Effect of Soil and Climate on the Productivity of Cashew

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Abstract

A review of soil and climate conditions of different cashew growing states in India in relation to the production potential of cashew reveals that a well distributed rainfall during growth and pre-flowering phase (from September to November) favours a higher yield potential. Brown forest soil or a deep well drained laterite soil with high water holding capacity and rich in organic matter content appears to be an ideal soil type for better growth and higher productivity of cahsew, while the eroded laterites and coastal sands appear to be poor soil types. The yield potential of cashew is very low under saline/alkaline conditions of the soil and soil water. The cyclonic storms along the East Coast resulting in heavy rainfall, floods and waterlogging also seriously affect the productivity of cashew. Augmenting supplemental irrigation facilities in the rain deficit regions coupled with appropriate soil conservation and fertility management practices are essential in raising the cashew productivity.

Introduction

Cashew is one of the gifts of the 'new' world to the 'old' world. Although a native of tropical America, it became commercially important in its adopted homes in India, Tanzania and Mozambique soon after its introduction over three centuries ago (Swaminathan, 1979). Cashew is grown almost throughout the tropics between the Tropics of Cancer and Capricon. In most tropical countries, it is found growing in coastal areas. Commercial production is mainly confined to India, Mozambique, Tanzania, Kenya and Brazil. The major cashew producing states in India are Kerala, Karnataka, Tamil Nadu, Andra Pradesh, Goa, Maharashtra, Orissa and West Bengal. In India cashew occupies about 5 lakh ha. with an estimated production of 2.24 lakh tonnes (Anon, 1988). Over the years, the area under the crop has been steadily increasing but corresponding increase has not been observed in production of nuts.

Kerala has the maximum area under the crop (29.9%) followed by Tamil Nadu (18.6%) and Andhra Pradesh (13.2%), while other states as Karnataka, Goa, Maharashtra, Orissa, West Bengal and Tripura are occupying still lesser area. In terms of

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Bold nuts - Bearing in bunches of 3-4 nuts.

production 56.4% is from Kerala followed by Andhra Pradesh, Karnataka and Maharashtra (Table 1). The trend in productivity reveals that the southern part of West Coast (Kerala) ranks first followed by Karnataka and Andhra Pradesh in productivity. Other regions towards north, both in the West and East Coast show lesser productivity. In this context, an attempt is made here to highlight the predominant influence of climate, especially the spread of rainfall and soil types on productivity of cashew in India.

Soils

In India cashew is grown mainly on laterite, red and coastal sands in the states of Kerala, Maharashtra, Goa, Karnataka, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal. The most fertile soils among cashew soils is the forest soils on the Western slope of Western Ghats in Kerala. They are often virgin soils rich in organic matter (Nair,1979). Devanandam (1983) from Andhra Pradesh reported that cashew is raised on a wide variety of soils as skeletal soils, eroded soils, undulating and slopy hilly terrains, coastal sands, red soils, laterite soils and light clay loams (black soils) too. Andhra Pradesh has about 900 kms. of shore line, along which cashew is mainly grown on sandy soils which are porous and poor in fertility. The subsoil water goes down upto 3m. in summer and rises to about one m during the rainy season. Cashew is grown on the red soil in the interior. Only soils which support scrub jungle is utilised for cashew cultivation. Yields are poor in sandy soils, while the yields are higher in northern coastal districts because of fertility of red soils (Sri Hari Babu, 1983). In Orissa cashew is grown in wide ranging soils. They are however, mostly located in lateritic red and yellow soils besides coastal sandy soils. Most of these soils are high in potassium minerals. (Mishra and Mahapatra, 1981).

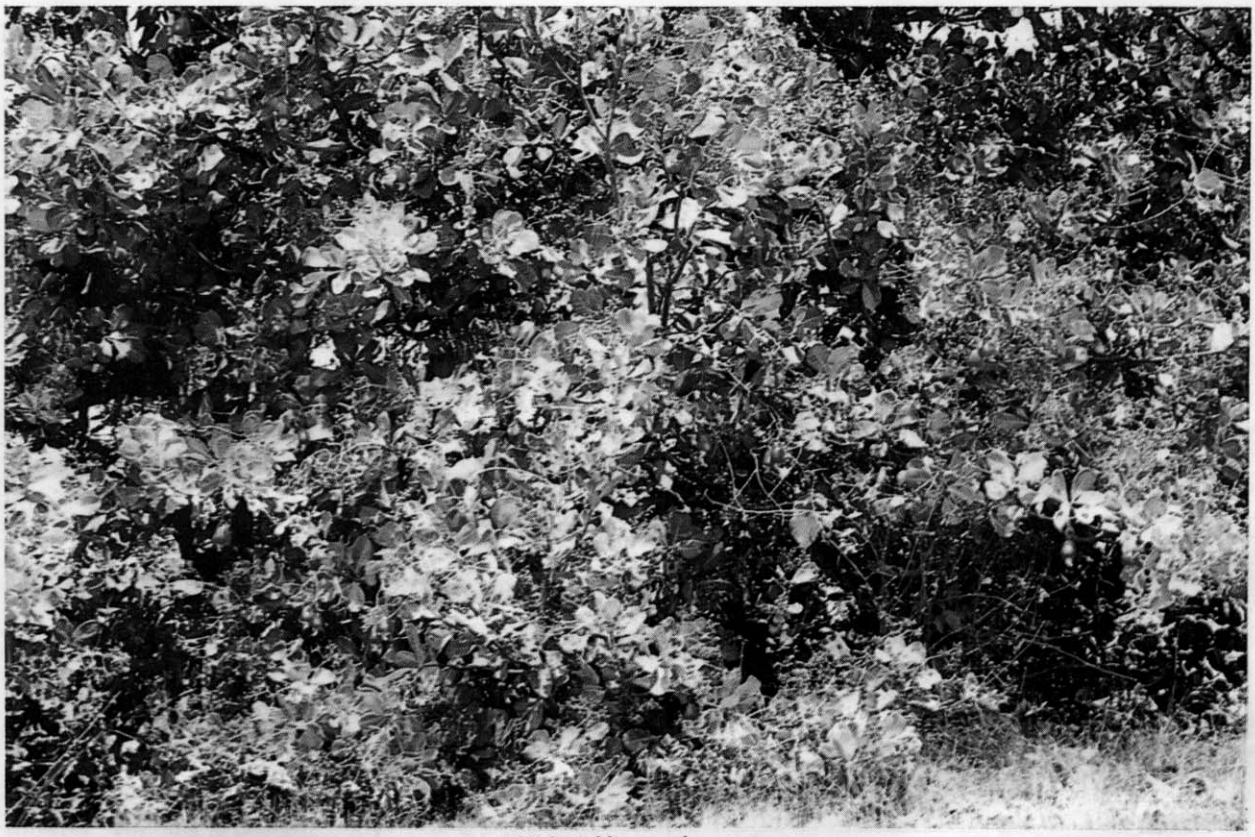
Cashew in Orissa was a neglected crop (until recently) mostly occupying the marginal land where no other crop can come with economic returns. Cashew orchards now extend from coastal plains to undulating slopes of (Eastern Ghat) inland

Table 1

Area, Production and Productivity of Cashew in different cashew growing states in India.

Sl.No.	Name of the State	Area ('000 ha)	Production ('000 t)	Yield (kg/ha)
1.	Andhra Pradesh	66.7	24.4	365
2.	Goa	44.2	13.5	305
3.	Karnataka	66.2	20.0	302
4.	Kerala	152.6	126.6	830
5.	Maharashtra	22.7	14.1	621
6.	Orissa	54.8	11.9	217
7.	Tamil Nadu	94.8	11.6	124
8.	West Bengal	6.7	2.3	343

Source: * Communication from Project Coordinator (Cashew), National Research Centre for Cashew, Puttur 574 202, Karnataka.



A high yielding cashew tree

districts (Misra, 1984). Cashew is mostly treated as a tree crop meant for soil conservation in Orissa.

Cashew is often considered a crop of the marginal lands and is very modest in its soil requirements and can adopt itself to varying soil conditions without impairing productivity. As a result, the worst soils have always been selected for cashew. Thus great harm has been done to cashew cultivation. In fact, cashew performs much better on good soil than on poor soil (Ohler, 1979 and Krishnaswamy, 1981)

The best soils for cashew are deep friable, well drained, sandy loam soils without a hard pan with the phreatic water level at a depth of 5 to 10 meters. Deep, red latosols are also very suitable. Cashew also thrives on pure sandy soils, although mineral deficiencies are likely to occur in these soils. Lateritic gravel, as long as it is not compacted and has an appropriate soil component to allow root growth may delay but not impede development of the cashew tree (Ohler, 1979). Mathew (1984) suggested that huge extent of unculturable laterite areas in Kerala and Karnataka can be made productive, initially with hardy trees like cashew and in course of time with other crops when the soil structure improves.

Cashew is wrongly considered a crop of the marginal and waste lands. As a result, the worst soils have always been selected for cashew. Thus great harm has been done to cashew cultivation. In fact cashew performs much better on good soils than on poor soils.

Unfavourable soil conditions or stress during at least part of the growing season commonly cause average yields to be much lower than the climate could permit. Soil moisture stress in the coastal sandy soils and skeletal, slopy and eroded lateritic soils are thus a limitation to high yields; until and unless soil moisture is supplemented through irrigation. Modern irrigation practices as drip irrigation paves way for utilizing the scarce water resource more effectively and it should be possible to bring the above poor soil types to be productive. As for soil nutrient status, soil chemistry has achieved much success in eliminating nutrient deficiences but stresses due to unfavourable soil physical conditions are often more difficult to over come.

Cashew trees some time grow very near the beach suggesting some tolerance to salinity. However, laboratory trials indicated that cashew has only little tolerance for soil salinity (Ohler, 1979). Soil conditions with more than 2% salinity has been found to be unsuitable for the growth of cashew.

From the foregoing review, it is clear that the virgin forest soils of the West Coast in Kerala is highly productive for cashew followed by the deep well drained red soils and laterites. Barren, slopy and hard core laterites, skeletal soils and coastal sands though sustain cashew orchards, the production potential is very poor. The production potential of these soils could be improved through supplemental irrigation and by improving its fertility through liberal addition of organic manures and appropriate soil conservation practices.

Climate

Cashew requires a mild humid tropical climate. High temperatures of the tropics could be moderated by well distributed rainfall through most part of the year. Also rainfall at frequent intervals builds up good atmospheric humidity. Such a mild humid tropical climate with well distributed rainfall prevails in Southern Kerala and hence, is more suitable for cashew cultivation and the productivity of cashew is reported to be highest in this region. However, during flowering and fruiting period (January to April in India), there should not be any heavy rainfall. It is also observed that prolonged cloudy weather during peak flowering period affects the fruit set in cashew. Temperature, humidity and sunshine hours prevailing in different cashew growing regions in India do not appear to influence the yield of cashew as compared to the rainfall distribution.

Heavy cyclonic storms during November-December along the East Coast of Andhra Pradesh and Orissa bringing unusally heavy rains, causing floods and inundation for periods of more than a week are deterimental to cashew orchards. Under such conditons, orchards located in the coastal sands will be seriously affected and the yield is bound to be uneconmical (Subba Rao *et al.*1983). If we look into the rainfall distribution from South Kerala to Goa in the West Coast (Fig.1), it could be seen that the spread of rainfall is the highest (6 to 8 months) in South Kerala and decreases gradually towards the north (Goa) with a minimum of 3 to 3 ½ months rainfall.

The effectiveness of fertilizers and manures in increasing the biomass production depends in large measure on the rainfall conditions in the absence of any arrangements for irrigation. Nutrient availability in the soil is affected by rainfall via soil moisture content. Nutrient distribution and vertical movement in the soil solution is controlled by soil moisture content. Thus purely as a rainfed crop, cashew is in an advantageous position in Kerala compared to any other states in India. In other important cashew growing countries as Brazil, Tanzania and Mozambique also, the distribution of rainfall appears to be a valid criteria (Fig.1). Well distributed rainfall of about 200 mm /month as a climatic component sets a higher limit for cashew yield. In

FIG.1 RAINFALL DISTRIBUTION PATTERN IN DIFFERENT CASHEW GROWING REGIONS IN INDIA AND OTHER COUNTRIES

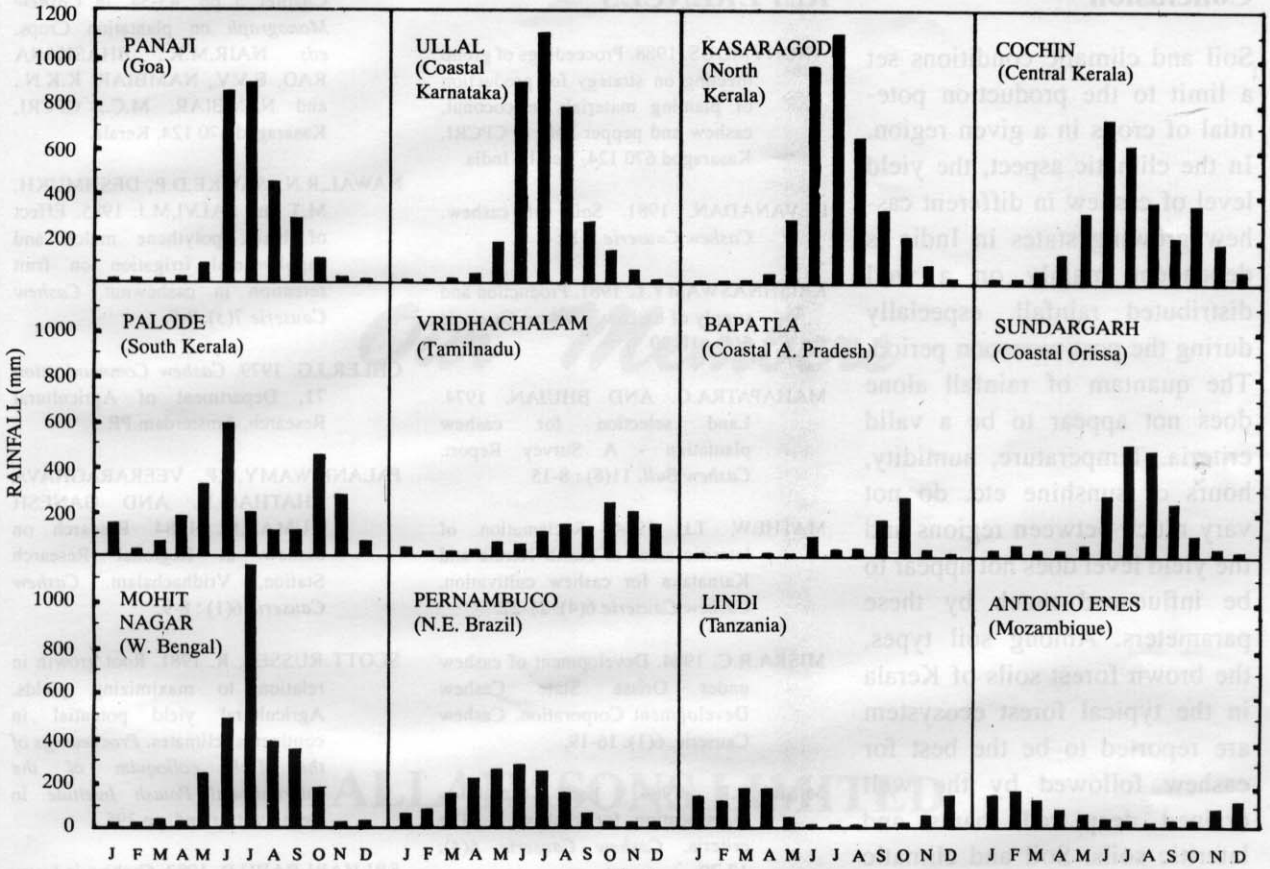


Fig.1

the cashew belt of Konkan region of Maharashtra, the rainfall is only for a limited period of 3 to 3 ½ months at a stretch (June- Sept.) and also, the slopy denuded, lateritic soils a majority of them are skeletal and with more of rocky outcrops where in cashew orchards are located, could not hold sufficient soil moisture, resulting in poor growth and yields (45 kg cashew nuts/ha.). The preliminary irrigation-cum-mulching experiments conducted in Konkan region of Maharashtra (Dapoli campus of Konkan Krishi Vidhyapeeta) revealed that there is a good scope for raising the yield level by giving 3 to 4 irrigations combined with mulching (Nawal *et al.*,1985). That is, when the limitation in rainfall and nutrient deficiency in soils are taken care of through irrigation and fertility management, the yield level can be raised to about 500 kg/ha.

Young orchards in their establishing stage receive protective irrigation and manuring in Tamil Nadu and Andhra Pradesh. Many farmers in Tamil Nadu are now going in for irrigation and manuring of cashew orchards and are registering higher yields (Palaniswamy *et al.*, 1984). The orchards depending only on rainfall give low yields. In coastal Andhra Pradesh, Orissa and West Bengal, cashew orchards are located mainly in coastal sands followed by degraded laterite soils. In such soils, in the absence of irrigation facilities, severe drought prevails in the flowering phase and hence the cashew yields are poor in the above tracts.

Conclusion

Soil and climatic conditions set a limit to the production potential of crops in a given region. In the climatic aspect, the yield level of cashew in different cashew growing states in India is dependent mainly on a well distributed rainfall, especially during the post-monsoon period. The quantam of rainfall alone does not appear to be a valid criteria. Temperature, humidity, hours of sunshine etc. do not vary much between regions and the yield level does not appear to be influenced much by these parameters. Among soil types, the brown forest soils of Kerala in the typical forest ecosystem are reported to be the best for cashew followed by the well drained deep red loams and lateritic soils. Soil and climatic conditions of South Kerala is found most suitable for cashew and hence, the average yield in Kerala remains highest followed by Karnataka and Andhra Pradesh. In other less yielding regions, efforts should be taken to augment irrigation facility for cashew orchards as that is a pre requisite for building soil fertility and better nutrient uptake in getting higher cashew yields.

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