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BIODYNAMIC AGRICULTURE AND TRADITIONAL FARMING PRACTICES IN SRI LANKA: A study of the potential of biodynamic agriculture for alleviating current agricultural problems

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ABSTRACT

This report is based on work carried out while the writer was the holder of a Commonwealth Research Fellowship based in the School of Geography at the University of Leeds, UK from March to December 1995.

The aim of the work was to investigate the philosophy and methods of biodynamic agriculture and to explore the extent to which these principles could be applied in the context of indigenous farming in Sri Lanka. The purpose of such application would be to enhance the knowledge base and income generating capacity of farmers who are largely outside the commercial sector.

The report concludes that although there are many ways in which biodynamics could fit into the pattern of rural community life, there are nevertheless significant constraints which would have to be overcome.

(1) INTRODUCTION

1.1 Background: Sri Lanka is an island of 65,600 square km which lies between 6 and 8 degrees north latitude about 40 km south-east of southern India across the Palk Strait. It has a population of 17 million with agriculture the most important sector of the economy. While the export-oriented sector of agriculture produces tea, rubber and coconuts, small farmers in the subsistence sector focus on the cultivation of rice and other subsidiary crops. The island is geographically divided into two regions; the Wet Zone and the Dry Zone. While the Wet Zone, which covers the south - west quarter of the island, receives rains almost throughout the year, the Dry Zone, which covers the rest of the island, is characterised by its long dry season and high annual rainfall variability. Agriculture plays a very important role in the national economy, contributing 21 percent of the gross domestic production and 42 percent of employment (CBSL, 1995).Therefore, improvement of agriculture is synonymous with national development and will promote the quality of living of the people. Most development projects which have so far been made have been aimed at promoting the food producing agricultural sector. Under these projects, massive investment has been made in terms of capital and technology in order to bring more land under crops and to increase farm productivity.

Though the use of modern technologies in agriculture has to some extent contributed to increasing farm productivity, the increased cost of farm inputs has absorbed a considerable share of farm income, reducing the net income of farmers. Hence, increased farm productivity has failed to alleviate poverty. Furthermore, clearing forest for the expansion of land under crops and the heavy use of chemical inputs has led to environmental degradation, threatening ecological sustainability. Introduction of modern technology has also brought social and cultural changes which have had negative impacts on equity and social harmony (CEA, 1988). Having witnessed the failure of the conventional approach over the last 3-4 decades, attention is now being focused on alternative approaches. In our search for alternatives, the experience of other countries suggests that it would be worthwhile to consider the suitability of organic farming methods, and in particular, a type of organic farming which is practised in both temperate and tropical parts of the world - biodynamics. However, since it has developed in Europe in a background largely different from that of Sri Lanka, before introducing biodynamics to Sri Lanka, it would be advisable to examine similarities and differences between biodynamic agriculture and traditional Sri Lankan agriculture. Such a study will help formulate strategies that should be adopted in introducing biodynamic agriculture to Sri Lanka. That is the purpose of the present study.

1.2 Objectives:
The specific objectives of the study were:

1. To identify similarities and differences between biodynamic agriculture and traditional farming practices in Sri Lanka

2. To identify the potentials of biodynamic agriculture to alleviate the present agricultural problems in Sri Lanka

3. To identify strategies that should be adopted in introducing biodynamic agriculture to Sri Lanka

1.3 Methodology: This study is based on the author's field experience in Sri Lanka, an extensive literature review, and personal travel and communication with a number of biodynamic farmers and practitioners in the United Kingdom.

(2) BIODYNAMIC AGRICULTURE: CHARACTERISTICS AND POTENTIALS

2.1 A Brief History of Biodynamic Agriculture: During the later part of the 19th century, it was noticed that the soil fertility of the farms in western and central Europe which had been farmed over centuries was on the decline. Science at the time failed to find reasons for this. It was with the rise of agricultural chemistry pioneered by Justus von Liebig (1803-73) that chemical fertilisers became popular among farmers as an easy method for maintaining soil fertility. Then the First World War broke out in Europe and wartime technology had discovered a method of making explosives with nitrogen extracted from the atmosphere, and after the war these methods were adapted for the foundation of agricultural development. In the same way, the technology for producing poisonous gases could be used to produce pesticides. These chemicals, were welcomed by farmers to enhance farm productivity.

However, with the excessive use of chemicals in farming, some farmers became concerned about the deteriorating environment and food quality, and this gave rise to organic movements in Europe. It was during this period that Rudolf Steiner (1861-1925), an Austrian scientist and philosopher, pointed out the incompleteness of natural science. Having been inspired by Goethe's writings, he introduced a 'spiritual science' which he called anthroposophy ,which bridged the gap between nature and the spirit. He pointed out that natural science did not explain the whole nature but only the physical aspect. He was aware that behind the physical aspects of nature there is a spiritual counterpart, which could be 'seen' and 'heard' but not with physical senses. His vision allowed him to see the spiritual World but there were very few to share his experience. Those who were interested came to him for inspirations and new ideas.

In 1922-23, a group of farmers and land owners went to ask Rudolf Steiner's advice about the increasing degeneration they had noticed in seed-strains and in many cultivated plants. They sought new insights for healthy farming aimed at the future. For their benefits, in June 1924, Rudolf Steiner delivered a series of 8 lectures to about a hundred farmers on the

Koberwitz estate near Breslau, which was then in the eastern part of Germany. This lecture series, now known as the 'Agriculture Course', laid down the concepts which were to form the basis of biodynamic agriculture. Steiner indicated that the spiritual and scientific ideas given in the course did not in themselves constitute a practical method of farming. Therefore, in order to implement these ideas and evaluate them, an 'Experimental Circle' was formed. The Experimental Circle was affiliated to the faculty of science at the Goetheanum, the academy of Anthroposophy established by Rudolf Steiner, at Dornach in Switzerland. After the death of Rudolf Steiner in 1925, the Experimental Circle went to undertake experiments and provide evidence to demonstrate what was taught in the Agriculture Course.

In the meantime, attempts were made to put biodynamic agriculture into practice and to introduce it to other countries. However, the biodynamic movement in Europe faced a severe setback during the second world war, and when the war ended in 1945, there was virtually nothing left of the biodynamic movement. After the war new initiatives were taken to revive it. Once again biodynamic associations were re-established and were formed in many other countries including USA, Canada, New Zealand and Australia. Each is involved in a wide range of activities such as research, advisory services, and training programmes aimed at furthering biodynamic agriculture.

2.2 Biodynamic Farming Practices: A Review: Organic farming is fundamentally different from conventional farming. The main objective of conventional farming is to maximise profit and this is usually achieved by using capital intensive methods. In this case, little attention is paid to the natural balance in nature. On the other hand, organic farmers work in a way that is environmentally friendly. They attempt to run successful enterprises within nature's limits. They rely on natural processes leading to regeneration of soil fertility and take action to strengthen these processes by applying organic manure and employing natural methods of pest and weed control. Biodynamic farming is a further step beyond organic farming, and is distinctive on account of its underlying spiritual philosophy. As Schilthuis, (1994) points out, biodynamic farmers work on the basis of understanding that every living being has a link with the spiritual cosmic world, and it is the duty of human beings to guide their life in such a way that these links can take place unimpeded.

In biodynamic agriculture, the Earth in its entirety is viewed as an organism. Everything within and upon the Earth is interrelated and functions as a whole. All minerals, plants, animals and human beings are influenced by the cosmic world, including the sun, the moon and stars. In contrast to conventional farming, biodynamic farming takes into account not only the nutrient substances which living organisms need but also forces, i.e. life forces and astral forces which cannot be seen by the physical eye but the physical manifestations of which are visible. According to Steiner, these cosmic forces work through substances and play an important role in living organisms. A living organism is different from a substance by its life body (etheric body). All living beings receive life forces by consuming living matter which is rich in life forces and vitality. In other words synthetic food is poor in life forces. Healthy soils full of organic matter permit plants to intake life forces, so intake of healthy fodder and food bring life forces to animals and human beings. Hence, in biodynamic farming, healthy soils, healthy plants and animals and healthy food are crucial.

While plants have only physical body and life body, animals including human beings have an additional body: an 'inner world of feeling' which is called 'astral body'. It is called astral because the forces which act on the astral body come from the world of stars and planets. Astral forces influence all substances and organisms on the Earth and therefore proper use of astral forces enhances health of plants and animals, and farm productivity. For instance, when an animal consumes green fodder, it assimilates substances and forces which are contained in fodder which the animal uses and afterwards its manure returns to the soil astrality from the animal. When the soil has manure added to it, it becomes enriched in forces. As a result, soils become able to develop their own life, to form humus and become more open to the beneficial cosmic effects. Therefore, biodynamic farming is done in such a way that astral forces can be utilised to enhance quality and to some extent the quantity of farm products too.

In biodynamic farming, the ideal is to create the farm as a self-supporting organism of which the key organs are soils, plants and animals. All these organs are closely interrelated and interdependent. In principle, one organ should not produce more than is needed by other organs, except for what is produced for human consumption. For instance, an ideal farm should not keep more animals than it could feed with its own fodder, and should not grow more crops than it could support by its own manure. An ideal biodynamic farm should be a mixed farm which would not need external inputs. Such a mixed farm could maintain a farming cycle: what livestock eat later becomes partly available in the form of manure which is returned to the soil so that the soil can produce more crops and fodder.

Biodynamics makes use of a number of unique preparations. Two of these preparations are known as the preparation 500, made with cow horn and cow dung, and the preparation 501, made with cow horn and ground quartz. While in the former case, cow horns filled with cow dung are kept buried for one winter, in the latter case, cow horns filled with ground quartz are kept buried for a summer. When being prepared for spraying, a small amount is stirred thoroughly in water for an hour. While the 500 enhances root growth and biochemical processes in the soils, the 501 encourages the process of light assimilation and the development of a strong structure in young plants, and maturation and flavour in mature plants. Application of both these preparations gives life forces and astral forces better access to the life processes in soil and plants and thereby enhances farm productivity and the quality of farm products (Schilthuis, 1994).

In contrast to conventional farming and organic farming, the effects of the whole planetary-cosmic system on plants and animals is taken into account in biodynamics. Therefore, farming is practised in such a way that maximum benefits from the planetary influence could be gained to enhance the farm productivity and the quality of farm products. For instance, sowing and planting dates and the dates for the application of biodynamic preparations are determined according to the rhythms of the moon and the planetary system. In this case, full moon and new moon and movement of the moon in relation to the signs of zodiac are taken into consideration. Each sign of the zodiac has a special relation with one of the four elements: earth, water, light/air and heat, and each element has a particular effect on plant growth. While the earth element has an effect on root formation, the water element has an effect on the formation on leaves. Light/air and heat elements have

effects on the formation of flowers and fruit/seed respectively. According to the part of the plant most needed in cultivation, e.g. roots, leaves etc. one can choose the dates for planting, sowing and working the soils for the cultivation of that particular plant.

2.3 Potentials of Biodynamic Agriculture: The experience of biodynamic farmers and results of scientific experiments provide evidence to show its potential to alleviate crucial problems faced by the farmers in the Third World. Poverty prevailing among the farmers is a common problem in the Third World. Modern inputs have increased the farm productivity, but decreased farmers' income and their access to basic needs. This is due to the expenditure on external chemical inputs which absorbs a considerable share of the farm income, reducing net revenues. Biodynamic farming, which almost exclusively relies on internal inputs is obviously a way to save the cost that farmers spend on external inputs, and therefore to promote net farm income. Schlueter (1985) has compared revenues and expenses of biodynamic and conventional farms in Germany and pointed out that biodynamic farms can produce higher profits. Furthermore, there is experimental evidence to prove the yield-increasing effect of biodynamics. Several research projects carried out in Germany and Sweden have shown that the application of biodynamic preparations increase yields in, for example, sugar beet, by 8-14 per cent and stimulate the growth of leaves by 8-26 percent (Spiess 1979, Abele 1973). Significant increases in yield of grains, root crops and vegetables have been demonstrated while the way of activating preparations before the application can also have beneficial effects on yields (Klett,1968; Pettersson,1977; Schikorr, 1994).

Furthermore, biodynamic farming requires a mixed farming system which has potential to enhance farm-level biodiversity. It is self-evident that the presence of both crops and animals on a farm and their species diversity keep the risk of crop damages caused by drought, flood, diseases and epidemics which is common in the tropical world, at a minimum level and increase the overall farm productivity. Poor keeping quality and storage loss often reduce net farm output. The potential of biodynamics for improving keeping quality of farm produce has been proved by experimental evidence. Some recent research into the physical composition of food has demonstrated that crops grown with the use of biodynamic preparations show an improved keeping quality. Samaras (1978) showed that biodynamically grown carrots were better in keeping quality than conventionally grown ones. Biodynamic treatments reduce the production of carbon dioxide, decomposition enzyme activity and the number of epiphytic bacteria, reducing losses during storage. Abele (1987) having experimented with carrots, beetroot and potatoes, has also demonstrated that biodynamically treated crops produced food with better keeping quality.

Specialisation and the market orientation in modern farming is, to a certain extent, responsible for increasing food insecurity among farming communities in the Third World. Unlike traditional style mixed farming which aimed at producing food mainly for family consumption, they now have to turn to the market for most foodstuffs. This affects household food security in two ways. On the one hand, specialisation and market orientation reduces domestic food stocks. On the other hand, the lowering net farm income reduces their purchasing power. Both situations threaten household food security. Therefore, change from conventional to biodynamic farming, which involves mixed farming, would undoubtedly enhance household food security. Furthermore, as pointed out earlier,

biodynamic methods improve the keeping quality of farm products. Improved keeping quality would also help to enhance household food security. The use of organic manures and the biodynamic preparations has been proved to be capable of enhancing the water holding capacity of soils and the root growth of plants (Abele, 1987). Pettersson and Wistinghausen (1979) found that the application of 500 and 501 improved the soil in terms of humus formation, structure of the subsoil (helped by deeper penetration of the rooting system) and microbial activities in general. All these improvements will obviously enhance the plants' resistance to drought, which frequently cause food shortage and famine in the tropical world.

It is increasingly evident that the technological improvements in farming have brought about serious environmental problems, including pollution of water, which is the source of life. The pollution of water caused by modern farming is the consequence of two main components: (1) pesticides and herbicides and (2) chemical fertilisers. The pollution resulting from the use of agrochemicals is not only excessive in surface waters but also penetrates to the ground water. Both forms of water pollution threaten human health in rural areas in the Third World where people have little access to pipe-borne water. Transition from conventional chemical farming to biodynamic farming, which rejects the use of any synthetic chemicals, would undoubtedly help to preserve the environment in general and water quality in particular. Furthermore, cessation of the use of synthetic chemicals in farming would also lead to improvement of the quality and safety of food. Biodynamic food is understandably free from harmful pesticide residues and chemical additives. People who regularly consume organic and biodynamic products are convinced that quality of biodynamic food is better than conventional farm products in terms of taste and flavour.

Biodynamic farming also has potential to promote human health. Nutritional superiority of biodynamic food over conventional food has been demonstrated by some experiments. Pettersson (1977) has compared quality of potatoes under conventional and biodynamic management, and pointed out that the biodynamically grown potatoes were richer in true protein and vitamin C content, and with superior flavour. Klett (1968) has pointed out that application of 501 (horn silica) on cereals and vegetables, increased protein qualities. Higher sugar levels in sugar beat treated with 501 was found by Abele (1973). There is evidence to indicate that organic and biodynamic food enhances immunity and thereby promotes the capacity to resist diseases. An experiment conducted with two groups of white mice, one fed with biodynamic feeds and the other with conventional feeds, has demonstrated that the animals fed with biodynamic feeds have developed a strong immunity system. Furthermore, their offspring have become stronger than their parents whereas the second generation of those which were fed with conventional feeds have become weaker (Pfeiffer, 1983). Again Tallarico (1931), who experimented with turkeys, has demonstrated similar results. Thus, there is sufficient evidence to believe that consumption of biodynamic food does enhance the immunity system in human beings. It is also believed that consumption of organic and biodynamic food reduces cancer risk (Last, 1995). These foods have been used as part of a strategy in cancer therapy.

The community based self-help system which was crucial for the functioning of traditional societies in most of the Third World countries, is increasingly disappearing with the progress of agricultural modernisation, and it has caused conflicts and disharmony in

village communities. However, biodynamic farming calls for a community self-help system. For instance, some activities which are necessary for biodynamic farming, e.g. composting, making biodynamic preparations, are more practical if they are undertaken on a self-help basis. Preparation of compost calls for exchange of straw, manure as well as labour within the community. Collection of herbal matter required for biodynamic preparations and also stirring of liquid preparations are often done communally, partly because these tasks involve a lot of manual work which single person sometimes cannot manage. Therefore, it seems that biodynamic farming has potentials to re-strengthen the traditional community based self-help system which would enhance social harmony.

(3) MANAGEMENT OF FARM RESOURCES IN TRADITIONAL SRI LANKAN AND BIODYNAMIC FARMS: A COMPARISON

3.1 Philosophy of Biodynamic Farming and Traditional Farming Systems: While traditional Sri Lankan farmers' attitude towards the environment, including the cosmic world, physical world, animal world and plant world is based on Buddhism; biodynamic farmers' attitude is based on anthroposophy which is fundamentally connected with Christianity. Both Buddhism and anthroposophy have reverence towards the cosmos and the earth, and emphasise environmentally-friendly farming systems. Both advocate the existence of spiritual beings. Traditional farmers in Sri Lanka seek the help of spiritual beings to protect their crops and animals from natural disasters. Buddhism as well as anthroposophy recommend a way of life with leads to conservation of natural resources. Use of synthetic chemicals in farming is unacceptable in both cases. In a Buddhist farming society it is unacceptable because chemicals harm living beings. Biodynamic farming is opposed to the use of synthetic chemicals since it disrupts the cyclic flow of life forces.

However, in contrast to Buddhism, anthroposophy distinguishes animals from human beings. Buddhism considers animals to have the same right as humans to survive on the earth and therefore animal husbandry for meat production is not acceptable in traditional farming society. But it *is* acceptable in biodynamic farming because anthroposophy distinguishes animals from human beings on the basis that human beings belong to a higher level of existence. According to anthroposophy, human beings are on a higher level as they have self consciousness and ego. According to Buddhism, killing animals is an evil activity. However, keeping animals for dairy, draught power and manure *is* acceptable for Buddhism and therefore it supports crop-livestock integration which is vital in biodynamic farming. The non-violent attitude of Buddhism towards animals, however, supports the non-chemical farming methods advocated in biodynamic farming. Both Buddhism and anthroposophy quite naturally encourage the integration of farming and wildlife.

3.2 The Farm: Components and Interrelationships: In biodynamic farming, the farm is considered as a self-supporting system or organism which should not require external inputs. Output of one component is often the input of another on the same farm. The same principle can be seen in traditional farming systems in Sri Lanka. But the interrelatedness is at village rather than farm level, as it in biodynamic farming. A typical traditional village consists of six major components such as the village irrigation tank, paddy tract, home gardens, shifting cultivation, livestock and fishery. Each farm family has a plot in the

village paddy tract, a block of shifting cultivation in the village forest, a home garden and a number of buffaloes or cattle. They also catch fish in the village irrigation system which is a common property. All these components are, at the village level, ecologically interrelated and function as a self-sustaining agro-ecocomplex.

Cows play a central role in both biodynamic farming and traditional farming systems in Sri Lanka. In both cases, the cow is considered as a source of milk and manure. In addition, while she is used for draught by traditional Sri Lankan farmers, cows are slaughtered for meat by biodynamic farmers. Cow manure and cow-horn are essential for some of the key biodynamic preparations. However, there is a wide contrast between the management practices of cows under the two systems. Under the traditional farming systems of Sri Lanka, the common practice is the free grazing system under which animals are allowed to move freely in search of green fodder whereas under biodynamic farming stall-feeding is common. Free-grazing system is appropriate in areas where there is no severe winter and where there are community owned jungles and grasslands. Since it does not involve hand-feeding and cleaning of stalls it saves much labour. But it does not permit accumulation of cow dung in a single spot so that the latter could be collected for composting and fertilising soils. On the other hand, stall-feeding systems allow proper management and easy collection of dung, though demanding labour (Ulluwishewa, 1989).

However, under the free grazing system, animals eat natural green fodder: grass and weeds grow in the wild, which is recommended to be given to animals under biodynamic farming. After the paddy crop is harvested, all the animals are led to the fields to feed on paddy residues. There is no practice of feeding cows with artificial foodstuffs either here or in biodynamics. Sick animals are usually treated with indigenous veterinary medicines which are made of native herbs, and animals are not de-horned. This is also identical for biodynamics. Throughout the year, animals enjoy light and fresh air in their natural habitat since they are usually kept outside. Young calves are allowed to follow the cows and are usually fed by them. Though these practices seem consistent with biodynamic principles, animals in this system are vulnerable to seasonal scarcity of fodder and water which cause a substantial weight loss during the dry season. The free grazing system can also lead to rapid spread of diseases and epidemics. By the end of the dry season when the animals become physically weak they become highly vulnerable to epidemics.

3.3 Soil Management: According to biodynamic farming, plants have a life body in addition to their physical body, and it is the vitality of the life body which brings health and strength to the physical body. Therefore, it is the prime task of biodynamics to assist plants building up a vital life body. In order to achieve this, soils must contain living substances or, at least, nutrients which have passed through a life process. It is the soils which have to be fertilised, not the plant. When soil is fertilised with living substances, e.g. organic manure and compost, soil organisms start to work in soil and consequently soils become alive, facilitating better growth of plant roots and hence, absorption of nutrients from the soil.

Biodynamic farmers must also work the soil in such a way that four elements: water, air, warmth and nutrients are maintained in the soil in appropriate proportions which is crucial for keeping the soils alive. For instance, there should be enough water in soil, but too much

water will disturb the movement of air. It is also necessary to facilitate the penetration of warmth into soils so that soil organisms can exist. Living soil permits the plants growing in it to absorb life forces from it. Application of synthetically produced chemical fertilisers adds the necessary substances but *not* the life forces since the synthetic material has not passed through life processes. Such artificially or chemically produced substances promote active growth but plants are short of vital life forces and consequently may be more susceptible to diseases. As it has been pointed out earlier, such farm products may have a good appearance but are inferior to the biodynamic farm products in terms of texture, flavour and keeping quality. Therefore, treatment of soils with organic manure from animals and compost is of vital importance in biodynamic farming.

Traditional farmers in Sri Lanka too appreciate organic soil fertility management, and they are aware of the significance of cow dung and green manure in soils. They facilitate or preserve natural processes which add organic matter to the soils rather than applying these organic substances by themselves. Some of these strategies which enhance the natural processes of the regeneration of soil fertility in paddy fields are a fallow period, growing trees on paddy fields, allowing cattle and buffaloes to roam freely on the paddy fields after harvesting, and encouraging fish into paddy fields (Ulluwishewa, 1991). The fallow period permits paddy soils to regain the nutrients that are lost during the cultivation period. During this period paddy fields are colonised by a wide range of leguminous weeds which add nitrogen to the soil. It is during the fallow period that cattle and buffaloes add their dung and urine to the soil, enhancing its fertility. It is a common practice among the traditional farmers to grow about 6 - 8 trees per acre of paddy field, mainly *Maduca longifolia* which provide seed from which a kind of oil is produced. Apart from the leaves from these trees, dung of the fruit bats using the trees to feed on fruits adds nitrogen to the paddy soils. Flooded paddy fields facilitate fish life in the paddy fields and their excretion also adds a certain amount of manure to the soil.

A further common practice occurs at the beginning of each cultivation season. The branches of trees around paddy fields, which have grown during the fallow period and which shade the paddy field, are cut down and buried. Decaying of these buried green leaves adds organic matter into the paddy soil. In the same way, when irrigation canals are de-silted at the beginning of the cultivation season, the silts taken out of canals are also added to the adjacent paddy fields, enhancing their fertility. There is evidence that in addition to the application of green manure as by-products of other farm activities, they purposely add green manure to the paddy soils. They identify various herbs which have specific favourable effects on soil when they are applied to soil as green manure. In the case of shifting cultivation, after cultivating a patch of cleared forest land over 5 - 8 years the land is left fallow until the particular piece of land is re-occupied by the forest and soil fertility is regenerated. In addition, the combination of a wide range of species and crop rotation are some of the methods which contribute to the management of soil fertility in shifting cultivation.

Composting plays a prime role in soil fertility management in biodynamic farming, and it is recommended that 6 specific biodynamic compost preparations be used in composting. These six compost preparations are made out of mainly herbal substances, i.e. yarrow

flower, camomile flower, stinging nettle, oak bark, dandelion flower and valerian flower.[1] These substances are treated in various ways, placed in specific animal organs and left under different circumstances exposed to cosmic forces over certain periods of the year. The final products are then placed in minute quantities into holes made in the compost heap. It is understood that these substances radiate the forces contained in them everywhere in the compost heap and thereby promote the activity of micro-organisms. In an experiment carried out in co-operation with an agricultural school and a government research station in Germany, preparations 502 - 507 were shown to increase the exchange capacity of organic matter in the finished compost heaps. They have also the ability to even out fluctuations in temperature in the compost heaps (Heinze and Breda, 1962). After application into soils, nutrients from biodynamic composts were released more slowly than compost without the preparations and thus the dangers of over manuring were reduced.

3.4 Pest and Weed Control: Biodynamic farmers as well as traditional farmers in Sri Lanka, do not rely on conventional chemical methods of pest and weed control. Both believe and know through experience that if crops and soils are healthy, pests are less active and easier to control. They point out that serious pest problems nowadays are mainly a product of conventional chemical agriculture. Wide use of hybrid seeds, and the chemical treatment of soils, have interrupted the natural processes which keep the pest population at a controllable level. This has also reduced the vitality of plants which should enable them to resist the attacks of pests. Both traditional Sri Lankan farmers and biodynamic farmers mostly rely on natural processes for pest control. For instance, both encourage the existence of natural enemies of pests in and around the farm. While the former use various herbal preparations to control pests, the latter use a combination of cutural and unique burnt substances to discourage the pest population. In addition, traditional Sri Lankan farmers use various mechanical methods, e.g. light traps, and setting devices which generate frightening noise etc. In the case of both type of farmers, pest control is done by environmentally friendly methods (Ulluwishewa, 1993).

The biodynamic treatments recommended for both pest and weed control are based on the same principle. The Earth by itself can only support growth processes in plants and animals. For reproduction, organisms need support from cosmic forces, e.g. lunar forces, forces coming from the planets or from fixed stars. The influence of the cosmic forces thus raise the normal growth processes in plants and animals to the level of reproduction, i.e. seed formation of plants and fertility of animals. The cosmic forces received by plants and animals are enclosed within themselves, and these forces generate positive effects on their reproduction. When either seeds or animals are burned at a time they are saturated with the cosmic forces, it creates exactly the opposite reaction: destruction of the formation of seeds and the fertility of animals. Based on this principle, Rudolf Steiner suggested that the seeds of the weed or the animal pest in question be burned when they are saturated with favourable cosmic forces, and the remaining ash diluted in water be spread on the farm and its surrounding in order to get rid of the weed or the pest in question. He pointed out that correct timing for burning is very crucial for this activity. According to him, in the case

[1] Each preparation is identified by code numbers: 502: Yarrow flower; 503: Chamomile flower; 504: Stinging Nettle; 505: Oak bark and 506: Dandelion flowers

of higher animal pests e.g. field mice the best time is when Venus is in Scorpio, and in the case of lower animal pests, e.g. insects, the best period is when the Sun is in Taurus.

Again, with regard to plant diseases, biodynamic farming suggests using special herb teas. Rudolf Steiner distinguished plant diseases from the diseases of animals and humans. In the case of the latter, diseases occur when the astral body exerts too much on any organ or the whole life body. Plants, have no astral body, and get diseases due to certain external influences. For instance, plants get fungus diseases when they are subject to an excess of lunar forces (wetness). It is the lunar forces, which act through the medium of water, which help plants in seed formation. However, if the soil remains too wet over a prolonged period lunar forces become too active and it arrests the flow of cosmic forces up to the seed formation zone. This facilitates the growth of fungi, giving rise to fungal diseases. Therefore, the practical way to control this disease is to remove the excessive lunar forces from the soil by reducing the mediatory capacity of water. According to Rudolf Steiner, this could be achieved by spraying a fairly concentrated tea of *Equisetum arvense* in the affected field. Then, water does not absorb the excess lunar influence and the disease is brought under control.

Somewhat similar to biodynamic practices of pest control, traditional farmers in Sri Lanka make use of the lunar calendar in order to protect their crops from pest attacks. According to the accepted tradition, while planting and sowing should be done on the day after the full moon, harvesting should be done during the new moon days. Both of these traditions are aimed at combating pests. The logic behind this tradition is that insects become more active when the moon waxes, and become less active or inactive when the moon wanes. When seeds are planted or sown just after the full moon when the moon begins to wane, insects begin to be less active, and therefore the planted or sown seeds are less likely to be damaged by the insects. In the same way, it is on full moon days that the harvest is likely to be damaged by the insects. Therefore, possible loss of harvest by insects could be reduced by harvesting on new moon days before the insects begin to be active. Depending on the time required for the growth of the crop in question, the farmers determine the planting/sowing days in such a way that the days of harvesting fall in the waning period. In addition, traditional farmers perform rituals and religious practices in order to protect their crops from pests.

(4) FARMING AND PLANETS: A Comparison of the Use of Astrology in Traditional Farming in Sri Lanka and Biodynamic Farming

4.1 Cosmic Influence on Farming: Biodynamic farmers as well as traditional farmers in Sri Lanka believe in cosmic influence on farming. In both cases, when dates for farm activities are determined, cosmic influence is taken into account. However, in Sri Lanka such practices are more or less confined to the lunar phases whereas they are far more widely rooted in biodynamic farming. Biodynamic farmers consider the whole cosmos as an single entity, of which all components, e.g. planets and stars (groups of stars: constellations) , are related to each other by cosmic forces that each component radiates. The cosmic forces are important for the life on the earth because they are associated with

basic elements such as water, warmth, air/light and earth (solidity), which form the life. The element with which any planet or constellation is associated is as follows:

Constellation	Element	Planet
Ram, Lion, Archer	Warmth/Fire	Saturn, Mercury, Pluto
Bull, Virgin, Goat	Earth	Sun, Earth, Ringall (M Thun)
Twins, Scales, Waterman	Air/Light	Jupiter, Venus, Uranus
Crab, Scorpion, Fishes	Water	Mars, Moon, Neptune

The type of cosmic forces that the earth receives at any given moment is determined by the position of the earth in relation to other planets and constellations. In this case, the position of the moon is particularly important because the moon radiates not only its own forces but also the forces that it collects from the constellation standing behind it. For instance, when the moon appears in Ram it radiates the warmth element towards the earth.

4.2 Moon and Farming: In Sri Lanka, as pointed out already, farmers' belief in lunar influence on crops is almost exclusively based on the synodic revolution of the moon (moon's phases: waxing and waning) which is totally dependent upon the moon's connection with the Sun's illumination. In biodynamic farming, in addition to the moon's phases, its position in relation to constellations (based on the sidereal revolution of the moon and including ascending and descending moon, perigee and apogee) is also taken into account. The high significance assigned to the lunar phases by Sri Lankan traditional farmers might be due to: (1) religious significance of the moon's phases and (2) its location in tropics. In Sri Lanka, as a predominantly Buddhist country, full moon, new moon and both quarter-moon days are considered as holy days (four *poya* days) on which the farmers ought not to work[2]. On *poya* days they are supposed to be involved in religious activities. Hence, *poya* days cause some kind of breaking points in the farming calendar, giving high significance to the moon's phases. On the other hand, being a tropical country, ascending and descending of the moon is not so evident as it is in the temperate zone.

In the traditional farming society of Sri Lanka as well as in biodynamic agriculture, planting is recommended during the full moon. For planting and transplanting, one day after the full moon is recommended in Sri Lanka whereas one to two days before the full moon is recommended in the biodynamic agriculture. Suitability of full moon for planting and transplanting has been mentioned by Rudolf Steiner (1923) and subsequently proved by experimental evidence by Kolisko (1982). Rudolf Steiner has stated that `the rays of the moon are reflected Sun-rays, but the Moon has imbued them with its own forces, and so they strike the earth as lunar forces. It is these lunar forces which enhance growth to reproduction. For a given location on Earth, all this is available only at full moon. At new moon, that area does not receive the benefit of the lunar influences'. He further states that we could achieve significant results if already at planting time, for instance, we were to

[2] Most important events of Buddha's life has taken place on poya days. For instance, His birth, enlightenment and death have taken place on full moon days of May (Vesak: according to the traditional calendar)

utilise the Moon to support early germination, if we were to sow according to the phase of the Moon as people in India did well into the nineteenth century'.

Lunar influence on plant growth has been explained by Leavons (1972) in terms of three factors: (1) lunar gravity (lunar tide) which is greatest at full and new moon, (2) earth's gravity which correspondingly increases when lunar gravity decreases and (3) moon light which increases from new moon to full moon. If seeds are planted at full moon or new moon when lunar gravity is at its maximum, the lunar gravity which exerts on the water in the seed, swells the seed and bursts the seed coat, accelerating the germinating process. On the other hand, on quarter-moon days, when the lunar gravity is least and therefore the Earth's gravity is greatest, root growth is enhanced. As the moon light increases from new moon to full moon, leaf growth is enhanced, and again it begins to decline after the full moon. Therefore, during the first seven days after new moon, as lunar gravity decreases (with corresponding relative increase in the earth's gravity) and moon light increases, plants undergo a period of balanced growth: increased root growth due to increasing Earth's gravity and increased leaf growth due to increasing moon light.

During the second seven days, lunar gravity begins to increase, the Earth's gravity begins to decline, and the moon light increases. Therefore, this period is characterised by germination of the seeds (which have not yet germinated) due to increasing lunar gravity, and stimulated leaf growth due to increasing moon light. During the third seven days, from full moon to the second quarter-moon, both moon light and lunar gravity begin to decrease, which slows down leaf growth but enhances root growth due to the relative increase in the Earth's gravity. This period is recommended for transplanting, since root growth is active. Again, during the last seven days, from second quarter moon to new moon, lunar gravity increases, and due to the corresponding relative decline in Earth's gravity, root growth slows down. The moon light also decreases and slows down leaf growth. Therefore, this period is considered as a 'rest period' which comes before the bursting forth of the period of new life.

As mentioned before, it is recommended in biodynamic agriculture to take advantage of lunar phases for weed and pest control. Somewhat parallel to this, Sri Lankan farmers who practise shifting cultivation, take the advantage of lunar phases to protect their crops and themselves from wild animals. While strong fences are erected around the farms in order to protect the crops from trespassing wild animals and roaming cattle, sturdy farm-lodges[3] are built up above the ground, often on strong trees, to protect themselves from dangerous animals. Dates for the commencement of work on erection of fence and construction of farm-lodge are traditionally determined according to *karana* which are based on lunar phases. According to the astrology of traditional farmers, there are seven *karana* which are known by the name of seven animals: Lion, Pig, Elephant, Cock, Tiger, Goat and Bull. The 28 days of the lunar month are divided into seven groups of *karana* as follows, with each *karana* having four days, 2 days during the waning moon and 2 days during the waxing moon.

[3] A tree-house for observation of predators

Community participation is, to some extent, a pre-requisite for success of organic and biodynamic farming. This is particularly true in the case of biodynamic farming, because making biodynamic preparations is more feasible if that is undertaken communally. Though such community based activities were common in the past, they are rapidly disappearing in the modern society in which competition is more important than co-operation. Hence, organic/biodynamic farming would be constrained in the modern farming society.

5.1.4 Technical Constraints

Ever since the indigenous farming systems were replaced by conventional farming, farmers have been relying on purchased highbred seeds which are responsive to chemical inputs. Indigenous seed varieties have been virtually neglected, and no attempts have been made to preserve local varieties. Consequently indigenous varieties which yield without the support of chemical inputs are now hardly available. Therefore, shortage of appropriate seeds would impede attempts being made to introduce organic/biodynamic farming.

Though biodynamic farming is generally accepted to be universal, it was originated in the West, in an area with temperate climate. Most of the biodynamic preparations appear to need material of herbs and animals that are available largely in the temperate zone. According to the way prescribed by Rudolf Steiner, the preparations have to be exposed to nature during particular seasons which exist only in the temperate zone. Therefore, biodynamic farming would find problems of interpretation in the tropics.

Biodynamic farming has been mainly designed to address the problems in non-irrigated farming, e.g. vegetable and fruit gardening. However, irrigated farming is predominant in the food producing sector in Sri Lanka. Although rice has been grown successfully by biodynamic methods in other tropical areas, further experiments are inevitably needed to apply these methods in Sri Lankan conditions.

5.2 Potential Ways Forward:

5.2.1 Recommendations: The following measures are suggested in order to alleviate some of the above constraints:

Appropriate measures should be adopted in order to compensate for the initial loss of income following the conversion from conventional to organic/biodynamic farming. Organic/biodynamic farmers should have a right to enjoy the subsidies given in various ways to their conventional counterparts.

An awareness programme should be undertaken in order to educate consumers about the health-promoting effects of organic/biodynamic foods. Such an effort would contribute to promoting the market for organic/biodynamic products. Initially, higher income categories would be prepared to pay more for healthier food.

Policy makers should be made aware of the advantages of organic/biodynamic farming. e.g. its contribution to employment generation in rural areas, its capacity to reduce the public

expenditure on health and environment, its potential as a source of foreign exchange in niche markets etc.

Support of local NGOs should be sought to pressurise the policy makers in order to get them to formulate policies which are favourable to organic and biodynamic farming.

At the initial stage, organic/biodynamic farming should be introduced to traditional farming communities in which indigenous farming practices and socio-cultural systems still exist. In such communities, people may still be prepared to work harder and in co-operation with neighbours.

Importation of seeds and biodynamic preparations would be a short-term solution to the problem arising from the non-availability of seeds and the herbal matter and animal organs required for biodynamic preparations.

5.2.2 Areas for Further Research: In view of overcoming the constraints identified the following areas are recommended for research.

In order to adapt biodynamic farming to tropical conditions, it is necessary to undertake research projects aimed at the following:, (1) identifying suitable periods and methods for composting and making biodynamic preparations, (2) adapting biodynamic practices to irrigated paddy farming, (3) identifying tropical plants and sources of animal organs suitable for biodynamic preparations,(4) determining lunar influence on plants and animals in tropics.

In order to identify the scientific validity of biodynamic preparations under tropical conditions, research should be undertaken on the following areas:, (1) potential of biodynamic preparations: 500 and cow-pat pit to rehabilitate degraded lands in tropics, e.g. degraded paddy lands, tea lands etc., (2) potential of the same preparations to accelerate the process of soil recovery during the fallow periods of paddy and shifting cultivation. (3) efficiency of biodynamic pest control and weed control under tropical conditions,

In order to identify the yield-increasing potential of biodynamic practices, the following areas are recommended to be researched: (1) effect of planting according to lunar calendar, (2) identifying suitable planting dates for tropical tree crops, e.g. coconut, rubber and tropical fruits, (3) effects of biodynamic methods in promoting the productivity and health of dairy animals

In order to demonstrate the health-promoting effects of organic and biodynamic food, the following areas are recommended for further research: (1) the effects of organic and biodynamic food in enhancing immunity in human body and reducing susceptibility to diseases common in tropics, (2) the adverse effects on health of conventional foods with significant levels of chemical residues.

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(7) REFERENCES

Abele, U. (1987) *Food Quality in Relation to Fertiliser Application: Chemical, Organic and Biodynamic*. Summary report on work carried out at the Biodynamic Research Institute, Germany. Landwirtschftsverlag Gmbh, 44 Muenster-Hiltrup, Germany

Abele, U. (1973) *Vergleichende Untersuchungen zum konventionellen und biologisch-dynamischen Pflanzenbau* [Comparative studies on conventional and biodynamic plant cultivation] Ph.D. Thesis, Giessen.

CEA (1988) *Sri Lanka National Conservation Strategy.* Central Environmental Authority, Colombo

CBSL (1995) *Sri Lanka Socio-economic Data*. Statistics Department, Central Bank of Sri Lanka, Colombo.

Heinze, H. and Breda, E. (1978) Tests on the Composting of Farmyard Manure. *Bio-Dynamics* 125- 12-22

Klett, M. (1968) *Untersuchungen über Leicht- und Schattenqualität in Relation zum Anbau und Test von Kieselpraparaten zur Qualitätshebung* [Investigation on light and shade as related to mode of production and enhancement of quality by silica preparations] Institut für Biologisch-dynamische Forschung, Darmstadt.

Kranich, E.M. (1984) *Planetary Influence upon Plants: A cosmological botany*. Biodynamic Literature, Wyoming, R.I., USA.

Koepf, H. (1989) *The Biodynamic Farm*. Anthroposophic Press, Hudson, NY.

Kolisko, E. & L. (1982) *Agriculture of Tomorrow*. Kolisko Archive Publications, Ringwood.

Last, W. (1995) Overcoming Cancer - a holistic programme. *Self-help Cancer Cure Book*. Soil and Health Association of New Zealand Inc. Publications, New Zealand, Auckland.

Leavons, J. (1972) *How to Grow More Vegetables*. Ten Speed Press, USA, California.

Pettersson, B. (1977) Vergleichende Untersuchungen zum konventionellen und biologisch-dynamischen Pflanzenbau. *Lebendige Erde.* Darmstadt.

Pettersson, B. and von Wistinghausen (1979) *Effects of Organic and Inorganic Fertilisers on Soils and Crops*. Woods End Agricultural Institute, Misc. Publications

Pfeiffer, E.E. (1983) *Soil Fertility, Renewal and Preservation*. Lanthorn Press, East Grinstead.

Schilthuis,W. (1994) *Biodynamic Agriculture: Rudolf Steiner's Ideas in Practice*. Floris Books, UK

Samaras, F. (1978) *The Keeping Quality of Differently Fertilised Vegetables with Special Consideration of Physiological and Microbiological Parameters*. Ph.D. Thesis, Giessen

Schikorr, F. (1993) A Comparison of Different Methods of Stirring the Biodynamic Field Preparations. *Harvests* 48(3) Biodynamic Farming and Gardening Association, Napier, New Zealand

Schlueter, C. (1985) *Arbeits und betriebswirtschaftliche Verhältnisse in Betrieben des alternativen Landbaus.* E. Ulmer, Stuttgart

Smith, R.T. (1987) Indigenous Agriculture in the Americas: Origins, Techniques and Contemporary Relevance, in *Latin American Development: Geographical Perspectives* Ed. D.A.Preston, Longman, London, pp. 34-69

Smith, R.T. (1992) Non-chemical Weed Control Strategies and Experimentation on Bracken Supression Using Biodynamic Approach. Working Paper 92/2, School of Geography, University of Leeds, pp. 29

Smith, R.T. (1995) Preliminary Investigations Using Biodynamic Methods in the Control of Bracken. *Bracken: An Environmental Issue*, Ed. R.T.Smith and J.A.Taylor, International Bracken Group, Special Publication No.2

Smith, R.T. (1996)Modern Agriculture, sustainability and biodynamics. *Bulletin of the Sri Lanka Association of Geographers.* 1(1) The Sri Lanka Association of Geographers, Colombo pp 29-45

Spiess, H. (1979) Über die Wirkung der biologisch-dynamischen Präparate [On the effect of the biodynamic preparations] *Lebendige Erde* Darmstadt

Steiner, R. (1993) *Spiritual Foundations for the Renewal of Agriculture*. Biodynamic farming and gardening Association Inc. Pennsylvania, USA

Tallarico, G. (1931) The Biological Value of the Products of Soil Fertilised with Animal or with Chemical Fertilisers. *Proceedings of the R. Accademia Nazionale dei Lineei. Mathematical, Natural - Scientific Division*. Vol. XIII series 6,1. Rome

Thun, M. (1990) *Work on the Land and the Constellations.* The Lanthorn Press, East Grinstead, UK.

Ulluwishewa, R. (1991) Soil Fertility Management of Paddy Fields by Traditional Farmers in the Dry Zone of Sri Lanka. *Journal of Sustainable Agriculture* 1(3), pp. 95-106

Ulluwishewa, R. (1989) A Comparison of Tethering and Free grazing Buffalo Management Systems in Sri Lanka. *Buffalo Journal*, 2:pp. 121-129

Ulluwishewa, R. (1991) Modernisation Versus Sustainability: Disintegrating Village Agroecocomplexes in the Dry Zone of Sri Lanka. *Environmental Conservation* 18(2), pp. 103-109

Ulluwishewa, R. (1992) Indigenous Knowledge Systems for Sustainable Development: The Case of Pest Control by Traditional Paddy Farmers in Sri Lanka. *Journal of Sustainable Agriculture* 3(1), pp. 51-63