



Precision Farming and its relevance in Coconut

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Introduction

The concepts like sustainable agriculture, conservation agriculture, organic farming and precision farming can be considered as emerging trends in modern crop production. The main features of all these systems of agriculture are utilization of natural resources judiciously and maintaining sustainable production on a long range basis with out causing damage to environment.

The negative impacts of current or modern agriculture practices include soil degradation, water depletion and contamination, inefficient energy use, loss of plant and genetic diversity and destruction of non agricultural habitat. Certain products and practices are implicated with human health problems like nitrates in ground water, pesticide exposure and pesticide residues in foods.

Modern Agriculture vs Conservation Agriculture

Farming systems should aim at maintaining the productivity of the crops indefinitely. Such a system should be resource conservative, socially viable and commercially competitive. Resource conservation and environmental protection are the new dimensions of sustainable farming. Judicious use of natural resources like soil, water and several inputs is the basic concept of

conservation agriculture (CA). FAO defines CA as "a concept for resource saving agricultural crop production that strives to achieve acceptable profits together with high and sustained production levels while concurrently conserving the environment" (FAO 2007). The main principles of CA are minimal soil disturbance, maintenance of soil cover and crop rotation. In the past it was believed that tilling the soil will increase fertility. In fact tillage destroys soil organic matter and removes soil cover. Tilling or digging the soil demands additional labour. If coconut farms are suitably intercropped wherever possible or an organic soil cover is maintained tillage can be totally avoided resulting in labour saving.

A permanent organic soil cover will be formed when tillage is dispensed with which also enhances microbial activity in the soil. The mulch formed on the top soil will prevent soil erosion. Intercropping or crop rotation in the coconut farms will help to check diseases as against monoculture. CA also emphasizes resource conservation. In many of the coconut farms in states other than Kerala coconut is copiously irrigated beyond the requirement which paves way for higher energy consumption and ground water depletion.

The prevailing agricultural system, variously called as

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conventional farming, modern agriculture or industrial farming has delivered tremendous gain in productivity and efficiency. The increased food production has been the result of conventional agriculture rather than increased acreage. The conventional farming systems vary from farm to farm and country to country and heavily depend upon improved and hybrid seed, high input, monoculture, extensive use of pesticides, fertilizers and external energy inputs. In this system of farming immediate productivity is the only concern with least consideration to long term sustainable production. The philosophy of industrial farming holds assumptions like:

- Nature has to be exploited to the maximum
- Efficiency is judged from immediate high production
- Progress is measured by higher material consumption

Unfortunately it has not been possible to maintain crop productivity in spite of the most exploitative systems of resource use either in western countries or in developing countries like India.

Agriculture system has to be eco friendly and resources conservative if it has to exist on a long range basis and to be acceptable to the community. It has been reported that 71 per cent of the water resources in the world are polluted; the agricultural chemicals being the most important contributor to such a situation. Natural resources are being exploited at an alarming rate all over the world. However, we have to make sure that the "development should be the one that meets the needs of the present without compromising the ability of the

future generation to meet their own needs."

It is in this context that we have to consider the opportunities available in practices like conservation agriculture, organic agriculture, precision farming etc. for resource conservation and sustainable production without causing environmental degradation.

Organic Farming

The terms "organic farming" and "organic agriculture" are freely used to denote a system of agriculture that is divorced from the use of chemicals and fertilizers as inputs and which is heavily depended upon organic materials, organic recycled products and other crop growing techniques like mixed farming, inter cropping, crop rotation etc. that will ensure long term sustainability of crop production. Organic farming has gained general acceptance mainly due to environmental and health reasons.

Driving forces of organic/sustainable agriculture are that

- 1) the present agricultural practices have a negative impact on environmental quality and resources
- 2) the present practices are contributing to a deterioration of human health.

The scientists and farmers are divided in their opinion on organic farming. The opponents of organic farming point out that a shift from conventional farming to organic farming may cause reduction in yield. Similarly they point out that a dependable organic package for the control of pests and diseases is not available in order to avoid chemical pesticides. The concern of the farmer for yield reduction and effective control of pests and

diseases in organic agriculture has to be set right if large scale acceptance of organic farming practices is targeted. In this connection the State Agricultural Universities and Central Government Institutions have the responsibility to intensify research on all aspects of organic farming and to come out with acceptable technologies for the benefit of the farmers and consumers. The farmer has to be compensated for the yield reduction during the conversion period to make him confident to venture into organic farming.

The FAO although had reservations on the success of organic farming initially has now accepted organic farming as a viable agricultural technique. A recent report of the FAO says:

- Global food supply is sufficient but not distributed equally and 850 million people are undernourished and go hungry
- Use of chemical agricultural inputs is increasing, yet grain productivity is dwindling to seriously low levels
- Costs of agricultural inputs are rising but commodity costs have been steadily declining over the past five decades
- Knowledge provided through fast information technologies is increasing, but nutritionally related diseases are on the increase
- Industrialized food systems cause death through pesticide poisonings

The policy makers and administrators have to realize that the increased cost of cultivation, high input costs and reduced commodity costs have made farming unattractive. The extremely high cost



of labour especially in a state like Kerala has made farming a losing proposition. Like wise instead of the heavy budgets on curative health care systems, a prudent approach will be a preventive system of health care in which production of safe foods has an important role to play. A cost reduction of health care seems possible through organic agriculture which ensures safe foods. The monetary savings from the health care of the State Departments can be used to provide compensation to the organic farmers.

Precision Farming

Precision farming or precision agriculture is an agricultural concept relying on the existence of infield variability. It is also known as site specific farming and is intended for better management of farm resources. This is information and technology based management system, which allows the farmers to identify, analyze and manage the spatial and temporal variability of soil and plants for optimum profitability, sustainability, and protection of environment.

It requires the use of new technologies such as global positioning system (GPS) Geographic information system (GIS), satellite or aerial images and sensors to assess and understand variables.

The conventional agronomic practices follows the thumb rule of applying inputs on a large area say per ha, and the recommendations are extended over the whole agro climatic zone. For example the fertilizer recommendation for a crop is the same for a particular agro climatic situation without any consideration to the variability in environmental factors that exist

within the zone. In other words the variability in the soil in a unit area or the micro climatic variations prevailing within an agro climatic zone is totally ignored, while developing the package of practices.

The pioneers in this field advocated that general recommendation of inputs like fertilizers, seed, water etc. results in wastage of inputs and the recommendations should be decided by the specific requirement of soil, breed, crop growth and yield.

Spatial information technology includes the use of GPS, and GIS. This necessitates monitoring of environment parameters in the soil and in the field. Precision farming makes use of sensors for spatial and temporal measurement of soil and environment. Data on a continuous basis is collected so as to predict their impact on crop production, pests and disease incidence and yield prediction. The precision farming system comprises the collection of the following.

- a) Agricultural parameters
- b) Sensing location and data gathering
- c) Transferring data from the field to control station
- d) Decision making for applications
- e) Application of inputs through applicators.

In practice precision farming requires skill, technology, equipment and scientific knowledge. At present precision farming is confined to developed countries where large scale farming is practised. Small holdings, heterogeneity of cropping systems and high cost of cultivation limit its application in India. More than 50 per cent of the operational holdings in India are less than

one ha. In Kerala the per capita land holding is less than 0.1 ha. However, the applicability of precision farming especially for tree crops deserves consideration. According to some experts in USA the ability to map yield in an orchard at a scale as small as a tree and to use that information to optimize inputs would revolutionize tree crop production and contribute to resource use efficiency.

Relevance to Coconut

Coconut belongs to the group of perennial crops, that is totally propagated through seeds. In spite of the best efforts for selection of mother palms and assessing the prepotency of the palms, the heterogeneity expressed in the seedling population is very high. The present practice is to apply fertilizers and other inputs in a general way without taking into consideration the individual needs of the trees which results in wastage of inputs leading to loss to farmers. A prudent way of assessing the input requirement of the coconut trees should be based on individual trees rather than on per ha. basis. This is more relevant to Kerala where small holdings predominate and individual trees become important. A tree that is inherently a poor yielder should be supplied with lower dose of inputs. In a study conducted at the Amrita Vishwa Vidyapeetham University, Coimbatore it was found that the yield contribution in a unit area is that of 50 per cent of the palms while 25 per cent remain least productive. It is important to formulate and implement a model project on precision farming under Kerala conditions so that input recommendation becomes more scientific and precise.