

Climate change, Carbon sequestration and Coconut based Ecosystem

V.V Shinde, S.L. Ghavale, S.M. Wankhede, H.P. Maheswarappa & P.M. Haldankar

AICRP on Palms, Regional Coconut Research Station, Bhatye, Ratnagiri

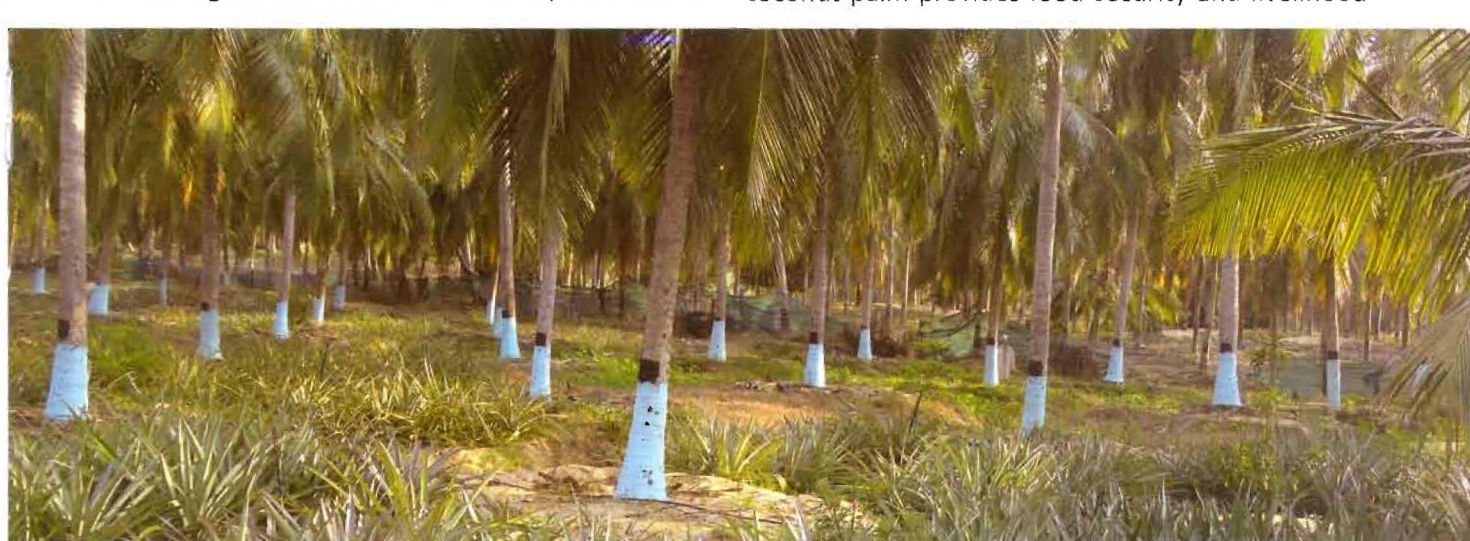
Dr. Balasaheb Sawant Konkan krishi Vidyapeeth, Dapoli, Dist. Ratnagiri

Climate change is a key issue of the present day. It refers to gradual increase in temperature and the consequent effect on the atmosphere. Today what we are experiencing is believed to be caused by the increase in atmospheric concentration of carbon dioxide and other green house gases. Several global initiatives have been launched to address this issue. Coconut based cropping system provides good opportunities for enhancing carbon sequestration through different perennial and annual crop combinations such as spice crops, tree crops, tuber crops and food crops. A study was initiated in 30 year old D x T coconut plantation at Regional Coconut Research Station, Bhatye, Ratnagiri (MS) under All India co-ordinated research Project on palms during 2013-14 and 2017-18. The component crops were nutmeg, cinnamon, banana and pineapple. The main focus of the study was yield maximization, carbon sequestration and employment generation potentiality generated through coconut based cropping system. Generating and establishing more sustainable cropping system is one of the needs of the hour. Multispecies and multi-storeyed cropping system ensures maximum utilization of resources for higher yield per unit area. There are many coconut based cropping systems in various countries and in India. Effective and efficient utilization of available resources for higher yield is the modern concept of cropping system. Improvement in the soil properties and biological activities in the rhizosphere due to

intercropping results in the modification of soil environment for the benefit of the plant growth. Studies revealed that natural resources i.e. soil, water; air space and solar reclamation are not fully utilized under the spacing schedule 7.5 m x 7.5 m. It is reported that a well designed high density multispecies crop model suited to a given agro-climatic situation generates biomass output, yields more economic and higher total income, additional employment opportunities for family labours and meets the diversified needs of the coconut farmers, such as food, fruit, vegetables, fuel etc. The coconut based cropping systems are gaining importance as there are serious market fluctuations for coconuts and coconut products. Systematic mixed cropping of compatible crops under coconut to compensate the economic losses of sole cropping by increasing income per unit of cultivable land has become a necessity.

Economic and Social Importance

Coconut is an important crop of economic importance to many of the Asian and Pacific countries in the world. The crop provides livelihood security and employment opportunities to a major segment of the rural mass of these countries. India being the largest coconut producing country in the world occupies 31% of the global production. Widely acclaimed as Kalpavriksha or Tree of life, the coconut palm provides food security and livelihood



opportunities to more than 10 million people in India. It is an important food crop for the major chunk of Indian population. Similarly it is an important cash crop for more than 10 million farm families and a fiber-yielding crop for more than 15,000 coir based industries which provides employment to nearly six lakhs workers of which 80 per cent are women folk. Coconut and coconut products are gaining global importance as a contributing factor to the health, nutrition and wellbeing of human being. This is due to its multiple medicinal and nutraceutical properties being revealed day by day. This new development in health sector brought in an unprecedented increase in the demand for coconut products in the domestic and international markets. It is estimated that there are 5 million coconut holdings and 12 million farmers in the country.

Coconut based cropping system demonstrating carbon sequestration

Agriculture can be a primary solution to the problem of greenhouse gas emissions and climate change. As a result, farmers are now familiar with terms like carbon credit, carbon financing and carbon payments.

The issue of climate change revolves primarily around the main atmospheric form of carbon, CO₂. In fact, CO₂ is the metric, or currency in which changes in atmospheric radioactive forcing (i.e., global warming) are measured. The most effective way to reduce atmospheric CO₂ levels is through Mother Nature's own process of photosynthesis. A few simple, back of the envelope calculations demonstrate agriculture's ability to assimilate CO₂, which can potentially lead to carbon capture and storage. Let's use coconut, the nation's plantation crop, as an example. In this experiment we have compared the coconut based cropping system with monocrop coconut.

Above ground carbon sequestration of crops

It was observed that, among the different integrated nutrient management systems, the above ground standing biomass (SDW) and above ground carbon stock (353.25 kg/plant and 31.06 t/ha, respectively) was significantly the highest in coconut based cropping system. The lowest above ground biomass and carbon stock were observed in coconut monocrop (288.8 kg/plant and 25.6 t/ha, respectively). This is because the intercrops in coconut based cropping system have added additional biomass production than monocrop. Hence the carbon stock was the highest in the cropping system plots compared to monocrop of coconut. Furthermore, the CO₂ sequestered also followed the same trend and accordingly, the highest CO₂ sequestration was recorded in coconut based cropping system, whereas the lowest CO₂ sequestration was noticed in coconut monocrop (93.8 t/ha). Trees are carbon reservoir on earth and in nature, forest ecosystem act as a reservoir of carbon and store huge quantity of carbon and regulate the carbon cycle by exchange of CO₂ from the atmosphere. Thus, forest ecosystem plays a significant role in the global carbon cycle by sequestering a substantial amount of carbon dioxide from the atmosphere by storing it in the biosphere.

Soil bulk density and organic carbon

The bulk density of soil (g/cm³), soil organic carbon (%) and soil carbon stock (t/ha) is at 0-30 and 31-60 cm depth in the rhizosphere of different crops in the system. With respect to bulk density, no significant difference was found among the different cropping system and INM practices at both the depths during the course of study. The organic carbon (OC) content differed significantly among the cropping systems at both the depths. Among the different crops, significantly the highest soil organic carbon (0.86% and 0.81%) was documented in coconut basin at 0-30 and 31-60 cm depth in fully organic managed garden. The coconut basin in the monocropping system recorded significantly the lowest organic carbon at both the depths (0.60 and 0.51 %). The rhizosphere of intercrops like nutmeg, cinnamon, pineapple and banana also recorded higher organic carbon content, whereas in the interspace of monocropping, it was found significantly lower (0.46 and 0.44 %). Growing intercrops in the coconut garden has led to addition of recyclable biomass from the intercrops which has resulted in improvement in the organic carbon content.

Table: Details of the component crops in coconut cropping system/ha.

Sr. No.	Name of the crop	Varieties /hybrids	Number of plants/block	Number of plants/ha
1.	Coconut	D x T (COD x WCT)	20	175
2.	Nutmeg	KonkanSwad	12	135
3.	Cinnamon	KonkanTej	62	615
4.	Banana	KonkanSafedVelchi	62	615
5.	Pineapple	Kew	960	10800

Soil carbon stock

The soil carbon stock was significantly influenced by coconut based cropping system. Among the different crops under investigation, the coconut rhizosphere had significantly higher soil carbon stock (42.31 t/ha and 39.85 t/ha) in the depths of 0-30 and 31-60 cm. The lowest soil carbon stock of 28.44 t/ha and 24.17 t/ha at 0-30 and 30-60 cm depth was noticed in the coconut rhizosphere in the monocropping system. Significantly the highest soil carbon stock was observed in coconut based cropping system at 0-30 and 31-60 cm depth in the rhizosphere of different crops. The lowest soil carbon stock observed in the coconut monocrop might be due to the absence of intercrops in the interspace which might not have contributed to soil carbon pool. Furthermore, the coconut basin rhizosphere has recorded higher carbon stock at both depths (0-30 and 31-60 cm), which might be due to increase in organic carbon in the soil owing to decomposition of root system over a period of time as compared to other crops and organic manure incorporation to the coconut crop and interaction effect of organic manure and green manure incorporation.

Economics and employment generation under coconut based cropping system

► a) Economics

The total cost involved in maintaining the coconut based cropping system was Rs. 123769.60 and the net return was Rs. 1,31,605.8 with the highest cost benefit ratio of 1:2.69. Merely monocrop of coconut recorded Rs 38,735 as net return with 1:1.60 cost benefit ratio.

► b) Employment generation

The employment potential of coconut based cropping system is observed to be very high. The labour input utilization of irrigated monocrop of coconut (at its stabilized yield stage) is 157 man days/ha/year. The labour utilization in the coconut cropping system with banana, pineapple, cinnamon and nutmeg was 297 days/ha/year. In percentage term, the increase was about 189 per cent over the sole crop system. Since it is expected that the bulk of the labour force is available from the family source of the farmer, family labour income could therefore be considerably raised when coconut based cropping system was adopted. ■

Independence Day observed in CDB



Shri. R.Madhu, Secretary, CDB hoisting the National Flag at CDB Head Quarter premises on 15th August 2021.