Clove(*Syzygium aromaticum* L Merr.& Perry) Mixed Cropping In Coconut Garden

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Abstract

The morphology and growth patterns of coconut palms provide opportunities to grow a wide range of crops in the interspaces for maximising productivity from a unit area of land per unit time. The crops will have to be selected carefully for a locality/region so that the farmer derives the maximum employment opportunities for family labour and high net returns. Clove being an important commercial crop which is suitable to high rainfall humid regions can be successfully cultivated under coconut plantations aged over 20 years with assured irrigation facility during summer months in the west coast of the country. Although, the yield potential of clove under coconut shade is slightly reduced, even then, a coconut small holder would gain more profits.

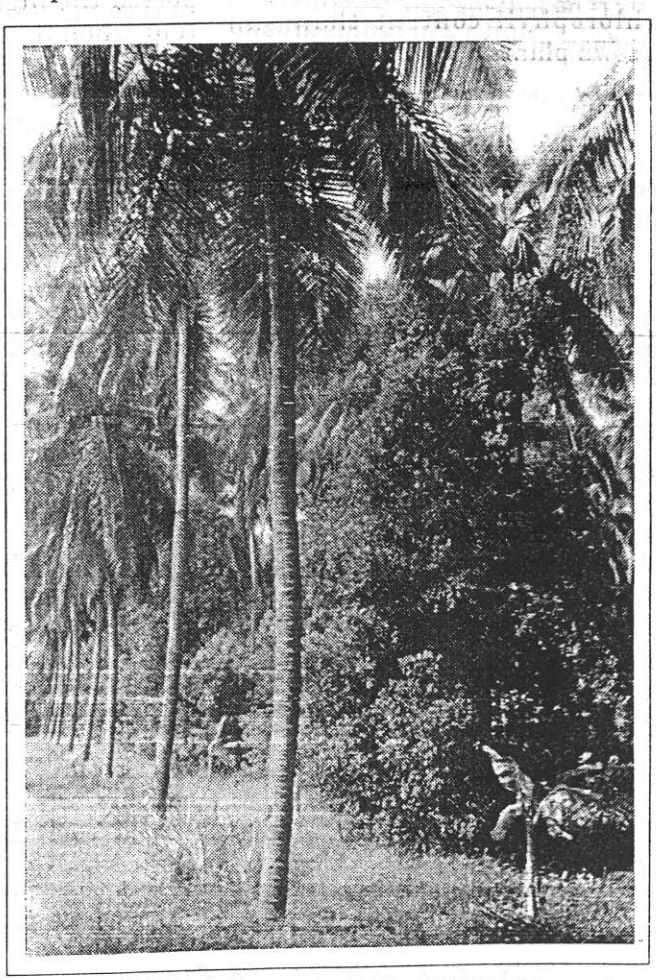
Introduction

Growing coconut as monocrop is the most inefficient way of using natural resources. Although recommended spacing for coconut is 7.5 x 7.5 m in the square system, mainly to accommodate the large crown of the palms, studies revealed that soil, air space and solar radiation are not fully utilized under 7.5 x 7.5m spacing and so much area is generally left unproductive throughout the long life span of palms. Theoretically, the maximum productivity of a crop under optimum management is 770 kg dry matter/ha/day or equivalent to 28 tonnes/ha/year (Loomis and Williams, 1973). In a coconut monocrop, the actual production of a coconut plantation with 100 nuts/tree/year yield was only 17.1 t/ha or 6.1 per cent of the maximum potential biomass production (Nelliat *et al., 1974).* Thus, energy utilization is also inefficient.

Further, in India, coconut is primarily a crop of small and marginal farmers and about 98 per cent of the 5 million coconut holdings in the country are below 2 ha in size. These small holdings neither provide gainful employment (coconut monocrop provides only 150 mandays/ha/year) opportunities for the family labour throughout the year nor generate sufficient income to meet the family requirements. One of the possible ways to step up production of coconut lands and enhance the family income is to grow compatible annual or perennial crops in association with coconut.

Scope for Mixed Cropping

The morphology and growth pattern of coconut palms are found to provide strong support to



Clove mixed cropped in Coconut at CPCRI, Kasaragod

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the coconut based farming systems. The young coconut palms below 9 years age group and palms of above 20 years do not pose any problem and allow sufficient sunlight under the canopy for successful raising of several crop species. Depending upon the spacing adopted (7 x 7 to 10 x 10 m), the amount of solar energy under the coconut canopy ranged from 43 to 88 per cent of normal sunlight (Gomez and Gomez. 1983). Similarly, the rooting pattern of mature coconut palms planted at a spacing of 7.5 x 7.5 m does not pose any problem for the uptake of nutrients and moisture from the soil by the compatible intercrops properly arranged in the systems, as the effective root zone of coconuts is confined mainly within a 2 m radius around its base and the top 30 cm soil is by and large devoid of functional roots while more than 85 per cent of the roots of coconut are found between 30 and 120 cm depth (Kushwah *et al., 1973*). Therefore, from land utilization point of view, a pure stand of coconut utilizes only 22 per cent of the area at a spacing of 7.5 x 7.5 m and 12.6 per cent of the area at 10 x 10 m spacing leaving considerable scope for exploitation of the inter row soil potential. Hence, the coconut palms provide the best opportunity for a wide range of farming systems.

A number of perennials like cocoa, clove, nutmeg, coffee, pepper, mulbery, jack, breadfruit, mango, sapota, papaya and timber yielding trees can be grown in association with coconut depending on suitability to a region and requirement of a farmer. Their performance depends much on the availability of solar radiation, agro-climatic conditions and the level of management. Studies carried out at CPCRI, Kasaragod have revealed that clove can be successfully grown as mixed crop in coconut garden.

Clove is an important tree species of India and clove, clove oil and oleoresin are extensively used in confectionery and medicine. The cultivation is being confined to mainly three southern states, namely Tamil Nadu, Kerala and Karnataka. This grows to height of 10-12 meters and has a short tap root with 2-3 branches which penetrate upto a depth of 3 meters and lateral spread can be seen upto a distance of 8 meters. It flowers at the age of 6-7 years and full bearing comes at 20 years, Thereafter sustained production can be expected for 60 years.

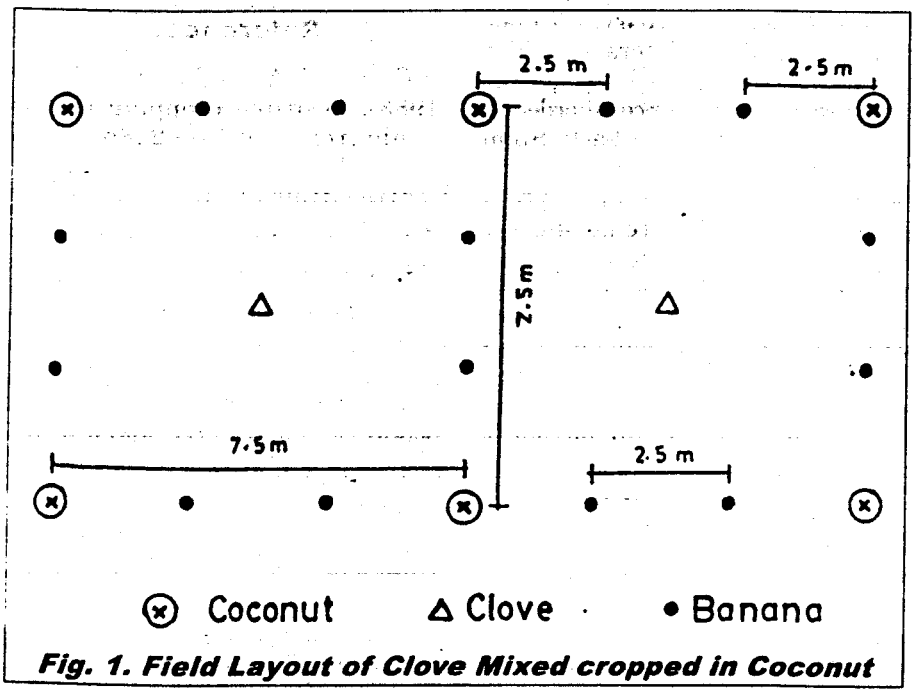

Fig. 1. Field Layout of Clove Mixed cropped in Coconut

Climate and Soil

Clove requires a warm humid climate with an annual rainfall ranging from 1500 to 2500mm . It grows well from sea level upto an altitude of 800 to 900 meters. Sandy loam soils with high humus content and good drainage is suitable for the cultivation of crop.

Planting Geometry and Age of Garden

The productivity of coconut as well as the inter crops is affected by the planting arrangement. Under a monoculture system, the triangular system provides the optimum number of trees, with 15 per cent more palms/hectare and minimum overlapping of leaves. However, in coconut based farming systems, the square or rectangular arrangement not closer than 7.5 metres is preferred as this facilitates the growing of perennials as mixed crop with the palms.

Based on the growth and canopy development, the lifespan of the coconut palm could be divided into three distinct phases from the point of view of intercropping. The first phase (upto 8 years) starts from planting till the full development of canopy. During this period, when the canopy size increases gradually, the interspace could be utilised for growing annuals or other short duration crops which would not compete with the developing coconut palms for their requirements. The period from 8 to 25 years is the second phase when the coverage of the ground by the coconut canopy is about 90 per cent and the crown is at lower level due to short trunk height.

There is little or no scope for growing, other crops in the interspaces during this period. After about 25 years of age, there is a gradual decrease in apparent ground coverage with increase in trunk height and reduction in crown size which facilitates more and more sunlight to reach the ground (Nelliat *et al.*, 1974). This period is ideal for growing clove as mixed crop in coconut garden.

Planting Clove Seedlings

In the centre of four palms in square or rectangular pattern of planting, a pit of 75 x 75 x 75 cm size should be opened a month in advance of planting. Fill up half the pit with a mixture of top soil and 15 kg of farm yard manure or compost. Two year old clove seedling is to be planted in the centre of the pit *(Fig 1)*. Proper time of planting clove seedlings is during the rainy season from May-June to August- September. Provide adequate shade and irrigation during breaks in the monsoon and summer. Banana may be planted in the interspaces of coconut as shown in *Fig.1* to provide shade during early seedling growth and also to get additional returns.

Fertilizer Application

An adult clove tree may be manured with 300g N,250g P_2O_5 and 750g K_2O/seedling/year. During the first year, apply 20g N,18g P_2O_5 and 50gK_2O/seedling and in the second year double the dose of the first year and so on as to reach the adult dose by the fifth year. Apply these fertilizers in two equal split doses in May-June and in September-October in a circular basin of one to one-half meter around the tree and 0.5 meter away from the base and mixed with soil. Coconut palms should be manured regularly as per the recommended package of practices.

Irrigation

Clove will compete with coconut for soil moisture during the stress period. Therefore, this cropping system should be practised only with assured water supply conditions during summer months. Perfo-irrigation is preferred as it wets the entire surface of the garden. Irrigation at the rate of 20mm once in a week has been found to be optimum for the system during summer months in the West Coast region. In the gardens where there is a problem of water stagnation, it is essential to provide artificial drainage by opening trenches around the garden during rainy season.

Weeding and Inter-cultivation

During the initial 4 years the growth of clove seedlings is very slow. Therefore, proper care is must during initial years. Weed slashing and light intercultivation twice in a year whenever optimum conditions prevail for proper soil aeration are required till the young seedlings are able to completely cover the ground. However, care should be taken not to damage the surface root system in the basin area.

Plant Protection

Infestation of shoot bore, *sinoxylon* sp. on tender shoots or young plants is very common in clove. This can be controlled by prophylactic application of Carbaryl 0.15 per cent. Prune off the laterals of older trees showing die-back symptoms and spray with one per cent bordeaux mixture to control die back. Stem borer infestation on main trunk can be treated with Aluminium phosphate tablets. After removing the frass the tablet can be introduced into the hole and plugged thoroughly with wax. The other diseases of clove include leaf spot, twig blight and flower bud shedding. Spray one per cent bordeaux mixture just prior to flower bud formation and it may be continued till the harvest of flower buds at one month interval which reduces disease intensity, defoliation and flower bud shedding.

Harvesting and Curing

The trees begin to yield from 7-8 years after planting and stabilised yield can be expected after 15 years of planting. The flowering is in September-October in plains and in December-January in high altitudes. Clove of commerce is the dried, aromatic, fully grown but unopened flower bud of clove tree. The fully developed buds are to be harvested ready in about four months. When most flowers in a cluster turn light pink or light yellow or when one or two flowers start blooming, that is the most appropriate time for harvesting them to guarantee high quality and maximum eugenol content. The very limited period available for harvesting to ensure the maximum oil content and more labour requirement for harvest are the major problems for the clove farmers. An average yield of 5-8 kg/tree fresh weight of buds can be expected per year. Because of the shade effect of coconut, the yield of cloves may be reduced by upto 30-40 per cent of pre stand yield. Even then, a coconut small holder will gain substantial profits. Spread the buds uniformly and allow to dry for 4-5 days under sunlight till they become crisp and dark brown in colour. The properly cured clove yield would be around 30 per cent of the fresh weight of buds.

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