.

### 4. Way Forward and Conclusion

In light of the above facts, it is evident that the traditional weather forecasting among farmers are unique and it differs from place to place. However, the recent infrastructural developments and changes in the environment have badly affected in making these climatic predictions by observing the environment. These observations on the environment are not included in the modern scientific weather forecasts too. Thus, there are pros and cons in depending exclusively on traditional weather forecasts in the present context. However, it is necessary to understand the traditional knowledge and their observations too in communicating scientific weather predictions. Therefore, the traditional weather forecasting and modern scientific weather predictions needs to be linked, which will then provide an effective forecasting for the farmer groups. Thus, it is of utmost importance that the climate or environmental observations harmonize with climatology in order to produce reliable predictions with higher accuracy and also to optimize the use of farmer's traditional knowledge.



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An Investigation of Indigenous Knowledge in Pest Control

Mr Mathugama Seneviruwan



### Introduction

Attraction of pests to a crop is a very natural phenomenon. Insects and their pupae stages suck plant sap from fruits and pods. Birds on the other hand are attracted to the worms in the plant leaves and at the same time, they get attracted to the crop. Therefore, pests of a particular crop do not necessarily mean insects. Nevertheless, farmers are aware of this situation, and they use different *Kem* methods from the beginning of crop cultivation.

The word *Kem Pahan* is in common use in local knowledge for controlling pest attacks. It can be observed that in the traditional procedures and in *Kem* methods which were used, have slight differences in different provinces as well as according to biodiversity concerns in Sri Lanka. The diversity of *Kem pahan* methods and their scientific approach of *Kem pahan* methods will be discussed in this article.

### Suitability of Kem Methods

When insect pests are attracted to a crop, they are controlled using

Kem Methods. One method is to drive the animals off the farm by tying their mouths which is known as "Mukha bandeema". This is done using mantras (literally a `sacred utterance' or a collection of orally transmitted poetic hymns). Chanting *mantras* is the systematic release of phonologically matched words. The method of tying up animals' mouths is considered cruel in a way. Basically, this method is targeted to control the paddy fly, that damages the rice crops. There is a belief that by catching and trapping a fly inside a sour orange and burying it in a *wakkade* (opening in paddy field for outflow of water) as well as catching three flies from the paddy field and releasing them after chanting "Karakkeswahang", it is believed

that the presence of other flies will decrease. The science behind this is to use the unique smell of



these flies as a repellent for other flies through their communication.

If a monkey damages the crops, then one of them will be caught and either paint or soot will be applied all over its body and after placing white colour paint dots, it is released back to its herd. When this monkey returns to its gang, the other animals get scared of this strange looking animal and try to escape from the field. However, this method also involves cruelty to a certain extent, and it is doubtful whether these kinds of practices existed in a Buddhist country like Sri Lanka. Nevertheless, Sri Lanka was influenced by other cultures, and therefore we can assume that these practices might have occured. According to Sinhala culture,

> casting a spell using oil and lighting oil lamps, and using that oil was common. After sweeping the temple and the area round the Bodhi tree, they refer to the name of their farm, and light oil lamps using ghee and cast a spell 108 times with

the phrase: Namo Athththathiya bhawawathiya siddha buddhathiya iti miti eswahan (තමෙරී අත්තතිය තවටාතිය සිධ බුද්ධාතිය ඉටි මිටි ඒස්වාහං). They believe that this way they could control the paddy flies.

Yantra and Mantra methods were practiced in Kem methods. The farming communities were experts in using these yantra and Mantra in their agricultural work as well as in other day to day activities. Yantra was a type of handwritten script on a thin copper sheet. Before they write a Yantra, they pay special attention to cleanliness, which is known as *Pey weema*, which they believe may otherwise cause adverse effects from unknown sources.

For that purpose, they keep the copper sheet on a special tray with Betel leaves and recite the verse "*sabba papassa akaranam*" and hang it in the farm. How this script acts cannot be explained using existing traditional knowledge. However, it has been effective when it is done in the correct way with the so-called cleaning method '*Jeewam*'.

Sabba papassa akaranam (සබබ පාපස්ස අකරණං) for a thousand times. Then they dig the eight corners of the farmland and plant those sticks on a special day called *Divi Karana* Day. This is usually done early morning before sun rise, to protect their demarcations of the farm. The farmers believe that

this repels the pigs from entering their farms.

If rodents such as rats damage the plants, then there is a risk of attracting reptiles to the field. Among reptiles, the snake is believed to be the

most powerful. Therefore, a picture of a snake is drawn on a thin copper plate and buried at the four corners of the field early morning on a special day such as Thursday Paddy plants damaged by rats are collected to form a pot bearer. A boiling rice pot is kept on this special pot bearer and thereby rat damage is controlled. Similarly, four pieces of the bark of *Mee* tree which are peeled from top to bottom

at around 4.00 a.m. in the morning is kept under a mortar. These barks are then removed at night around 7 p.m. and taken to the paddy field. Also, milk rice prepared using the rice milled in a mortar will be offered to the god to control rat damages. It is believed that

both these methods convey a message to the gods, as rats are considered as the vehicle of gods.

Excreta of

cats, fur of cats and the latex of the *Wara* plant (milky weed) are mixed together and kept in several places along the bunds to allow rats to escape. Not only these, even anchovies are ground and mixed with coconut flakes and seeds of well ground Jaapaala seeds, to be placed along the pathways where rats walk. The flowers of *Gliricidia* and *Tuna* plant are also kept in such a way to control rats.

# Kem Methods included in Offerings

Yantra mantra are used together with other *Kem* methods in some provinces to control pest attacks and diseases in rice cultivation. By doing so, they handover the crop to

### Treatment for venom treatment

involves the heavy use of a plant known as Divi Kaduru (දිවි කදුරු). Farmers have used this plant in controlling the damage caused by pigs. Here again they use eight matured Divi kaduru sticks and do jeewam with the verse



provincial gods. A lamp will be lit up and request their protection over the crops from gods saying that we hand over the crops to gods. After harvesting, they boil milk and offer alms to the Gods in return.

If "*Godawella*" damage is severe in the paddy field, they are collected into a pot and handed over to Kataragama *Devalaya* and get the blessing from gods. The scientific background of these offerings cannot be interpreted. Nevertheless, these kinds of appeals have been practiced as *Kem* methods for a long period of time.

# Use of plant extracts and various medicine/drugs in Kem Methods

It is observable that the ancient farmers had the knowledge and understanding on the use of different plants and their chemical compounds in controlling pest attacks in agriculture. *Kathurumurunga Kema* (කතුරුමුරුංගා කෙම), *Paragedi Kema* (පරගෙඩි කෙම), *Daluk thaleema* (දලුක්තැලීම),

kukuruman kema (කුකුරුමාත් කෙම), Nawa Nilla kema (තව නිල්ල කෙම) etc. are some such practices used. Kathurumurunga

*Kema* is practiced when paddy plants are at young stage. Farmers were aware of the cause for the yellowing of rice plant leaves which is due to a worm attack. They use the extracts of the roots of *Kathurumurunga* plant, diluted with water to spray on *paddy* plants. Daluk thaleema (දලුක් තැලීම) is done again to control worm attacks. White spot disease is controlled by spreading pieces of Daluk plant fronds in the field. What happens here is the released Daluk phloem sap from the frond whichs controls the worm population.

Nawa nilla kem (තව නිල්ල කමේ) is practiced when paddy plants get

the disease called "*Ala kola rogaya* (අල ක**ාළ** රත්ගය)". For this kem method, nine bluish colour leaves, nine sugarcane sticks.

nine immature coconut leaves and a banana leaf are used. After chanting *(jeewam*), these nine leaves are placed in nine places of the paddy field. Furthermore, farmers have used fire sources using robes of Buddhist monks to attract and



reflect the insects. These techniques have had different approaches depending on the region. These methods have also been used. Not only pest attacks, but also to

control the fungal diseases, several procedures have been adopted to protect the crop. When considering paddy cultivation, there are few types of pests. However, the application of chemical pesticides causes the death of favourable insects as well. Therefore, agriculture carried out by repelling insect pests can be considered as a very scientific method.

Pest attack is found only during a definite period. Therefore, understanding of their lifestyle is important in managing the crop to avoid their attack. For instance, if breeding of paddy flies which happens during the evening of the day can be identified, then their

> population can be controlled. Paddy flies breed in the evenings. Therefore a breeding control method known as *Mande Gaseema* (මණ්ඩේ ගැසීම) has been practiced during evening. Farmers attach a hoe to a coconut leaf which moves fast

due to the wind flow. Because of the movement of the coconut leaf, it acts as a ringing bell. Echoing sound from the bell disturbs the breeding of paddy flies. In the meantime, when it becomes dark, gradually the paddy fly breeding is controlled.



Mathugama Seneviruwan Related references: Kethaka Mahima Kem Pahan. Piyasena Kahandagamage, 1995.





According to historical information agriculture in our country has been maintained in a sustainable manner for thousands of years through the "animal -crop" combined approach. The concept of "*Patipas parane*" provides further evidences for this.

### Patipas parane"

When we examine the historical information regarding the rearing of animals in Sri Lanka the concept of *Patipas parane*" has received a dominant place. We have heard of how The God Kadawara protected the Kalawewa tank. It is an annually conducted custom of the people of Nuwarakalawiya to worship and make offerings to God Kadawara. The last two stanzas of the chanting words in verse form is as follows:

### *"Patipas parane rakadennta kiyalaa kadawara dewiyanee keekan iwara kala"*

God Kadawara the request made to you in verse form to protect the *patipas parane*.

The "Patipas paraney" refers to the five young one, who were

then considered important to our nation. The five one's are the child, bull, dog, the cat and the domestic cock.

Our ancestors used the participation or involvement of all these five in agriculture for sustenance of life. The cattle provided nutrition, physical effort, energy (power) and fertilizer. The dog signaled the icily of wild animals to the home garden, to the chena and the paddy field. The cat provided safety and protection to the cereals that were stored in the households. The cock reminded of the time in the day while the hens contributed to the nutrition of the people. The child was the symbol of the uninterrupted existence of the human race. This is why the child is list first among the "patipas paraney" of the rickets the most valuable to the human is the child.

The second is the oxen /cattle. Water and forests are also included among the resources.

### Biodiversity, protection of animals and the Hela system of Agriculture

In order to fulfill agricultural requirements, our ancestors used the participation or inputs of many animals ranging from the tiny ants to the huge elephants. Reciting the rhythmic verses. "Kela elawum yathikaawa" is an example for this. This method is used for the cleaning of chena before the getting it ready for the next farming cycle. the farmer used to chant this loudly for three sessions. [morning, evening, and next morning] while going around the chena and then he sets the fire. By this loud chanting the farmers call for all living animals from the tiny ant up to



the huge elephant [ Bootave maha athithal to leave the chenas, before he set for to it. The chena cultivator knew through experience that this chena cultivation was protected not by the destruction but by protecting these animals, / life forms. The term "animal husbandry" when translated into Sinhala 'Sathwa paa lanaya' [control of animals]. Husbandry is not control but looking after. Often ancestors made this country to be the granary of the East by looking after the crop as well as the animals concerned. We can identity the (the inhabitants) of Sri Lanka as the people who used integrated farming and agricultural practices or patterns on a scientific basic ensuring the sustainability of animals and plants.

### The input and assistance of all animals in the ecosystem towards agriculture

The chena can be given aa an example where utmost use has been made of the animal crop integration. A mix of more than nine crops were grown in a chena. Therefore, the population of animal species that damaged crops was limited. Because of the mix of crops, disease control was also brought about naturally.

The rice crop [paddy field] was also protected by the helpful animal species that lived in the paddy field bunds (niyara), anthills, and trenches. The Kandiyan home gardens were also sustainable due to its biodiversity.

Our traditional agriculture practices were methods which used biodiversity to help in protecting all animals in the ecosystem.

# Protecting the domestic animals

Our society has paid special attention to safe guard and protect domestic animals for sustainability



of life. People have identified the animal diseases, treatments for the disease conditions to protect the animals. We have a long history of treating animals for their diseases. It is said that these practices extend to the time of king of Ravana. 'Sushena' who lived during that time was renowned for the medical treatment of animals. It is stated in the historical records that when Mahinda Thera visited the country there were specialist veterinarians in the group which accompanied them It appears that the indigenous medical treatment of animal is a practical system by experience that has been handed down from generation to generation. Jeevakan

> (medical practitioner) took steps to write down the facts in leaf books after testing the medical treatments.

### Medical treatments from generation to generation

I went to meet a few

indigenous traditional veterinarians in the latter part of the decade of the year 2000. I was accompanied by Mrs Bhashini Dissanayake. Given below are a few of the Veda lineages we met.

 Palleperuwa veda genaration / lineage - Lunnwatta

 ViharavaththaVeda lineage -Puhulpola

Delwmgahakotuwa veda lineageHantanangoda

- Pathanbokka veda lineage
- -Welimada



### The Disintegration of the Indigenous Vedakama (medical treatment of cattle)

The Indigenous veterinary medical system that was protected throught generations was disintegrated by the middle of 1980-1990 decade. The reason for this was that the agricultural methods introduced with the green revolution. The tractor replaced the buffalo to plough the paddy field. The fertilizer of animal origin was replaced by the fertilizer of chemical origin. The Western veterinary practices were introduced with the sponsorship of the government to replace the vedakama (medical treatment of cattle). Eventhough the government plan to keep up the Ayurveda system of medicine it is sad to say that the traditional vedakama was highly neglected.

hens and special breeds for meat types were introduced instead of the traditional breeds. Goats such as saanen and Jamnapari were introduced to replace the goats. Therefore, the farmers tend

to sell the local traditional breeds for the meat. The traditional Vedakama was abandoned with such activities. No written documents are available regarding the traditional system. Eventhough the traditional Vedakama is still with us due to the

with us due to the features which have a scientific basis.

### Reverting to the traditional medical system along with organic agriculture



The developed cattle breeds such as (Jersey, Friesian and Ayrshire were imported and distributed among the farmers. Layer type of World over the people are tending to use organic agriculture seeing the disadvantages of chemical agriculture. Antibiotics and the poisons are prohibited for the organic agriculture. Therefore, there is an increasing trend to use Ethnoveterinary by people all around the world.

Indigenom medical system for treating animal

Traditional medical system cattle diseases and therapies on have

been written down in the books and passed down the information from generation to generation. Every Veda generation has used the triplet of energies for the therapies followng



- Physical energy
- Cosmic energy
- Spiritual energy

### Physical energy

Parts of plants and different types of oil have been used for this system.

### Cosmic energy

The system of indigenous medical treatment of cattle has also considered the environmental changes that results from the paths of celestial bodies such as the sun, moon, planets and stars. When using the plant plants to obtain the "therapies" the times of the day, such as morning or evening has been taken into consideration. The growth and directions of the roots has been considered. In special instances attention also has been paid to the day, time, path of the moon, auspicious and bad time (Karanaya0 mentioned in Astrology. (That is the time laws mentioned in the astrology).

### Spiritual Energy

Given below are a few procedures/ activities related to the energy of the mind. Worshiping of the medicinal plant before obtaining a plant part from it for treatment.

- Chanting pirith
- ✤ Kem procedure

✤ Yanthra Manthra (chains and exorcison)

Ruddf Steino who is a Western philosopher has said the following regarding spiritual science.

"Matter in never without spirit spirit in never without matter"

# Identifying the various diseases of cattle

It is difficult to find a definite nomenclature (name) for each and every disease of cattle in



Figure 02: Worshipping to trees prior to obtaining plant parts (spiritual energy)

the indigenous system. In the ola leaf books and ancient texts their diseases are mainly identified as Veppan (foaming from the mouth) and Addappan (Bloating of the stomach). They are generally described in verses.

Bade purawa usmuruththawata enne Lande duwamin keema nokanne Anda manda vee duwa avidinnne Veppu Adappan in denaganne



Figure 01: Chanting for treating cattle diseases

(if the stomach is full and bloated and if the cattle does not eat, If it is confused the animal has veppn/ Adappan)

It is not possible to distinguish between veppn and Adappan, However the veda texts contain information regarding the main diseases of cattle.

### Epidermis in cattle

The most dangerous disease in cattle in our country was the epidemic hemmorrhagic septicemia. The following verse has been given in a Veda text, giving the details of the diseases. Bella mana gerawuma hata ganne Nahen katen penahalu damaminne Kammul deka hira karagena enne Wasangathaya bawa in danaganne

"If the knee in bent and the animal growls, if it is from the nose and mouth. If the chests get into or tighten, then know that the oxen have got the cattle epidemic.

### Indigenous therapies/remedies

According to the Western Medical system the cattle has to be vaccinated in order to prevent death. According to the indigenous method it is possible to prevent death of the animal if it is treated as soon as the symptoms of the diseases are recognized. Gongoradi, where the froth that oozes from the animal's mouth, when it is

bellowing and *kukuruman* are burnt together

and then mixed with canfor oil and the animal is made to drink it. Simultaneously a manthra is chanted on to animal with a brush of the *cassia fistula* tree.

### Foot and mouth disease

This is called the "*Kuru gaya*" and "*kata gaya*" (irritable feet and mouth) It is also called *Kuru Leda* and *Kate leda*. It is a disease caused by a virus. The indigenous cattle were more resistance to the disease when compared with the European breeds. Therefore, when one ox was infected the Vedagurus rubbed the saliva of the diseased animal in to the mouth of the healthy cattle of the herd and make them get diseased at the same time and therby get them cured/or immunized. In order to prevent secondary infection by the entry of germs through the wounds in the foot, they tied the cattle in mud for a period of 1-2 days. The oxen is tied in the mud to which equal portion of banks of *syzygium assimile, terminalis arjuna* and *pongamina oinnata* (damba .kumbuk and karada) are mixed in.

In order to prevent the wounds in mouth becoming acute, potassium Aluminium sulphate(sennakkkaram) is spread on a piece of a pineapple plant and the throat of the ox is cleaned by rubbing with the piece of stem.

# Other therapies/Medical treatment

A special feature of the indigenous therapies for animal is that the adverse side effects are minimal. The reason is that parts of the palnts with medicinal properties are used for the treatment. (Listed below are a few of the plants that are widely used in Sri Lanka for the medicinal treatments.

- 1. Nika (Vitex negundo L.)
- 2. Ankendaa (Acronychia pedunculata)
- 3. Lime (Citrus aurantifolia Christm')

4. Lime (Cinnamomum zeylunicum Blume)

- 5. Kohomba (Azadirachta andica A.)
- 6. Ginger (Zingiber officinzle Roscoe)
- 7. Garlic (Allium sativum L.)
- 8. Mee (Madhuca longifolia L.)
- 9. Goraka (Garcinia quaesita Pierre)
- 10. Kaha (curcuma longa L.)
- 11. Wadakaha (Acorus calamus L.)
- 12. Coconut (Cocos nucifera L.)
- 13. Karanda (Pongamia pinnata L.)
- 14. Diyalunu (Sodium chloride)
- 15. Karapincha (Murraya koenigii L')
- 16. Murunga (Moringa oleifera Lam.)

 Koththamalli (Coriandrum Setivum L.)
 Pawatta (Adathoda vacica)
 Aralu (Terminalia chebula Retz.)
 Bulu (Terminalia bellirica)
 Black pepper (Piper nigrum L.)
 Diwi kanduru (Pagiantha dichotoma)
 Undupiyaliya (Desmodium triflorum L.)

### Maha gavaraja guliya

13 types of medicines are obtained (kalada) and blended with pepper juice and prepared as guli and then dried in shelter. This will be used for the cattle for the treatment of veppu and addappan with a combination of the juice of "Nika".



24. Kubuk (Terminalia arjuna)
25. Kapparawalliya (Plectranthus amboinicus)
26. Aththana (Datura metel L)
27. karabu nati (Syzygium aromaticum L)
28. kahata (Careya orborea Roxb)
29. kansa (Cannabis sativa L)
30. rice (Oriza sutiva)

There are differences in the quantities of the different medicines used for the different treatments based on the specific type of disease. They are identified with different measurements such as"*mitak*", "*Pathak*", *doothak*, "*kaladak*". The different methods used are grinding, squeezing, using as a liquid, making guli types, applying on the body.

# Formulation of medicines in the indigenous medical system

In the indigenous system there is limited evidence to shon the preserving of medicines. The medicines are produced as a ready to use items. Eventhough there are few examples for the different types of medicines which are used as preserved types.

### Diviya wurthikawa

This is used to treat the stomach aliments of oxen. The immature betal leaves and nine other ingredients are ground with the juice of ginger, and pellets about the size of "anoda" seeds are prepared. Then the pellets are dissolved in "*kapparawalliya* leaves or *maduruthala* leaves and used as a medicine.

### Meniswadii oil

This oil is used for the treatment of all types of diseases. There are different types of prepared "guli" for the treatment of diarrhea and worm infections in the alimentary tract.

### Yanthra pilissum

The burning/ tattoos of the "*nila sthans*" as in acupanture, is a special treatment. Pointed needles made of iron are used for this purpose. They are called "*Kurikatu*". The needles are also used in branding identification marks on the animal. It is important to identify the exact position and applying the correct

burning method. It is performed for the quick healing of the animal.

As an example, if the stomach of the ruminant is bloated/puffed and the animal lies on the ground for a long period of time, it can cause the subsequent death of the animal due to breating difficulties. Such an animal is first given a suitable medication to induce diarrhea, and the then burning method is applied

for the stomach area. With that compression the cattle is facilitated get up, That will facilitate the survival of the animal. Many of the vetarinary physicians believe that this method is a "*kem method*"

### Kem methods

These are very interesting practices applied for the treatment of diseases.

### Ken gediya

Equal portions of five types of medicines are ground and made in to the shape of a ball. It is wrapped in a peeled bark of a plant. Then it is hung round the neck of the ox with injured limbs. This pouch is called the "Kengediya". When this ball of medicine dries up, the animal; recovers simultaneously. The medicines used to make this kengediya are kept a secret. The ingredients are known only by the veda guru of the specific lineage. The medicines are taken from specific trees only after performing "nava wadum" which is done with great respect. The vedaguru does not speak until the medication is prepared and the

bundle is hung round the neck of the animal. With that the spiritual power is applied.

# Burning chanted musterd seeds in the fire

If a wound in the ox is infected with worms the owner of the ox informs the veda guru. The vedaguru chants the seven fists of mustard seeds and give it to owner.



After receiving the mustard seeds the owner should not speak until the mustard is fire lit. The farmers have experienced that when the mustard is burnt in the fire the worms in the wounds of the ox falls off.

Some vedagurus use both mustard and ash for the treatments. First the mustard is chant and the ash is applied on the wound.

It is now the time to revisit and research to determine the scientific basis of the traditional/indigenous medical system of treating animals. The sustainability of Agriculture

in Sri Lanka is dependant on an

also uses the ancient experiences.

integrated agricultural system which

Wijerathna Dutuwewa Former Senior Farm Manager, Livestock Development Division, Mahaweli Authority, Sri Lanka



Traditional Agro-Post-Harvest Methods for Achieving Food Security Prof. Sanjeewnie Ginigaddara



"Sabbe Saththa Aharaththika" - All animals depend upon food. Food is not only what we eat; it is also a combination of customs, cultures, and the effort and dedication of several individuals engaged in the process from farm to fork. In addition to satisfying their hunger, ancient Sri Lankans utilized food to express their thoughts and feelings with one another. They worked with utmost care in food production, from cooking, to consumption, to proper storage and preservation of excess food, because they respected food.

Currently, there is a food crisis. Even though enough food is produced to feed everyone on the planet, around 811 million people still experience hunger every day, according to data on world hunger. According to study papers, one-third of the food produced is wasted, and the World Food and Agriculture Organization claims that most of the world's population has developed a practice of wasting food. Food waste results from internal problems like physical rotting and external problems like mechanical damage and crop illnesses. A lot of food

is wasted when it is improperly stored, transported, and packed, as well as when it is consumed at home. Food wastage is not only quantitative but also significantly affects their qualitative parameters as well. According to some research studies, post-harvest, and food processing account for more than 40% of food losses in developing nations, whereas marketing and consumption account for more than 40% of food losses in industrialized countries. Additionally,

post-harvest losses of perishable fruits, vegetables, etc., are thought to be between 30 and 40 percent in developing countries.

The term "post-harvest technology" refers to a set of procedures for preparing agricultural products to meet the dietary needs of the consumer population. These procedures include preservation, processing, packaging, distribution, marketing, and also the use guarantying the safety of the products after harvesting. We can understand how well thought out and organized it was when we consider the post-harvest technologies and knowledge of food storage and preservation used by the Sri Lankan of the past. There are several conventional approaches to food preservation and storage. They all have a significant position for techniques like drying, salting, adding sugar



or honey, and pickling. In addition to using various techniques for food production, handling, packing, storage, and subsequent consumption, Sri Lankans had demonstrated the capacity to adapt and apply these techniques in accordance with various agroclimatic conditions. is noteworthy that all these details have been applied in antiquated food preservation techniques. They did not learn this information through laboratory studies; instead, they learned them through their experiences and a body of knowledge that they inherited



Traditional post-harvest and storage techniques were preferable because they prevented postharvest damages, and used the surplus effectively, kept them for off-season use, improved food nutrition, which were passed down through traditional knowledge from generation to generation, reduceing production costs, guarantying health, preserving quality by avoiding contamination with harmful preservatives, and enhancing flavor and appearance.

The post-harvest methods which Sri Lankans employed in the past were simple, practical, financially viable, and based on indigenous knowledge. The primary foundation for ancient food preservation was precisely to prevent food spoilage and destruction, and to provide food security during times of food scarcity. Temperature control, oxygen control, moisture management, and pH value control were the key factors taken into account when preserving food. It through tradition.

These days, dried fruits and vegetables are also popular, and have even been used commercially. Although this is nothing new in Sri Lanka, drying food was formerly a common method of food preservation. Being a country close to the equator, the ancients used the year-round sunlight to dry fruits, vegetables, mushrooms, to different kinds of meat and fish. Given the technology at the time, consideration was given to the types of wood used for smoking and the quantity of sunshine received during sun-drying of items. Even at present, one of the common plant-based meals in Sri Lanka are breadfruit and jackfruit. We have seen how much of vield go waste when jackfruit and breadfruit trees begin to produce fruits. However, the ancients preserved them for off-season consumption by drying jackfruits and breadfruits to a proper degree, and in boiling and drying jackfruit seeds, fleshy jackfruit pods, and breadfruits to produce atukos, etc.

This association lowers the moisture content of the product and during the process of salt preservation, which also impairs the food's microbiological activity. From personal experience, our elders were aware that water could be removed from meals through the process of concentration. They carefully prepared and kept salted lime and dried fish, dry fruits, salted



and fish. We can see how much a single approach has been varied by applying techniques like salting and drying fish and transforming it into a flavor-enhancing dish. Furthermore, smoking was applied mangoes, and other salted foods. These goods were used to pique appetites and were consumed during times of food shortage.

Our ancients

were well-versed in the process of preserving food by burying in the sand. By burying them in the sand throughout the growing season, they preserved potatoes, limes, turmeric, ginger, Ceylon breadfruit,

jackfruits, wild breadfruit, and other foods for later use. Methods like soaking fruits and meat in honey might explain how ancient Sri Lankans were able to preserve food using locally accessible ingredients. Food was preserved by immersing in high sugar solutions, and not only in honey. Some of the aforesaid methods were used to preserve the excess oil cake (Kawum) made during the New Year times. Pickling is a method that can help us recognize their knowledge of food preservation as well as their capacity to use a mixture of methods to preserve certain foods.

Benefits of post-harvest work and food preservation processes can be achieved only through systematic food storage. Sri Lankans have incredibly sophisticated storage systems that could be utilized continuously for many years. The staple food consumed by Sri Lankans was rice. After the harvest, haystacks would overflow. signifying prosperity. In terms of storage techniques, Atuwa, and Vee Bissa, emerged as a standout in the storage of grains. The grains could be kept in those storage systems for extended periods without suffering damage because of the scientific techniques employed to develop them. Additionally, grains might be well stored using techniques like Varuwa, Kuruniya, Pasa, and Veniya. The well-dried grains are kept in these storage containers until moisture is eliminated after they have been carefully cleaned and reformed, especially to remove the cracks, etc. Additionally, it is

important to carefully evaluate the raw materials used to construct the storage units while building these warehouses, safeguarding the grains from insect threats, determining

how much water the grains should contain, and ensuring enough ventilation. The warehouses were continuously maintained, cleaned, and inspected even when grain was stored inside.

Most preserved items were kept in sanitary clay pots that were

properly covered. Since no chemical reactions occur in this situation, the meal can be utilized again without causing poisoning. Smoking was another organized method employed at the time to store and preserve extra produce. Therefore, it was effective in preserving both long-term food storage and food for daily use. The compound in the smoke that the stove produces regulate the microbial activity and keeps the food from becoming



rotten. When potatoes, meat, fish, vegetables, chilies, and other foods needed to be preserved in the past, they were stored in smoke. Food was stored in well-ventilated



packets made out of Areca leaves (*kolapat*), hemp, coconut leaves, and palm leaves.

The ancient Sri Lankans got engaged in carefully and cleanly preparing meals. Through this they ensured the prepared food remained in high quality, did not degrade before it was ready for consumption. Our ancients respected food. They took up such precautions while

> preparing and storing food with enthusiasm. So, only the necessary amount of food was consumed. And even wellknown travelers like Robert Knox have acknowledged in their books that Sri Lankans are among the most hospitable people in the world. In the past, Sri Lankans were eager to share prepared or uncooked food with the poor and needy and also with their neighbours, family, and acquaintances. As a result, everyone's nutritional value got improved. The beauty of this idea is how it reflects on our principles in sharing

food with others, and how we care about their needs for nutrition and hunger. Additionally, Sri Lankans in the past not only made excellent, high-quality cuisine, but also gave significant consideration to the tastes and health of those eating it. It is obvious that preventing

food waste is beneficial. Food safety and nutritional value were improved using all these techniques. Additionally, the flavor combination may have impacted the development of appetite. This is also unique because anybody who understands the technology may create and utilize it in times of shortage. After all, it is simple to create and inexpensive to make.

The world has technologically evolved nowadays while Sri Lanka's agriculture is also getting advanced. No matter how developed the world gets, it will

not be sustainable if the positive qualities vanish. Most food items in the market today have been created by expanding local post-harvest management techniques. However, we can still produce better food locally and commercially by employing conventional postharvest technologies and food preservation techniques. Everyone has a duty to minimize food waste at home on a household level. It is crucial to recognize surplus, save it at the family level using the proper methods, and use it when appropriate. Additionally, it is essential to storing them correctly and according to the proper

procedures. When purchasing food, even at the market, it is crucial to consider the residents' and patrons' requirements and preferences. The most outstanding quality foods should be distributed when the surplus is shared with others. If not, there will be more waste. Even



as food is being prepared, food waste may be avoided by preparing them in the right proportions to maintain both the flavor and nutritional content. According to current data on food storage, food waste is caused by negligence and ignorance in domestic food storage practices, poor storage conditions, and improper management in largescale warehouses. The quality of food products rapidly deteriorates when they are stored in dirty containers, use of previously stored containers without cleaning and, use of damaged containers. But it is evident that the ancients created systematic storage using more

sophisticated techniques. In today's hectic world, it is nearly hard to dedicate time to conventional food preservation methods. But suppose we use current technology in agricultural value chains properly and combine traditional post-harvest and storage expertise to the greatest extent. In that case, we may be able to come up with novel solutions to the food waste problem. Here, it is important to provide the generation with fresh ideas with the necessary backing to be put into practice. Additionally, people must understand that reducing food waste is their duty. I want to emphasize that we shouldn't be afraid to move forward using lessons from the past without losing sight of our unique values.



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# What have you learnt from the Vidurava 2022 July - September Q<sub>3</sub> Issue? Scan your

### own memory!

#### 1] Science behind the Traditional Agriculture

#### True or False?

1. Chena is regarded as the oldest form of cultivation in Sri Lanka, extending as far back as 5000 years in Sri Lankan history.

2. The advent of iron technology in Sri Lanka around 1000 BC was witnessed to this ascendance of man.

3. Identification of a suitable land for chena cultivation, selection of crops, sharing of the land block among the group, time of cultivation, crop management, protection and all any other activities taking place in chena were not based on sound scientific reasons.

4. Many agricultural practices found among rural communities in the past had aimed at increasing the losses and failures of crop due to climate, wildlife and other natural disasters.

5. Paddy cultivation under rain-fed conditions or with supplementary irrigation water from reservoirs of varying sizes evolved to become a sustainable farming practice in the dry and intermediate zones of Sri Lanka.

#### 2] Science Behind the Traditional Weather Forecasting

#### True or False?

1. Agriculture is an important sector in the Sri Lankan economy, which contributes to nearly 8 percent of the Gross Domestic Product (GDP)

2. Most farmers in Sri Lanka, especially the paddy farmers do not use techniques and methods inherited from their ancestors.

3. Farmer predictions can be seen in different stages of the cultivation process, such as on set intensity and duration of rain fall, wind speed and wind direction, temperature, humidity etc.

4. Farmers use appearances of budding and flowering in trees, especially in indigenous trees such as more and wood apple trees for weather forecasting and climate prediction.

5. Traditional lunar-based calendars are not important in the structuring of traditional agricultural practices.

### 3] An Investigation of Indigenous Knowledge in Pest Control

#### True or False?

1. When insect pests are attracted to a crop, they are controlled using Kem Methods.

2. According to Sinhala culture, cast a spell using oil and lighting oil lamps, and using that oil was uncommon.

3. The farming communities were experts in using these yantra and Mantra in their agricultural work as well as in other day to day activities.

4. When this monkey returns to its gang, the other animals get scared of this strange looking animal and try to escape from the field.

5. The method of tying up animals' mouths was not considered cruel in a way.

### 4] Traditional methods of tending to animals and special medical therapies

#### True or False?

1. When the historical information regarding the rearing of animals in Sri Lanka is examined, the concept of Patipas parane" had received a dominant place.

2. The chena is an example where the worst use had been made of animal crop integration.

3. Jeevakan the medical practitioner took steps to write down the information in Ola Leaf books after testing the medical treatments.

4. The Western veterinary practices were introduced without the sponsorship of the government to replace the vedakama (medical treatment of Cattle).

5. According to the indigenous method it is possible to prevent the death of the animal if it is treated as soon as the symptoms of the disease are recognized.

### 5] Traditional Agro-Post-Harvest Methods for Achieving Food Security

#### True or False?

1. Food waste results from internal problems like physical rotting and external problems like mechanical damage and crop illnesses.

2. The term "post-harvest technology" refers to a set of procedures for preparing agricultural products to meet the dietary needs of the consumer population.

3. The post-harvest methods which Sri Lankans employed in the past were simple, practical, financially viable, and based on indigenous knowledge.

4. Our ancients were well-versed in the process of preserving food by burying in the sand.

5. No matter how developed the world gets, it will not be sustainable if the positive qualities do not vanish.

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#### **Answers**



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