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Soil and water conservation techniques in cashew grown along steep hill slopes

R. Rejani [a,*], N. Yadukumar [b]

[a] Soil and Water Conservation Engineering, Directorate of Cashew Research, Puttur, D.K., Karnataka 574 202, India
[b] Agronomy, Directorate of Cashew Research, Puttur, D.K., Karnataka 574 202, India

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ABSTRACT

Cashew (*Anacardium occidentale* L.), the highest foreign exchange earning perennial horticultural crop in India is generally grown as a rainfed crop along steep slopes of hills or on neglected land unsuitable for any other crop. In India, cashew experiences severe moisture stress from January to May, adversely affects its flowering and fruit set. In order to harvest the rainwater and to make it available to the cashew plant during critical period, an *in situ* soil and water conservation experiment was conducted at Directorate of Cashew Research, Puttur, Karnataka, India during 2003–2010. This experiment was laid along contour with five treatments namely, modified crescent bunds, coconut husk burial, reverse terraces, catch pits and control plot without any soil and water conservation. Among the treatments, modified crescent bund and coconut husk burial were superior. These two treatments reduced the annual runoff (22.3 and 20.4% of the annual rainfall compared to 36.9% of the annual rainfall in control), soil loss (47 and 49% of control) and nutrient loss. Also it increased the mean soil moisture content, growth of plants, yield of cashew (6.45 and 6.60 t/ha respectively compared to 4.88 t/ha in control for the first 5 harvests) and net profit from cashew garden (40% more than control). In addition to this, the groundwater level in nearby wells and ponds increased. Hence, the barren land even in steep slopes with proper soil and water conservation measures can be effectively utilized for cashew cultivation.

1. Introduction

In many parts of the world, the overdraft of groundwater is resulting in declining groundwater levels, freshwater scarcity, salt-water intrusion and land subsidence (Rejani et al., 2003, 2008, 2009). It is estimated that if the current trend continues, about two-thirds of global population will face moderate to severe water stress by 2025 (Kuylenstierna et al., 1997). According to the Ministry of Water Resources, Government of India, groundwater levels in the 16 states of India have dropped to more than 4 m during the 1981–2000 (GOI, 2001). The Dakshina Kannada District of Karnataka, India is no exception and is plagued with declining groundwater levels. Arecanut is the main crop in this region and the major source of irrigation is groundwater. Excessive pumping of groundwater for arecanut cultivation in the area, especially during non-monsoon seasons has resulted in lowering of groundwater levels (Personal Communications, 2005). In the hillocks of high rainfall area, erosion can be controlled by planting crops along the contour and by managing landuse in such a way that soil disturbing activities should be less during the period of erosive rains (Dhruvanarayana, 1993). Cashew is a suitable crop in this case since no intensive soil disturbing activities are required for this crop. Adoption of cashew in large scale will generate rural employment related with its nut collection and processing and aid in sequestering carbon in the soil. About 3650 cashew processing units are in India employing more than 17 lakh people especially women (DCCD, 2009).

The largest area under cashew cultivation is along the steep hillocks of west coast region of India where the mean annual rainfall ranges from 3000 to 3500 mm with 80% of its contribution during June–September. The runoff and soil erosion are very high in steep slopes. Due to the non-uniform distribution of rainfall, cashew experiences severe moisture stress from January to May which adversely affects its flowering and fruit set, resulting in immature nut drop and lower productivity of cashew gardens. During fruiting season of cashew (February–May), a mean rainfall of around 67–415 mm is received. The water deficit is highest during March–May (112–183 mm) (Yadukumar et al., 2009). Irrigation during the critical period will help to double the cashew nut yield (Yadukumar and Mandal, 1994). But in India, cashew is generally grown as a rainfed crop along the steep slopes where the source of irrigation water is insufficient. The average productivity of cashew in India and Karnataka is 0.90 and 0.72 t/ha/year respectively against the target of 1 t/ha/year. However, there is possibility of increased production by adopting soil and water conservation measures with high yielding varieties of cashew. With proper soil

* Corresponding author. Tel.: +91 8251 230902.
E-mail address: rrejani@rediffmail.com (R. Rejani).

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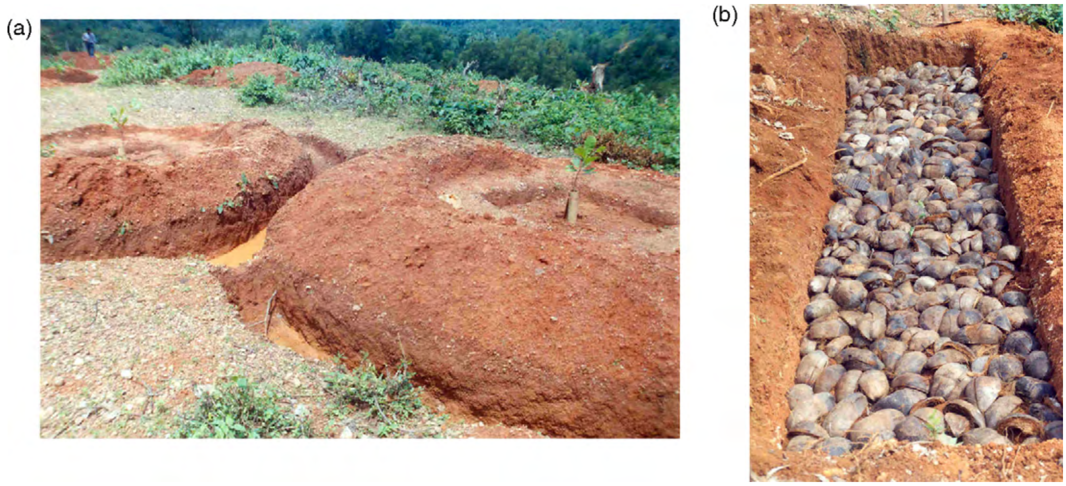

Fig. 1. (a and b) Modified crescent bund and coconut husk burial treatments.

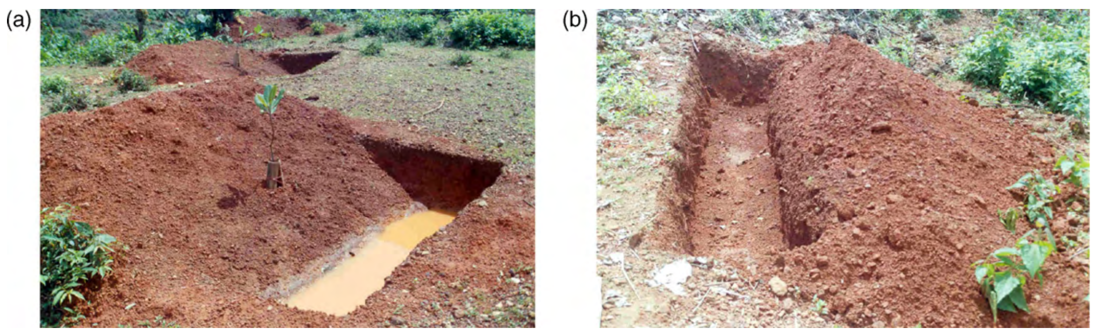

Fig. 2. (a and b) Reverse terrace and catch pit treatments.

and water conservation, the soil loss can be minimized; the runoff water from post-monsoon and pre-monsoon rainfall can be harvested and make available to the plant during the critical period (Yadukumar and Rejani, 2004; Rejani and Yadukumar, 2007). Better growth and yield for mango and cashew was observed with platform bench terraces due to the increased moisture content in the root zone of plants (Deshmukh et al., 1992). A reduction in peak runoff and increase in recession time and groundwater recharge due to soil and water conservation practices have been reported in earlier studies (Sastry and Druvanarayana, 1984; Singh et al., 1989; Pedke et al., 1994). Therefore, the present experiment was formulated with the following objectives:

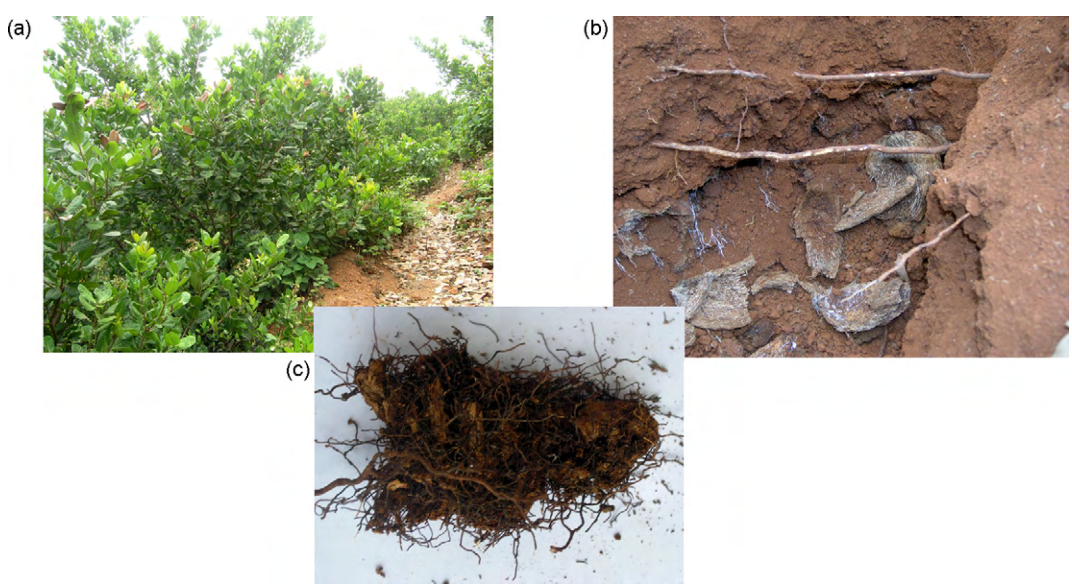

Fig. 3. (a) Plants with coconut husk burial treatment, (b) roots of cashew in coconut husk buried trenches and (c) decomposed coconut husk covered with roots of cashew (six years after coconut husk burial).