Unearthing Coconut Productivity in the changing climate regime

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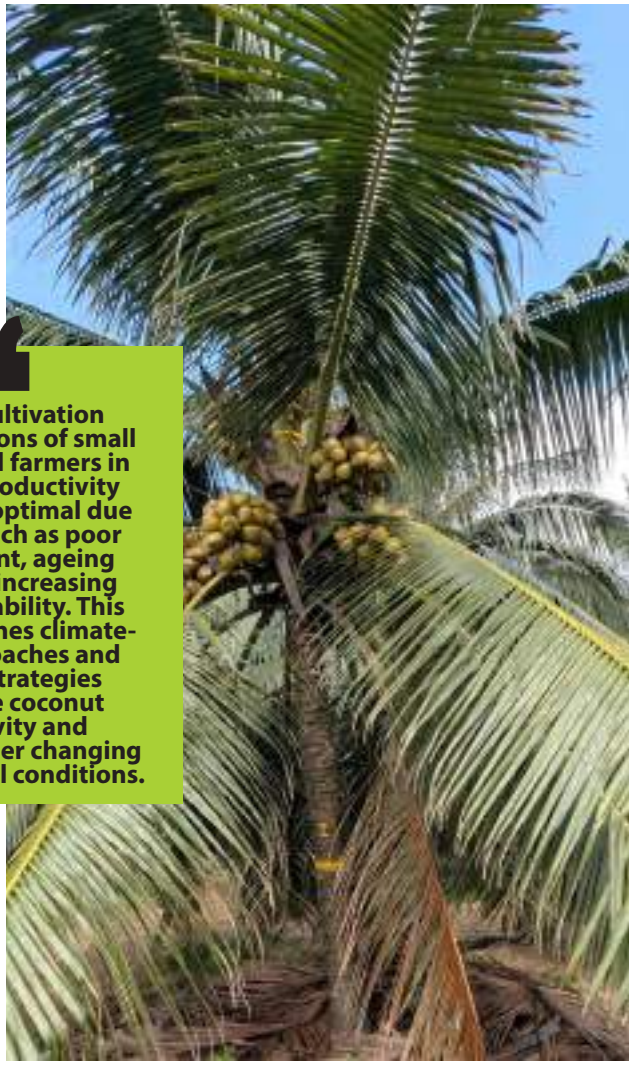
Coconut plays a significant role in the agrarian economy of India. About 10 million people in the country are dependent on coconut cultivation, processing and the trade. However, coconut is a crop of small and marginal farmers since 98 % of about five million coconut holdings in the country are less than two hectares.

Coconut, the major plantation crop of Tropics is affected by global warming and climate change. Climate variability and extreme weather conditions will have severe impact on marginal coconut farmers and hence low cost smart technologies and other coping measures are the need of the hour to maintain and enhance productivity in a sustainable manner. Climate resilience is the ability of any entity or system to bounce back from adverse climatic conditions. So climate smart coconut farming is in essence preparing coconut or coconut based systems to stay on top of adverse climate due to global warming maintaining productivity and sustainability in the long run.

Coconut cultivation sustains millions of small and marginal farmers in India, yet productivity remains suboptimal due to factors such as poor management, ageing palms, and increasing climate variability. This article examines climate-smart approaches and adaptive strategies to enhance coconut productivity and resilience under changing environmental conditions.



Studies show that in the future climate scenario, theoretically coconut yield can go up in the west coast of India, but in the east coast it may decline. Realizing higher yield will depend mainly on good planting material, its environment or microclimate and management. Global warming and incidental climate change is affecting almost all tropical crops

Fig.2:Palm residue mulch throughout the year

Fig.3: Variation in soil temperaturein different zones of a coconut garden

*(29.2° C under mulched and drip-irrigated portion, 40.7 °C in coconut inter-spaces and 48.4°C in open field in 7.5 cm depth at 3.00 pm; *Observations were recorded at atmospheric temp. 37° C in sandy loam soil conditions)*

and most of the crops manifest decline in yield. This is mainly due to changes in rainfall intensity and duration affecting soil moisture regime, soil health and productivity along with changes in mean temperature affecting soil properties and crop physiology. Summer temperature in most tropical climate exceeds 35 degree centigrade and surface soil temperature goes up to 45 degree centigrade. This higher temperature is a major reason for button shedding and reduced yield in coconut. This article focuses on improving productivity in coconut as a plantation crop under changing climate regime.

1. Role of Good planting material in unearthing productivity

Genetic adaptation measures like growing improved local tall cultivars and hybrids under improved crop management is needed for long-term adaptation of plantation to climate change, particularly in regions that are projected to be negatively impacted by climate change. Many varieties and hybrids released by Central plantation Crops Research Institute, Agricultural universities and private organizations are available in the market. Based on the farming conditions and requirement of the farmer, variety may be selected. Always take seedlings from a trustworthy organization to ensure that all the procedures of mother palm selection and seed nut selection are followed in raising nursery. Planting one year old seedlings are better for better establishment in the field. Seedlings may be selected based on the selection criteria like vigour, seedling girth >10cm, more than 6 leaves and early splitting of leaves. Development of resistant/tolerant varieties, production and distribution of disease-free planting material at reasonable cost are fundamental to climate smart coconut farming, more due to its perennial nature and very long duration.

Varieties with higher leaf production rate of >12 leaves per year will have an equal number of inflorescence production, leading to more number of female flower production ultimately leading to higher yield under good management. Longer leaves with more leaf area will aid in production of more photosynthates, ultimately contributing to yield. Hence care should be taken to maintain 35-40 healthy leaves in the palm. Cutting and removing green leaves should be strongly discouraged. Only dry leaves should be removed or may be allowed to fall down from the palm. This will also facilitate movement of mobile nutrients from senile older leaves to younger leaves.

2. Role of Microclimate and its management

2.1. With irrigation

Climate change is manifested in the form of rising mean temperature, increasing cyclonic circulation and high intensity rainfall events etc. Though coconut is a tropical palm the ideal climate required is an atmospheric temperature ranging between 27±5 °C, annual rainfall of 1000 to 2000 millimetre and a relative humidity of more than 60 % with abundant

Fig.4: Green manuring with cowpea in the coconut basin

Effective utilization of coconut residues through mulching offers a low-cost, sustainable solution to improve soil health, conserve moisture, and enhance nutrient recycling in coconut gardens. This article highlights practical mulching techniques using leaves, husk, and coir pith to regulate soil temperature, reduce yield losses, and promote long-term productivity.

sunlight. However summer temperature always go beyond this range. Higher temperature can lead to more water requirement, unfavourable gas exchange in the plant and reduced root activity in the soil. This ultimately reduces water and nutrient uptake and yield loss due to button shedding. Irrigation and mulching practices can be used as a measure to regulate the microclimate. But shortage of water for irrigation is more common in summer months. Water saving irrigation measures like drip irrigation can be used in such situations. It is recommended that 32 litres of water per day through drip irrigation will keep the palms safe from drought effects. However based on the canopy, root spread and transpiration requirement of varieties, this amount may vary. When adequate water is available for irrigation, for maintaining higher productivity, it is advisable to replenish the water lost in evaporation from the root zone which comes to 50-60 litres per day during months of December to May.

2.2. Mulching with coconut palm residues

Coconut provides 14 to 20 tonnes of crop residues per hectare per year which if effectively used, can supply most of the nutrients lost from the system. Mulching with coconut leaves, husk and coir pith can be practiced which helps to reduce soil temperature and evaporation from soil surface and create conditions for proper root growth, reduce weed growth and promotes earth worm activity and microbial activity. Mulching is to be done before the end of the monsoon and before the top soil dries up. Fallen leaves from the palm may be cut into 2-3 pieces and may be used along with spathe and other residues. If coir pith is used about 40-50 kg may be spread around the palm in 2 m radius and slightly covered with soil. Due to its fibrous and loose nature, incorporation of coir pith considerably improves the physical properties and water holding capacity of soil and thereby increases the coconut productivity. Mulching with husk will require about 250-300 husks which may be buried in 25-30 cm depth around the palm in 2 layers. This practice is a low cost activity and found to reduce soil temperature up to 10 degree Celsius compared to interspaces in top layer of soil. During summer months this will bring the soil temperature in the basin to a tolerable limit, thus reduces button shedding and thereby increasing yield. Retaining mulches throughout the year is also a good practice particularly in sandy soils and sloppy lands. During rainy season mulch will reduce the impact of rain drops and reduce soil erosion and leaching of nutrients. When left undisturbed throughout, a favourable microbial environment may be created which will promote better soil health and nutrient availability.

2.3. Cover crops and green manuring

Green manure legumes viz.,Pueraria phaseoloides, Calapagonium mucunoides and Mimosa invisa can be grown as cover crops in the coconut garden. This can generate 15-20 tonnes of biomass per hectare. Cover crops are soil protective and helps to minimize soil erosion. Moreover, leguminous cover crops also supply nitrogen apart from carbon addition to soil due to decomposition of above and below ground biomass. In basin management with green manure crops, during May-June, green manure seeds can be sown around the palm basins and when one or two plants start to flowering, the biomass can be incorporated in the basin. This practice is inexpensive and can be adopted even by small farmers. The basin management with green manure crops supplied 25 kg or more green manure and 150-200 g nitrogen and yield increase in palms.

Fig.6: Response to fertigation in hybrid coconut (Kalpa Sankara)

Fig: 5.Higher nut set and uniform nuts per bunch under fertigation

2.4. Husk burial in interspaces of coconut palms

The practice of husk burial in interspaces of palms can retain soil moisture and promote root spread thereby help the palm to tide over summer drought condition. This will also help in better growth and yield of intercrops. Trenches of 100 cm width x 50 cm depth and convenient length are to be made in between two rows of coconut palms and filled with coconut husks in layers with the bottom layers facing up and top layer facing down.

2.5. Biomass recycling through vermicomposting

The dried coconut leaves and other wastes in coconut plantations can be effectively converted into vermicompost with a help of earth worm, Eudrilus sp. Coconut leaves and other wastes can be vermi-composted by heap method or pit method or in coconut basin itself. For compost preparation, coconut leaves weathered for 2 to 3 months are to be used. Depending on the extent of weathering of leaves used for composting, 70 per cent recovery of the compost is obtained within a period of 60 to 75 days. Vermi composting holds promise as a biological tool for management of residues of crops/trees in homestead farming system.

2.6. Coconut based systems

Climate resilience in coconut farming is possible through diversified systems approach and measures improving soil health, palm health and micro climate. Due to its versatility, coconut is compatible with wide range of tree crops like nutmeg, cocoa, fruit crops, fodder crops, biennials like banana, pineapple, papaya flower crops like heliconia and annual crops like seasonal vegetables and spices. Through nourishing the soil with organic amendments, conservation measures and crop residues, soil biological, chemical and physical properties can be improved leading to better soil health. Adopting low cost and climate smart technologies such as cover cropping, mulching, crop residue management through vermicomposting, integrated nutrient management, micro irrigation, fertigation etc. can lead to better palm health and create favourable micro climate for coconut production.

3.Other management practices promoting higher productivity

3.1 Spacing and planting

Like any other plant coconut also requires light, water, nutrients and space for establishment for better growth and productivity. Under monocropping of coconut palms may be given a row to row and palm to palm spacing of 7.5 metres. When intercrops

especially perennial crops are planned in between, a spacing of 7.5 to 10 meters may be adopted. Light requirement is 7-8 hours of sunshine per day from morning onwards. Shading trees should be pruned or removed to avoid competition for light, water and nutrients. Palms should be given attention from planting onwards. When preparing to plant new seedlings, the pit should be dug at the beginning of summer rains. In laterite areas, pits should be dug that are 1.2 x 1.2 x 1.2 metres long, wide, and deep. Adequate manures should me mixed with soil before planting for better rooting and early growth. Fertilizer application schedule should be followed starting from 3 months after planting.

3.2 Fertilizer application

In order to combat the problem of soil acidity, and to increase the fertilizer use efficiency, lime or dolomite application@ 1 kg per palm two weeks prior to fertilizer application should be done. Liming could also facilitate the microbial activity in the soil and promote the root growth

When Irrigation is given, it is generally recommended to apply nutrients in for equal splits at three month intervals. Apart from major nutrients like N, P, K, coconut requires secondary nutrients like Calcium, Magnesium and Sulphur and micronutrients like Iron, Manganese, Copper, Zinc, Boron, Chlorine and Molybdenum etc. It is recommended that 500 g Magnesium Sulphate is applied to coconut every year during September. Productivity is always limited by the nutrient in short supply, to the extent of its deficiency. . In Kerala soils wide spread boron deficiency is seen and also zinc deficiency in some areas. Potassium and magnesium deficiency is also prevalent. Hence instead of following general recommendation, soil test based nutrient application is recommended. Application of micronutrients should be regular and should be accorded equal importance along with major and secondary nutrients for realizing higher productivity

3.3. Irrigation

Drought is one of the main environmental factors that limit coconut productivity. Studies show that about 2/3 of the potential coconut production is generally lost due to either poor nut setting or immature nut fall as a result of water deficit conditions. The studies on yield of coconut and rainfall relationship have indicated that both high rainfall during June to August and absence of post and pre monsoon showers adversely affect the yield in the following year.

Water-smart technologies like micro-irrigation, rainwater harvesting structures, cover-crop method, deficit irrigation and drainage management can support farmers to decrease the effect of variations of climate. Irrigation methods commonly adopted in coconut gardens are flooding, basin, hose irrigation, sprinkler and drip irrigation. Out of these, drip irrigation is most popular for coconut as monocrop and sprinkler irrigation for coconut-based cropping system. Drip irrigation along with mulching will be a useful practice with regard to both soil moisture conservation and soil temperature regulation in case of littoral sandy soil.

3.4. Fertigation- a technology which can unearth productivity

Scheduling application of water soluble nutrients with irrigation water is called fertigation. In the broadcast application of nutrients, large quantity is applied to the surface of basin at wider intervals of time. This leads to volatilization and leaching losses and problem of weed growth etc and ultimately a small quantity of applied nutrients become available to palms and that too for limited periods of time. Application of nutrients with irrigation water will take the nutrients to the root zone and becomes uniformly available to roots. Scheduling application at weekly, fortnightly or monthly intervals can be done according to convenience. Coconut palms produce one inflorescence per month in tall varieties and in dwarfs and hybrids it may produce 12-15 inflorescences per year as leaf production rate is higher. Hence application at monthly or fortnightly intervals and following proper distribution of dripping points can help to convert all the inflorescences into productive bunches with higher nut set and higher yield. In the on-going study at Regional station, Kayamkulam, using disease tolerant hybrid coconut (Kalpasankara), higher dose of nutrients are found effective in producing more leaves, more bunches and higher nut set leading to higher yield from early stage of growth. Scheduling fertigation at 15 days interval found to improve nutrient availability in coconut basin and promotes consistently higher yield with more than 200 nuts per palm per year

This shows fertigation can elevate yield level with better resource use efficiency even in disease tracts. Uniform crop stand and bunch quality can be maintained through fertigation. Early maturity and higher yields and better quality of produce are some benefits of fertigation

3.5 Pollinators, weed management and timely harvesting

Presence of pollinators are one of the deciding factors promoting higher yield. In the changing climate scenario, with increasing temperature and intense rainfall events, foraging by pollinators gets affected. Keeping honey bee colonies in the coconut garden can improve the nut set and productivity.

Reducing weed competition by application of a suitable herbicide at appropriate dose will be cost effective and improve the yield when coconut is taken as monocrop in plantation scale. Use of tractors with rotovator, power tillers and other small machinery are also effective in well drained soils for weed management and aeration when intercrops are grown.

Since on an average, every month an inflorescence matures into nuts regular harvesting will help in removing the mature bunches so that photosynthates get distributed to younger bunches, thus reducing button shedding and improves yield. In this respect, occasional harvesting of bunches for tender nuts will also promote better nut setting and higher yield.

Disease management protecting the healthy leaves and management of pests like rhinoceros beetle, red palm weevil, mite, coreid bug, white flies etc are very important for realizing higher productivity. Standard package of control measures are available which may be followed. Early detection of pests and diseases are very important and this is not possible without active interest of the farmer.

Different residue management practices can increase soil carbon stocks and stimulate soil functional stability. With a good variety, regulating the environment with residue mulching and augmenting organic matter in the soil, drip irrigation and management of nutrients through fertigation can produce very high yield in coconut. All the management practices for better productivity become successful, only with dedication and passion shown in farming. ■

Retirement

Shri Anil Kumar Singh retired from the services of CDB on 31st March 2026 after serving the Board for more than 35 years.

IAS Officer Trainees visited Coconut Development Board

IAS Officer Trainees from Lal Bahadur Shastri National Academy of Administration visited Coconut Development Board on 20th March 2026. Shri. Pramod P Kurian, Secretary, CDB, Shri. Jayanath R., Deputy Director, CDB briefed on various schemes, activities of the Board. The trainees expressed sincere appreciation for the valuable insights and exposure gained through the guidance and stewardship of the Board's officials.